PRINCETON FIELD GUIDES

MAMMALS OF

ROLAND W. KAYS AND DON E. WILSON

Mammals *of* North America

PRINCETON FIELD GUIDES

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Mammals of North America Second Edition

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Princeton University Press Princeton and Oxford ARTISTS' CREDITS Sandra Doyle/Wildlife Art Ltd.: Plates 88–91, 99–112 Nancy Halliday: Plates 2–9, 28–32 Elizabeth McClelland: Plates 10–18, 33–49, 92–98 Consie Powell: Plates 76–87 Wendy Smith: Plates 50–55, 65–75 Todd Zalewski: Plates 1, 19–27, 56–64 Cover illustration: Elizabeth McClelland Scat illustrations: Diane Gibbons Track illustrations: Susan C. Morse and Jesse Guertin

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In the United Kingdom: Princeton University Press 6 Oxford Street Woodstock Oxfordshire OX20 1TW

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Kays, Roland, 1971-Mammals of North America/Roland W. Kays and Don E. Wilson.—2nd ed. p. cm.—(Princeton field guides)
Includes bibliographical references and index. ISBN 978-0-691-14278-4 (cloth : alk. paper)
ISBN 978-0-691-14092-6 (pbk : alk. paper)
I. Mammals—North America—Identification. I. Wilson, Don E. II. Title. QL715 .K38 2009
Sp9'.097—dc22 2009001417

British Library Cataloging-in-Publication Data is available

This book has been composed in Galliard (main text) and ITC Franklin Gothic (headings and tabular material)

Printed on acid-free paper.

press.nathist.edu

Edited and designed by D & N Publishing, Baydon, Wiltshire, UK

Printed in Italy by Eurografica SPA

10 9 8 7 6 5 4 3 2 1

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ACKNOWLEDGMENTS

The trick to writing a good field guide is to collect the scattered information on species identification and concentrate it into one concise volume. As a whole, North American mammals are a well-studied group, and the details in this book are largely a credit to the work produced by generations of mammalogists. Although books and journal articles provided some of this detail, no field guide could be completed without substantial research in natural history museums, and this guide is no exception. Our own institutions, the New York State Museum and the National Museum of Natural History, provided the collections, library facilities, and a wide variety of witting and unwitting ancillary support. In addition, we thank the Denver Museum of Nature and Science, the University of Colorado Museum, and the Field Museum, for access to their collections. A specimen in the drawer is much easier to bring to life when an expert helps point out the relevant characters. For this museum and identification help we thank:

Greg Anderson, Andrea Bixler, Joe Bopp, Harold Broadbooks, Mike Carleton, Chris Conroy, Linda Gordon, Lawrence R. Heaney, Al Hicks, Rosanne Humphrey, Cheri A. Jones, Zack Knight, Bill Longland, Chris Maser, Jesus Maldonado, James Mead, Bruce Patterson, Jim Patton, Toni Piaggio, John Phelps, Roger A. Powell, Eric Rickart, Dave Schmidt, Michi Schulenberg, Andrew T. Smith, Bob Smith, William Stanley, and Westarp Wissenschaften. Additionally, we thank William Gannon for his assistance with chipmunk vocalizations, Dan Simberloff for his help with introduced species, and Al Hicks for plunging into caves to help us get the bats just right. Tim Page carefully read and corrected the entire text. A special thanks to Wade Sherbrooke and the staff at the Southwest Research Station for their hospitality during one of our field trips.

The range maps were provided in a GIS for this field guide by Wes Sechrest. In collaboration with many conservation, museum, and academic groups including Conservation International, the Institute of Applied Ecology, and the International Union for the Conservation of Nature (IUCN), Sechrest has compiled distribution information for all mammal species in the world. The initial products, extent of occurrence maps for all mammal species, will soon be freely available on the new Species Information Service (SIS) of the IUCN.

A field guide is part science and part art. For help and critique of artwork we thank:

Catherine Chapman, Marlene Hill Donnelly, Ben Flemer, Patricia Kernan, Clara Richardson Simpson, David Steadman, and Karen Teramura, the staff at WILDlifeART, and Christa Wurm. Thanks to Keeping Track's (www.keepingtrackinc.org) founder and Program Director Susan Morse for taking the time off their citizen-based wildlife monitoring, educational, and conservation programs to provide her expertise regarding the animal tracks and scat illustrations.

We thank Greg Anderson, Tom Brooks, Chris Byrne, Chip Foster, Fritz Hertel, Barret Klein, Darrin Lunde, Chris Skelton, and John Young for insightful discussions about field guide design. Thanks to Ron Gill, Adam Fox, and Dimitri Karetnikov for computer help. Our editors at Princeton University Press, Sam Elworthy and Robert Kirk, gently pushed and pulled at appropriate points throughout the process, contributing greatly to the timely completion of the book.

While the above offered their "perspiration," we owe thanks to another suite of individuals for their inspiration and encouragement, especially Jim Findley, John Gittleman, Bonnie and David Kays, Deedra McClearn, Kevin McGowan, Karen Zich Reiss, and Bruce Patterson. Most importantly, we thank our wives Judy Kays and Kate Wilson, for their continuing graceful tolerance of our long hours in the field and museum over the years.

A Moose crosses the road and traffic stops. Fearful campers scrutinize a Black Bear as it moves through their campsite. Even a mouse scurrying across the ground in the back yard will attract notice. Mammals command attention. Except for a few common species, most of our 462 mammal species are rarely seen; when they do show themselves, it can be quite exciting.

Mammals arouse our emotions, often in contradictory ways. The fluffy Gray Squirrel is awfully cute, until it nests in your attic. The charismatic Wolf is a majestic symbol of wilderness, until it threatens your livestock. Depending on your point of view, a White-tailed Deer is a precious little Bambi, a trophy to be mounted on the wall, a hunk of meat to be sizzling on the grill, a pest that won't leave your garden alone, or a 300-pound roadblock that could jump in front of your car at any moment.

These anthropomorphic views are obvious, but the less obvious ecological duties fulfilled by our mammals may be even more important. The diverse ways in which they make a living means that they play myriad ecological roles that are at the very core of a healthy environment. Granivorous mammals (e.g. squirrels and mice) eat seeds, killing many potential plant offspring; but they also disperse some seeds away from the shade of the mother plant unharmed and into a good environment for germination. Thus they sometimes act as a friend of the plant, sometimes as a foe. Folivorous mammals (e.g. deer and rabbits) eat the leaves of plants and can keep certain species from overgrowing an area. Carnivorous mammals (e.g. weasels, Bobcats, and Killer Whales) keep their prey populations in check by eating the most abundant species. Predators can actually increase prey diversity by preventing a single species from becoming overabundant and driving others out. Insectivorous mammals (e.g. bats and shrews) help control insect populations, including many pest species. Our diverse and abundant mammal fauna constitute an important, well integrated part of our varied ecosystems.

There are a number of reasons why one might want to identify a mammal, from idle curiosity to hard-core scientific inquiry. Anyone with a nose for nature will be curious about mammals encountered in the wild. The relative rarity of those encounters makes them all the more special, and our "biophilia," or attraction to animals, carries with it a strong desire to identify whatever we see. For most of us, this book will serve as a handy guide in pocket or vehicle, for casual encounters with mammals. For others, it may be a useful companion on field trips or research projects designed to find and identify specific mammal species.

SPECIES INCLUDED

This field guide is designed to efficiently and accurately identify all 462 mammal species known from North America, north of Mexico. In addition to native species, this includes tropical species that rarely venture north across the border, exotic species introduced from foreign lands, and extinct species.

Some species on our list have very rarely been recorded in North America (e.g. Margay and Hairy-legged Vampire Bat), but deserve coverage in a field guide so that naturalists know what to look for in the event that these species recolonize.

Selecting which introduced mammal species to include in a field guide is a bit tricky. We selected only exotic mammal species known to survive and reproduce in the wild. This includes a number of ungulate and rodent species that could be confused with our native species. We decided not to include species such as the domestic horse or domestic cat, which have feral populations but are known to everyone, and unlikely to be confused with any native mammals. Because they are unlikely to be confused with native fauna, we did not include the various monkey species known to have escaped from zoos or breeding centers and that may survive in some areas in Florida, and perhaps Texas.

WHAT IS A SPECIES?

Scientists continue to refine our definition of the term species. Traditionally, we recognized independent evolutionary lineages that were reproductively isolated from other such lineages as species. This biological species concept is often difficult to apply in real life. Recent advances in molecular technology that allow much greater resolution of evolutionary relationships have led to a continuing re-examination of our ideas about what constitutes a species. For the purposes of this book, we have followed Wilson and Reeder (2005) in determining which species to recognize. In addition we have followed the more recent scientific literature and recognized a few additional species or name changes published subsequent to Wilson and Reeder (2005). So, for our purposes, a species is an evolutionary lineage of mammal that is recognized as distinct from other such lineages by appropriate authorities in the field of mammalogy.

WHAT INFORMATION IS INCLUDED?

We designed this book to be useful both to amateur naturalists and professional mammalogists. We have packed as much detail into this volume as possible, but also worked hard to keep it concise and efficient, so that it is not unwieldy in the field. All the information for a given species is displayed on two facing pages.

- Artwork

The 110 color plates are the core of this guide and will be the most useful component for mammal identification. Each species is represented by an illustration, and some species have a number of illustrations to show variations in their appearance due to age, sex, season, or geographic variation. All paintings are original works of art created for this book and are the result of close collaboration between the artists and ourselves. Credits for each plate are listed on the copyright page.

— A NOTE ON SKELETAL MATERIAL

Most species can be identified based on external appearances. However, sometimes two species of mammal can be distinguished only by a dental or skeletal character. In these cases we include an illustration of such differences.

— DISTRIBUTION MAPS

The maps show the most recent geographic distribution data for each species. Data for these maps were provided by NatureServe in collaboration with Bruce Patterson, Wes Sechrest, Marcelo Tognelli, Gerardo Ceballos, The Nature Conservancy, Conservation International, World Wildlife Fund, and Environment Canada. Mammal ranges are dynamic, with some populations expanding into new areas and others becoming extirpated locally. Readers should therefore be on the lookout for species outside of their normal geographic range.

Each species account has a brief paragraph noting a species' common name, scientific name, measurements, and details about appearance, general ecology, and behavior. All species accounts are written with a specific formula to make it easy to find the bit of information you are looking for:

COMMON NAME *Genus species* total length, tail length, weight (with differences for male and female where significant)

- 1) The single most important piece of information for identifying the species.
- 2) Description of the physical traits of the species. Details of within-species variation and how to tell it apart from similar species.
- 3) Description of behavior, where relevant, including vocalizations.
- 4) Description of habitats used by a species.

SCAT ILLUSTRATIONS

Mammals are often elusive, but their scat (feces) can be easy to find. This makes scat an excellent tool to document the presence of local mammals, and some mammalogists get quite excited over a good scat discovery. To aid in scat study, we have included examples of mammal scat shapes (*see* pages 236–239). While

some species have very characteristic scats, others can be quite variable, with the shape and size dependent on the contents of the animal's last meal. Generally, herbivores have more consistent diet, and therefore their scat can be more reliably identified. Carnivores and omnivores have more variable diets, and therefore are much more difficult to identify by scat alone.

— Mammal Tracks

Most big or medium-sized mammals have characteristic footprints that can be detected and identified in soft mud or snow. We have provided illustrations of these tracks, with a range of measurements, on the inside flap of the cover of this guide.

WHAT INFORMATION IS NOT INCLUDED?

While this book has all the information you need to identify every mammal species in North America, it does not have much more. To keep this field guide efficient to use, small, and easy to take into the field, we have minimized discussion about the ecology, behavior, evolution, and conservation of each species. We encourage readers to read more about the mammals they see and identify, and recommend the following sources for their bookshelves and coffee tables – but not necessarily for their field backpack.

FURTHER READING

Elbroch, M. 2003. Mammal Tracks & Sign: A Guide to North American Species. Stackpole Books, Mechanicsburg, PA.

- Glass, Brian P., and Monte L. Thies, 1997. A Key to the Skulls of North American Mammals, 3rd edn. Oklahoma State University.
- Nowak, Ronald M., 1999. *Walker's Mammals of the World*, 6th edn, vols 1 & 2. Johns Hopkins University Press.

Wilson, Don, and Sue Ruff (eds), 1999. The Smithsonian Book of North American Mammals. Smithsonian Institution Press, Washington.

Wilson, Don E., and DeeAnn M. Reeder (eds), 2005, *Mammal Species of the World*. Johns Hopkins University Press.

Regional Tracking guides, by J. Halfpenny, published by Pequot Press.

The Journal of Mammalogy, published 6 times a year. Hard-core science, not for the faint of heart.

Recommended Internet Resources

- The Animal Diversity Web: http://animaldiversity.ummz.umich.edu
- Mammal Species of the World Web Site: http://www.bucknell.edu/msw3/
- The American Society of Mammalogists: http://www.mammalogy.org
- North American Mammals, including interactive maps: http://www.mnh.si.edu/mna/

USING THIS BOOK TO IDENTIFY A MAMMAL

1. What general type of mammal is it?

Whale? Bat? Mouse? Consult the mammal chart on the next page for hints on general mammal classification, and appropriate page numbers.

2. LOOK AT THE MAMMAL PICTURES.

Examine the artwork that covers your mammal type. Look for pictures similar to your mystery mammal.

3. CONSIDER RANGE MAPS.

Species that don't live where the mystery animal originated are unlikely, but not impossible, candidates.

4. COMPARE THE CANDIDATES.

Look carefully at the illustrations of species that resemble your mystery mammal and are known to live in your area. These should be on the same, or neighboring pages, allowing easy comparisons.

5. READ THE DETAILS.

The text for each species provides additional details that may help in species identification. If no illustrations match your mystery mammal, look here for details about known variation in size and color. If more than one species seems to match your mystery mammal, look here for details about small characters or measurements that distinguish similar species. Sometimes the distinguishing character is quite technical, and may require examining features of the bones or teeth (e.g. some shrews, some western chipmunks), which may not be practical for all situations. Don't forget to consider habitat type, which is always described in the final sentence of a paragraph, and can sometimes be quite specific and useful in identification.

6. MAKE IDENTIFICATION.

In most cases this book will help you precisely identify your mystery mammal to the species level. However, the species of some groups are very difficult to identify, requiring skeletal material, or even genetic tests (e.g. some gophers and ground squirrels). If this is the case, you may have to settle with a genus level identification (e.g. *Thomomys* sp.) or a species group identification (e.g. the Richardson's Ground Squirrel Species Group).

QUICK MAMMAL ID CHART

This chart should help point the novice mammal identifier to the right section of the book based on general characters. Based on the two descriptors, find the group or groups of mammals that best fits your mystery mammal. Then go to those pages and compare similar species.

DESCRIPTOR 1	DESCRIPTOR 2	Name	Page
Flying or Gliding Mammals	Fly; wing membrane mostly naked	Bats	146-164
	Glide; heavily furred Membrane	Flying squirrels	58
Seagoing Mammals	Very large	Whales	212-218, 230-232
	Small to medium-sized	Dolphins	220-226
	Rounded hind flipper	Manatee	196
	Paired hind flippers	Sea otter, seals	180, 190-196
Hoofed Animals	Have hooves	Ungulates	198-210

DESCRIPTOR 1	DESCRIPTOR 2	Name	Page
CARNIVORES	Dog relatives	Canids	170-174
	Cat relatives	Felids	166-168
	Skunks	Skunks	186-188
	WEASEL RELATIVES	Mustelids	180-184
	Bears	Ursids	176
	Raccoon relatives	Procyonids	178
Medium-sized Mammals	Quills	Porcupine	48
	Large, flattened, scaly tail	Beaver	50
	SMALL EARS, EYES, AND TAIL	Sewellel	48

QUICI	K MAMMAL I	D CHART	continued
DESCRIPTOR 1	DESCRIPTOR 2	Name	Page
Medium-sized Mammals cont.	Aquatic; rounded tail	Muskrats, Coypu	50
	SHORT LEGS, SHORT BUSHY TAIL	Marmots	52
	Large ears	Rabbits, Hares	38-46
	Armored	Armadillo	18
	Long, bushy, ringed tail	Ringtail	178
	POINTY NOSE, FAINTLY RINGED TAIL	Coati	178
	White fur; scaly pinkish tail	Virginia Opossum	n 18
Small Mammals	Bushy Tail	Tree squirrel, ground squirrel, woodrat	54–58, 62–70, 108–112
	BIG-EARED AND LONG-TAILED RATS	Woodrats, Rattus	108-112

DESCRIPTOR 1	DESCRIPTOR 2	Name	Page
Small Mammals	Small ear, no tail	Pikas	36
	Hairy tail, small ears	Ground squirrels, prairie dogs	60-70
	Stripy face	Chipmunks	72-80
Very Small Mammals (mouse size)	Big ears, white belly	Peromyscus and relatives Baiomys, Reithrodonto	, 116–126
	Big feet, long tail	Kangaroo mi kangaroo rat jumping mice	ce, 96–106
	Small ears and eyes	Cotton rats, voles and relatives	128-144
	Tiny ears and eyes	Shrews, moles, gophers	20–34, 82–86
	Short tail	Grasshopper mice	114
	Small feet, long tail	Oryzomys	114
	Small ears, tan color	Perognathus, Chaetodipus, Liomys	88-94
	SMALLEST MICE	Baiomys, Mus, Reithrodonto	116-118 mys

HOW ARE MAMMALS RELATED?

The family tree of mammals below is arranged to show the basic phylogenetic, or evolutionary, relationships of all of the major orders of mammals. Our understanding of these relationships is changing rapidly, as mammalogists bring to bear a series of new techniques. Significant advances in molecular genetics in recent years have greatly increased our ability to study the evolution of all mammals. In the schematic diagram below, the length of the lines connecting the groups is a relative indication of how closely related each group is to another. This diagram is a composite, based on several recent studies. The actual degree of relatedness is poorly known for most groups. However, ongoing studies not only document changes, but add to our confidence in our ability to recognize phylogenetic relationships.

The study of phylogeny forms part of the field of systematic biology, and scientists doing this type of research are known as systematists, or taxonomists. Understanding systematic relationships at the species level, and at higher taxonomic levels such as the orders shown below, is fundamental to all other studies of the biology of any organism.

FAMILY TREE



Mammals NOT indigenous to North America



MAMMAL MEASUREMENTS AND ANATOMY

Because we rely on differences in morphology to identify mammals, some knowledge of their anatomy is necessary for distinguishing similar species. Traditionally, mammalogists have used measurements of different parts of the body to make these distinctions. Externally, the measurements most often used are Total Length, Tail Length, Hind Foot Length, and Ear Length. For bats, forearm length is also sometimes a useful indicator. We have also included at least Total Length, Tail Length, and Weights for each species; where useful for identification, we have included other measurements in the text. Obviously, these very specific measurements were done on mammals in the hand, and in most cases, on museum specimens. Translating them into useful gauges of the size of an animal you see scampering away from you will be much more difficult. While most measurements and descriptions we give are nontechnical, bats are so specialized that some unfamiliar terminology is needed. The figures on the right illustrate these terms.

NOTE ON MEASUREMENTS

The main section of the book describing each species uses metric measurements. The following conversions link metric with Imperial measurements:

10mm = 1cm (0.4in) 100cm = 1m (3ft 3in) 1000g = 1kg (2.2lb) 1ha = 2.47 acres



nose leaf

tragus



PLATE 1 Opossum and Armadillo

 $\mathbf{O}_{\textbf{POSSUMS}}$ – This is the only one of the 94 species of New World marsupials that extends its range northward into the United States. The Virginia Opossum is still spreading north in association with human settlements. Frostbite regularly nips off their ear and tail tips on cold winter nights.



VIRGINIA OPOSSUM *Didelphis virginiana* 350–940mm, 215–470mm, ♂ 800–6500g; ♀ 300–3700g

Unique with white head and long, scaly, prehensile tail. A medium-sized, rather ponderous-looking mammal with a long pink-tipped snout, white toes, and leathery, white-tipped ears. Body fur is gray with long white and

gray guard hairs giving an overall scruffy appearance. Has bright yellow-green eyeshine at night. Known for "playing possum," a catatonic state assumed in the face of danger. Although it is omnivorous, its slow reflexes make it a better scavenger than active hunter. Diet typically includes a mixture of locally abundant fruits, grains, grubs, and carrion. Nocturnal and primarily terrestrial, opossums are also adept climbers and can exploit fruiting trees. For a mammal of its size, opossums have remarkable reproductive potential and very high turnover in their population. Females typically have one litter of 7–9 young, although in the south some females may have a second litter. Babies are born after only a 2-week pregnancy, but grow for another 8 weeks in their mother's pouch. Survival is low and the oldest known wild opossum was 36 months old when last captured. These slow mammals are frequent roadkills, and are often preyed on by predators such as coyotes. Surviving the winter in northern areas requires the use of human houses, barns or sheds as dens. In the south they use a wide variety of woodland habitats. In the northern portions of its range they primarily occur in lower elevation areas with less forest cover and more human development.

 $\mathbf{ArmADILLOS}$ – Only one of the 21 New World armadillos inhabits the United States. This insectivorous group specializes on ants and termites, and all species have very reduced, peglike teeth.



NINE-BANDED ARMADILLO Dasypus novemcinctus 615–800mm, 245–370mm, ♂ 5.5–7.7kg; ♀ 3.6–6.0kg

Bony skin plates are unique. Long head, prominent ears, short legs, and short, tapered, scaly plated tail are distinctive. Body has nine moveable bands encircling the mid-section. It digs burrows with its nose and forefeet,

and lines them with vegetation as a sleeping den. Primarily nocturnal and crepuscular, it is sometimes active during the day in the winter. One of the few mammals with no eyeshine. Surprisingly strong swimmers, can float with their head above water or exhale and sink to walk along stream bottoms. Breed in mid-summer, but implantation of the embryos is delayed, and young are not born until March or April. All litters consist of a set of identical quadruplets that come from a single egg. Although clumsy looking when rooting through leaf litter for insects, it can escape quickly by bounding straight up and then running away quick-ly. Searches for food with its nose, and digs small conical holes when extracting insects from underground. Armadillos are expanding their range east and northward; they were known only from southern Texas in the 1800s. Their colonization of Florida resulted from a combination of introduced animals in the Miami area in the 1920s and 30s and the natural eastward expansion of animals from Alabama in the early 1970s. Armadillos are adaptable to a wide variety of habitats including woodlands, fields, and brushy areas.

18 MAMMALS OF NORTH AMERICA





PLATE 2 Eastern Sorex

SOREX SHREWS – A group of long-tailed, insect-eating shrews. Because of their small size, most are rarely captured in box traps. Pitfall traps have revealed surprising diversity and abundance in many areas. Many of these species are difficult to identify, even for experts. Geographic range, color, and tail distinguish most species, but dental characters are needed for some.



CINEREUS SHREW Sorex cinereus 75-125mm, 30-50mm, 2-5g

Tip of tail black. Medium-sized shrew lacking distinctive markings. Back brownish, fur of underparts is gray at base, paler at the tips. Darker color in winter. Tail is long (roughly 40% of total length), brown above and slightly paler below; dark tail tip not always obvious. (For dental characters see

page 26.) Nocturnal and rarely seen. Common in northern forests, shrublands, grassy areas, and herbaceous habitats.



SOUTHEASTERN SHREW Sorex longirostris 75-100mm, 25-40mm, 2-6g

Only long-tailed shrew in most of range. Small brown body with long and narrow rostrum. Broadly distributed in southeastern United States, but rarely seen. Favors moister areas with dense ground cover, but can occur in pine woods and scrub habitats as well.



AMERICAN PYGMY SHREW Sorex hoyi 60-105mm, 20-40mm, 1-7g

One of our smallest mammals, with small, bright eyes and obscure ears. Long snout has conspicuous whiskers. Color varies from coppery brown (summer) to grayish (winter) above, underparts are paler, grayish brown or drab tinged with copper or tan. Tail is dark brown above, paler below,

and muzzle is paler than the crown and back. Tail is less than 40% of total length. (For dental characters see page 26.) Often stands on hind limbs in kangaroo fashion. Runs quickly with the extended tail slightly curved. Most abundant in boreal habitats.



LONG-TAILED SHREW Sorex dispar 105-135mm, 45-65mm, 3-8g

Slender, dark-gray shrew with a long tail. Belly only slightly paler than back, tail not distinctly bicolored. Smaller than American Water Shrew; larger than Gaspé Shrew; tail longer than Smoky Shrew. Typically smaller in northern parts of range. Rarely encountered due to activity in passages and run-

ways below rocky surface. Procumbent incisors may aid in probing rocky crevices for insects. Favors rocky areas in cool, moist, boreal forests.



SMOKY SHREW Sorex fumeus 110-125mm, 35-50mm, 6-11g

Short, heavy-bodied shrew with a dark back, light belly, and long tail. Back is gray in winter and brown in summer. Tail shorter than American Water Shrew and Long-tailed Shrew. Nocturnal and active year-round. Nests of shredded vegetation are often in rotten logs or under rocks. Common in

wet forests, where it is active on forest floor and under litter.



GASPÉ SHREW Sorex gaspensis 95-125mm, 45-55mm, 2-4g

Very limited range in Quebec and Nova Scotia. Like Long-tailed Shrew but smaller, with paler pelage. Almost never seen, except in pitfall traps. Uses rocky boreal habitats preferring cool, rocky stream edges.





PLATE 3 Northern Shrews



ARCTIC SHREW Sorex arcticus 100-125mm, 35-45mm, 5-13g

Dark tricolored pelage. Back is very dark brown to black, sides are paler brown, and belly is grayish brown. Winter pelage is more uniformly dark brown, and young of the year may be bicolored (brownish above with pale brown underparts). The tail is indistinctly bicolored. (For dental characters

see page 25.) Often uses vision to hunt small insects. A common species, occurs primarily in marshes and grassy clearings within northern boreal coniferous forests.



MARITIME SHREW Sorex maritimensis 105-117mm, 40-45mm, 7-8g

A tricolored shrew from Nova Scotia and New Brunswick. Compared with the slightly larger Arctic Shrew, the Maritime Shrew is more brown than black on its back, has much lighter shades of brownish gray on the sides, and is lighter gray on the belly. (For dental characters see page 25.)

Originally described as a subspecies of the Arctic Shrew, it is now considered a full species. A rare species found primarily in wetlands such as marshes and wet meadows.



ALASKA TINY SHREW Sorex yukonicus 68-75mm, 23-27mm, 1-2g

One of our smallest mammals. Tricolored, with dark brown back, gray-brown sides, and gray belly. Smaller than other tricolored shrews. Alaskan subspecies of American Pygmy Shrew is slightly larger, without tricolored pelage. (For dental characters see page 25.) Close relative to the similar Miniscule

Shrew (S. minutissimus) from Siberia. Most common in vegetation close to streams and rivers.



TUNDRA SHREW Sorex tundrensis 85-120mm, 20-35mm, 5-10g

Contrasting, tricolored pelage, lighter colored than most other shrews. Light brown back contrasts with pale brown or grayish sides and pale belly. Larger than Barren Ground Shrew, lighter colored than Arctic Shrew with a relatively shorter tail than both. Winter pelage is longer and more uniform

in color. (For dental characters see page 25.) Occurs in dense vegetation including grasses, shrubs, and dwarf trees in tundra zone north of boreal forests.



PRIBILOF ISLAND SHREW Sorex pribilofensis 90–95mm, 30–35mm, 3–4g

Only shrew on St. Paul Island, Alaska. Superficially similar to the closely related Barren Ground Shrew. These small, bicolored shrews have been isolated in the Pribilof Islands for about 16,000 years. It may have

occurred at one time on Unalaska Island also, but no recent specimens are known. Nothing is known about the life history of this species.



BARREN GROUND SHREW Sorex ugyunak 75–105mm, 20–30mm, 3–5g

Small tricolored shrew. Distinct line separates dark fur on back from pale fur on sides. Once considered a subspecies of *S. cinereus*, but the coloration is more like *S. tundrensis*, which is much larger. The brown back

of the Barren Ground Shrew looks like a well-defined median dorsal stripe. Tail is pale brown above and whitish below, with a pale buff to brown terminal tip. (For dental characters see page 25.) Immatures are more uniformly colored than adults. Lives in short grass meadows and woody thickets of northern tundra.

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PLATE 4 **AQUATIC SHREWS AND SKULLS**



AMERICAN WATER SHREW Sorex palustris 130-170mm, 57-89mm, 8-18g

Large shrew with black or gravish back. The long (>18mm) hind feet have fringes of stiff hairs. The subspecies from Glacier Bay, Alaska (S. p. alaskanus) is sometimes considered a full species based on their smaller

size and more ridged skull; recent efforts to study this subspecies have not turned up any water shrew populations. Capable of skipping across surface of water by taking advantage of the bubbles trapped in the hairs on its feet, or diving to stream bottoms in search of food. Can be common along fast flowing streams, less common in slower moving rivers and lakes. Found throughout boreal forests in the north of its range, restricted to montane areas in the south.



MARSH SHREW Sorex bendirii 128-174mm, 58-80mm, 7-21g

Large, velvety, brownish-gravish dark shrew with relatively uniform belly and back. Similar to American Water Shrew, but without stiff hairs on hind toes. Olympic Peninsula subspecies (S. b. albiventer) has white belly. Forages both on land and in water, but eats prey on land. Occupies coastal forests, typi-

cally associated with skunk cabbage marshes, riparian alder, small streams, and beach debris. May temporarily move into new habitats during rainy times (red and orange areas on map).

ROHWER'S SHREW Sorex rohweri 90-113mm, 32-50mm, 2-5g

Newly described shrew from northwestern North America (not pictured), externally similar in appearance to the Cinereus Shrew. In front view, incisors much more angled, like an upside-down V. than in the Cinereus Shrew (orange area on map of Marsh Shrew).

ARCTIC SHREW Sorex arcticus (See page 22 for more details)

Skull has five unicuspids. The first four gradually decrease in size from front to back, while the fifth is significantly smaller. Most similar to the Maritime Shrew.

MARITIME SHREW Sorex maritimensis (See page 22 for more details)

The skull is nearly identical to the Arctic Shrew, except in being smaller and flatter, with a less tapering rostrum and a more noticeably arched maxillary tooth row.

TUNDRA SHREW Sorex tundrensis (See page 22 for more details)

Skull has five visible unicuspids, with the first two being larger than the last three. The third, fourth, and fifth are similar in size, but gradually become smaller from front to back. The fifth unicuspid is relatively larger than in the Arctic Shrew.

ALASKA TINY SHREW Sorex yukonicus (See page 22 for more details)

This tiny shrew skull has five unicuspids, with the fifth being conspicuous and pigmented. The third unicuspid is larger than the fourth. The other shrew skull this small, the American Pygmy Shrew, has only three unicuspids visible (see page 27).



ST. LAWRENCE ISLAND SHREW Sorex jacksoni 86-105mm, 32-37mm, 4-5g

Only shrew on St. Lawrence Island, Alaska. Strikingly colored, like the Pribilof Island Shrew but with slightly darker flanks. Skull has five unicuspids, although the fifth is tiny. Skull is larger than the Pribilof Island Shrew, having a maxillary breadth of at least 4.6mm. Lives in most habitats.





CINEREUS SHREW Sorex cinereus (See page 20 for more details)

Skull has a series of upper unicuspid teeth showing a gradual reduction in size from front to back.

AMERICAN PYGMY SHREW Sorex hoyi (See page 20 for more details)

The third and fifth unicuspid teeth are so tiny that this shrew's skull appears to have only three unicuspid teeth.



PRAIRIE SHREW Sorex haydeni 75-100mm, 25-40mm, 2-5g

Small brown shrew with relatively short tail lacking black tip. Red pigmentation on lower incisor on tip and first two cusps, with more on only the third cusp. Occupies prairie grasslands in the Great Plains, including the Black Hills. Builds bird-like nests under logs and rocks.



DWARF SHREW Sorex nanus 80-105mm, 25-45mm, 2-3g

Tiny shrew with pelage back black at base, overlain with grayish brown. Third upper unicuspid smaller than second and fourth; fifth minute. Occurs in arid shortgrass prairies to alpine tundra throughout Rocky Mountain area. Prefers rocky areas such as talus slopes.



MERRIAM'S SHREW Sorex merriami 90-105mm, 35-40mm, 4-7g

Small shrew with grayish-brown pelage on back, paler flanks, and whitish underparts. Third upper unicuspid larger than fourth; fifth tiny. No medial tines on incisors. Occurs in sagebrush, grasslands, and woodlands up to 3000m. May use vole runways in grassy areas.



ARIZONA SHREW Sorex arizonae 80-115mm, 35-55mm, 2-5g

Slightly larger than Merriam's Shrew and slightly smaller than Dusky Shrew, with similar coloring. Third unicuspid roughly equal in size to fourth and a small medial tine on upper incisors. Favors forested slopes from 1500–2500m. Active year-round, but more so during periods of rainfall.



PREBLE'S SHREW Sorex preblei 75-95mm, 30-40mm, 2-4g

Very small with gray-brown back and silvery belly. Distinguished by medial tine on upper incisors, and the third unicuspid being equal in size to fourth. Among the smallest shrews in North America, it occupies shrub and grasslands, as well as wetter areas at intermediate elevations.



MT. LYELL SHREW Sorex lyelli 88-108mm, 38-43mm, 4-5g

Similar to Cinereus Shrew, but restricted to central Sierra Nevada Mountains of California (red area on map). Third unicuspid larger than fourth.

INYO SHREW Sorex tenellus 85-105mm, 35-50mm, 3-4g

Slightly larger than Dwarf Shrew, and with relatively longer tail. Grayish-brown pelage above and paler below; sometimes has reddish color on back. Rarely trapped, almost nothing is known about habits. Occurs in semiarid areas and some moist woodlands on mountain ranges in the Great Basin (see yellow area on map of Mt. Lyell Shrew).

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PLATE 6 Coastal Sorex with Skulls



DUSKY SHREW Sorex monticolus 95-140mm, 30-60mm, 4-10g

Dark brown pelage; medial tine on upper incisors large. Hind feet have more (>4) paired friction pads than Vagrant Shrew. Active all year at all hours. Previously called the Montane Shrew. Widespread and common in a variety of wet habitats.



ORNATE SHREW Sorex ornatus 80-110mm, 28-46mm, 3-9g

Small, grayish-brown shrew with medial tine on upper incisors. Fourth unicuspid larger than third. The belly is paler than the back and the skull lacks postmandibular foramina. Body is like Inyo Shrew, but slightly larger and darker. Restricted to Pacific Coastal region of southern California. Favors streamsides

with dense vegetation, but also occurs in upland forests (red area on map).

BAIRD'S SHREW Sorex bairdi 100-145mm, 30-65mm, 5-11g

Externally like Vagrant Shrew but slightly larger, with a well pigmented medial tine on the upper incisors. Smaller than Marsh Shrew and Fog Shrew; larger than Dusky Shrew. Pelage darker than Pacific Shrew. In winter the pelage is darker brown. Favors moist coniferous forests (see red area on map of Fog Shrew).

NEW MEXICO SHREW Sorex neomexicanus 103-121mm, 39-54mm, 6-8g

Like the Dusky Shrew but restricted to Capitan, Manzano and Sandia Mts. in New Mexico. Recently recognized as a unique species based on having a longer unicuspid toothrow and wider space between the two first upper unicuspids than the Dusky Shrew. Known from fir, ponderosa pine, and aspen woodlands (see yellow area on map of Ornate Shrew).



FOG SHREW Sorex sonomae 105-180mm, 36-85mm, 5-15g

Largest of the brown shrews found along the Pacific coast. Back color is dark grayish brown, and the upper incisors lack medial tines. Like Pacific Shrew but larger, browner, and with no protuberances on upper incisors. Uses moist areas within coniferous forests (yellow area on map).



VAGRANT SHREW Sorex vagrans 100-115mm, 38-48mm, 3-8g

Has small, pigmented medial tines on upper incisors that are usually separated from the pigmented tips by a pale line. Back is brown, sides are paler, and belly is white; tail is bicolored. Prefers moist habitats, frequently in sedges, grasses, and willows along streams and lakes, and in coastal salt marshes.



PACIFIC SHREW Sorex pacificus 135-155mm, 60-70mm, 10-18g

Large, pale, reddish-brown shrew. Hind feet with five sets of friction pads. Upper incisors do not have a medial tine, but do have a small protuberance. Prefers moist, dense areas along streams especially in dense vegetation with fallen logs.



TROWBRIDGE'S SHREW Sorex trowbridgii 104-131mm, 48-59mm, 3-5g

Small shrew with nearly uniform, dark fur, whitish feet, and bicolored tail. This is the only shrew in its range whose belly is not significantly paler than its back, but does have a strongly bicolored tail. Grayer in winter and browner in summer.





PLATE 7 Other Shrews



NORTH AMERICAN LEAST SHREW Cryptotis parva 61–89mm, 19–37mm, 3–10g

Tiny shrew with a very short tail (<45% of head and body length). Smaller and browner than other short-tailed shrews in their range. Nests are constructed of grass and leaves in hidden areas, and may contain up to 31 $\,$

individuals. Occurs in wide variety of habitats, including grassy, weedy, and brushy fields, marshes, and wooded habitats.

SHORT-TAILED SHREWS – BLARINA – All short-tailed shrews have nearly uniform silver to black fur with brown tips on the hairs. Summer fur is shorter and slightly paler. They are significantly larger and have shorter tails than other shrews in their range. They have a strong and unique smell. The four species of short-tailed shrews are very similar, and most easily identified by geography. The four are identified confidently only by examining chromosome numbers. They are habitat generalists, but are most abundant in moist, well-drained areas.



NORTHERN SHORT-TAILED SHREW *Blarina brevicauda* 95–139mm, 17–32mm, 11–30g (Red area on map.)

ELIOT'S SHORT-TAILED SHREW *Blarina hylophaga* 92–121mm, 19–25mm, 13–16g (Yellow area on map.)



SOUTHERN SHORT-TAILED SHREW *Blarina carolinensis* 72–107mm, 12–26mm, 5–13g (Red area on map.)

EVERGLADES SHORT-TAILED SHREW *Blarina peninsulae* 72–107mm, 12–26mm, 5–13g (Yellow area on map.)

Northern limit between Highland and Leon counties in Florida.



DESERT SHREW Notiosorex crawfordi 77-98mm, 24-32mm, 3-6g

Conspicuous ears extend beyond the silvery to brownish-gray fur. Tail short (less than one third of total length) and unicolored. The belly is paler. This is the only shrew in most of the arid and semiarid habitats of the southwestern United States. It builds golf-ball-sized nests of fine

fibers inside woodrat houses. Ranges widely in arid environments from southern California eastward to Arkansas (yellow areas on map).

COCKRUM'S GRAY SHREW Notiosorex cockrumi 77-98mm, 24-32mm, 3-6g

Identical in appearance to the Desert Shrew. This cryptic species is presently only distinguished through genetic testing. Known from southeast Arizona and Sonora Mexico (red dots on Desert Shrew map), but geographic range may change with more study.





PLATE 8 Western Moles

MOLES – Moles are tunneling insect- and worm-eaters with tiny eyes. They differ from shrews in having broad forepaws, lacking pigmentation on their teeth, and generally being larger. Compared with the urinary papilla of a female, the penis of a male mole is larger and starts further from the anus. Evidence of their digging in an area can often be seen in the form of tunnels near the surface, and piles of excavated dirt mounded up above tunnel entrances.



SHREW-MOLE Neurotrichus gibbsii 92–132mm, 12–19mm, 9–11g

Smallest of the moles, with a short thick tail. Not as well adapted for life underground as other moles, but still mole-like with no external ears, reduced eyes, and slightly broadened forepaws. Forepaws larger than in any shrews. Some of the hairs are longer and coarser than others, mak-

ing them less velvety looking than other moles. Color ranges from gray to black. Active both day and night, it spends more time above ground than other moles, and frequently makes tunnels through the leaf litter rather than completely underground. Ranges in elevation from sea level to 2500m. Prefers areas with heavy leaf litter, or abundant shrub or bunch-grass cover.



TOWNSEND'S MOLE *Scapanus townsendii* 3 207–237mm, 35–56mm, 100–171g; \$ 183–209mm, 29–51mm, 50–110g

Larger than all other moles in North America. Hindfoot exceeds 24mm; tail not as hairy as Broad-footed Mole. May form as many as 800 large mounds per hectare in some areas. Exceptionally large mounds contain

a large nest chamber 15–20cm below the surface. Constructs both deep and surface tunnels. Feeds mainly on earthworms, insects, and vegetation. Primarily lowland, below 700m, but up to 1900m in Olympic Mountains. Favors deep, loamy soils in meadows and adjacent areas.



BROAD-FOOTED MOLE *Scapanus latimanus* 136–193mm, 21–45mm, 39–55g

Hairiest tail of western moles. The snout is shorter and broader than other moles, and the unicuspid teeth are unevenly spaced. Dark gray fur may have coppery wash. Gradual decrease in size from north to south,

with largest individuals in Oregon and smallest in Mexico. Shallow foraging tunnels are constructed near the surface, and deeper, more permanent tunnels are used for resting and nest building. Prefers moist soils from sea level up to 3000m, but also occasionally found among large boulders in drier areas.



COAST MOLE *Scapanus orarius* & 136–190mm, 30–45mm, 64–91g; \$\vee\$ 133–168mm, 21–46mm, 61–79g

The forefoot is broader than it is long, and the hindfoot is less than 24mm long. Evenly spaced unicuspids and scantily haired tail distinguish it from Broad-footed Mole, and it is slightly smaller than Townsend's

Mole. Some individuals have patches of white, cream, yellow, or orange fur on the belly. Mounds of soil deposited on the surface from tunneling activities are slightly smaller than those of Townsend's Mole. Occurs in coastal sand dunes, grassy meadows, sagebrush grasslands, deciduous forest, and coniferous woodlands.





PLATE 9 Eastern Moles



EASTERN MOLE *Scalopus aquaticus* & 103–208mm, 16–38mm, 40–140g; \$ 129–168mm, 20–28mm, 32–90g

Tail is longer and less hairy than other moles in its range. Foretoes have webbing between them, hence the name "aquaticus." Although they can swim, they are not aquatic. Three upper and lower premolars on each

side. No external ears, and the eyes are completely covered with skin. Northern animals are larger and dark colored; southern animals are golden or silvery colored. Males tend to be larger than females in all areas. Active year-round, and feed on a variety of invertebrates including earthworms and ant larvae. About 99% of their time is spent underground, in tunnels and associated chambers. Construction of roads and golf courses has provided quality soils and increased moisture, allowing spread of Eastern Moles in some areas. Both surface and deeper tunnels are constructed in moist, loamy soils throughout eastern North America.



HAIRY-TAILED MOLE Parascalops breweri 151–173mm, 26–33mm, 41–63g

Fleshy tail densely haired, constricted at base, and less than one quarter of total length. Stiff hairs on the snout, behind the eyes, and on the edge of the forefeet are thought to have a tactile function. Snout shorter than

that of Eastern Mole, and lacking appendages of Star-nosed Mole. Fur grayish-brownishblack on back; paler and grayish on belly. Young of the year are grayer, with shorter pelage than adults. Tail, feet, and base of snout dark brown, becoming whiter with age. They mate in March–April, and produce a single litter of 4 or 5 young after gestation of 4–6 weeks. Young remain in nest for 4 weeks. Maximum life span is 4 years, and degree of tooth wear can be used to age the animals. Ridges of near-surface tunnels are not as pronounced as those made by the Eastern Mole. Most abundant in light, sandy loams with good cover and sufficient moisture.



STAR-NOSED MOLE *Condylura cristata* 132–230mm, 48–99mm, 40–85g

Unmistakable, snout has 22 fleshy, tentacle-like appendages surrounding the nostrils. Pelage is dense, coarse, and ranges from blackish brown to black, with slightly paler undersides. Tail about as long as head and body,

scaly, constricted at base, and covered sparsely with black hair. Most aquatic of the moles, they forage both in the water, and in the usual mole tunnels. They swim by using the enlarged forepaws as paddles. Tunnels are about 3cm in diameter and range in depth from 3 to 60cm. Tails thicken in winter for fat storage. Animals are active year-round and both day and night. They are more active above ground than other moles, although aboveground activity is more common at night. May be gregarious or even possibly colonial. Prefers wet areas, including moist fields, meadows, woods, and marshes.




PLATE 10 **Pikas**

PIKAS – These egg-shaped rabbit relatives have small ears and no apparent tail. Our two American species do not overlap in range. Pikas do not hibernate, but survive over winter by hunkering down and eating stored grasses, sedges, weeds, leaves, and other vegetation. Signs of their presence include hay piles in crevices and urine stains on rocks. Emit loud, short, sharp calls for alarm and social purposes. Use talus slopes or areas of broken rocks near meadows.



COLLARED PIKA Ochotona collaris 178-198mm, 0mm, 117-145g

Has gray collar, creamy buff facial patch, and white underparts. Upperparts are drab and washed with gray or black. Hindlimbs slightly longer than forelimbs. July juveniles are near adult-size, but are clear gray while adults' heads and necks are tinged with brown at this time. The fur

is long, dense, and soft, and winter pelage is much longer than summer pelage. Active during the daytime, foraging for grasses, which they store in winter caches. Can also be seen sunning on exposed rocks during rest periods. Territorial males accept females in late spring, and 1 or 2 litters of 2–6 blind, naked young are produced after a gestation period of about 30 days. Young reach adult size after 40–50 days, and females breed the following year. Usually found above timberline, but range extends downward to near sea level. Most Pika home ranges include rocky areas for shelter and basking, and adjacent meadows for foraging.



AMERICAN PIKA Ochotona princeps 162-216mm, 0mm, 121-176g

Lacks gray collar, has rusty brown facial patch, and buff underparts. Summer pelage ranges from grayish to cinnamon-brown. Winter pelage is grayer and nearly twice as long. Soft gray juveniles mature to adult color by late summer. Easily seen during daylight hours sitting on rocks, sur-

veying surrounding territory. Male and female territories are usually adjacent, and separate except during breeding season. Short vocalizations signal movements to and from territories, and are used as alarm calls as well. Longer calls are used by the males during the breeding season. Both sexes also leave scent marks by rubbing their cheeks on rocks. Females produce two litters of about 3 young per year, but frequently only one litter survives. Maximum longevity is about 6 years. Use talus slopes or areas of broken rocks near meadows.





PLATE 11 WESTERN COTTONTALLS

COTTONTAILS - Typical rabbits, often identified by relative ear size. Cottontail identification in some areas may require examination of skull characters. Most active at dusk and dawn.



MOUNTAIN COTTONTAIL Sylvilagus nuttallii 338-390mm, 30-54mm, 628-687g

Short, rounded ears are haired on inner surface; whiskers are mostly white. Hind legs are long; feet covered with long, dense hair. Large, grizzled tail is dark above and white below. Associated with sagebrush or

timbered areas.



DESERT COTTONTAIL Sylvilagus audubonii 372-397mm, 45-60mm, 755-1250g

Large ears are pointed and sparsely haired. Slender feet lack dense hair of other Sylvilagus. Large legs. Whiskers are generally black. Large tail is dark above and white below. Occurs in desert brush, near willows along rivers, or in pinvon-iuniper woodlands with shrub cover.

EASTERN COTTONTAIL Sylvilagus floridanus (See page 42 for more details)

Larger than other lowland western cottontails, relatively smaller ears than Desert Cottontail. Range extends into some western states, requiring especially careful scrutiny in Texas and New Mexico where it can easily be confused with the Manzano Mountain and Robust Cottontails, which are restricted to select mountain ranges. One additional cryptic rabbit from the mountains of southwestern New Mexico (Hidalgo, Luna, southern Grant counties), S. f. holzneri, is still considered a subspecies since its relationship to Mexican populations of Eastern Cottontails remain unclear. (See page 42 for map and more details on eastern cottontails.)



MANZANO MOUNTAIN COTTONTAIL Sylvilagus cognatus 440-462mm, 55-75mm

Restricted to the Manzano Mountains, New Mexico. A large rabbit with relatively dark and rich colored fur. This mountaintop endemic has recently been considered a full species, but is very similar to the Eastern

Cottontail and difficult to distinguish. It has relatively small ears compared to adjacent Desert and Eastern Cottontails from the western plains. Uses upper montane and subalpine coniferous forest with Douglas fir, white fir, Engelmann spruce and corkbark fir. Also found in subalpine-montane grassland, and montane scrub on dry, steep western slopes.



ROBUST COTTONTAIL Sylvilagus robustus 440-482mm, 50-80mm

A large rabbit restricted to montane areas of the Trans-Pecos area of Texas and New Mexico. Compared with other cottontails it is more grizzled gray than brownish. It has longer ears (near 70mm) than the Eastern Cottontail (typically 55mm). Uses pinyon-oak-juniper woodlands of the

Guadalupe, Davis, Chinati, and Chisos Mountains at elevations between 1400m and 2400m. May also occur in the Mogollon highlands. The populations in the Guadalupe and Davis mountains are particularly endangered and may now be extinct.





PLATE 12 Pygmy Rabbits and Short-eared Cottontails



BRUSH RABBIT Sylvilagus bachmani 303–369mm, 10–30mm, 511–917g

Small rabbit with short legs and tail. Ears are slightly pointed and sparsely haired inside (not well haired like Pygmy Rabbit). Dark gray on back and sides; pale gray on belly and underside of tail. Whiskers are mostly black,

some may have white tips. Will forage in groups. Thumps ground with hind foot when frightened; may climb low branches to escape. Grasses form most of the diet, although they also browse on shrubs. Can be seen sunning in mid-morning, but is secretive and wary most of the time. Californian subspecies (S. b. riparius) is Endangered. Lives in dense brush, from sea level up to about 2000m.



PYGMY RABBIT *Brachylagus idahoensis &* 252–285mm, 15–20mm, 373–435g; \$ 320–305mm, 15–24mm, 415–458g

Our smallest rabbit. Ears are very short, rounded, and densely haired inside and out. Inconspicuous tail is buff (not white) on underside. Autumn pelage is long and gray on the back; belly hairs are white tinged

with buff. Mid-winter fur is worn and gray, becoming somewhat darker gray in spring and summer. Moves by scurrying, rather than hopping. Mostly crepuscular, but can be seen feeding any time during the day. Females have up to 3 litters of 6 young per year. Alarm call is a buzzing, one- to seven-syllable squeal. Specialist of big sagebrush habitat, on plains, hillsides, gullies, and also along roadsides.



SWAMP RABBIT Sylvilagus aquaticus 452–552mm, 50–74mm, 1.6–2.7kg

Our largest rabbit; ears are relatively small. Underside of tail is white. Head, back, and upper tail are rusty brown to black; throat and belly are white. Cinnamon eye rings. Feet are pale to reddish. Most active at dusk.

Good swimmer. Territorial, unlike most cottontails. Males defend territories both vocally and by scent-marking using a chin gland. Animals can be found resting during the heat of the day on stumps and logs, low tree crotches, in honeysuckle tangles, cane patches, and even in grassy patches on the floodplain. Common in swampy areas.



MARSH RABBIT *Sylvilagus palustris* 425–440mm, 33–39mm, 1.2–2.0kg

Smaller than Swamp Rabbit, with a dingy underside of tail (rarely white). Dainty feet are red to buff in color. Back, rump, upper tail, and hind legs are chestnut brown to rusty red; back of neck is dark cinnamon; abdomen

is white, rest of belly is buff to brown. Florida Keys subspecies (S. *p. hefneri*) Endangered. More active at night than in the daytime. Nests of soft grasses lined with rabbit fur are found among sedges at the water's edge. Uses swamps, lake borders, and other wet areas, in low-lands below 150m elevation. More common in brackish water areas, especially marshes with hummocks of vegetation. Frequently found in cattail marshes.





PLATE 13 EASTERN COTTONTAILS



EASTERN COTTONTAIL Sylvilagus floridanus 40–50cm, 2–6cm, 800–1500g

Our most common cottontail; has relatively large ears. Different from Appalachian and New England Cottontails by: 1) often showing a white (never black) spot between ears; 2) lacking a black fringe on front edge of

ears; 3) lacking a black penciled effect on back; 4) having a postorbital process that is broad, flat, and frequently touching the skull (not thin, tapering, and rarely touching skull); 5) having a suture between nasals and frontals that is smooth (not jagged or irregular). Upperparts are densely furred in brownish or grayish; belly and undertail are furred in white. Common in variety of habitats including overgrown fields, meadows, and brushy areas. (See also page 38 for western form.)



NEW ENGLAND COTTONTAIL Sylvilagus transitionalis 40-44cm, 5-7cm, 995-1347g

Restricted to New England. Virtually identical to the Appalachian Cottontail, distinguished only by range and genetics. Identification vs. Eastern Cottontail outlined above. Nests are in depressions, ca. 12cm

deep by 10cm wide and lined with grass and fur. Eats grasses and clovers in summer and forbs and twigs in winter. Home ranges are less than a hectare, although males have slightly larger home ranges than females. Hard to see, as they are secretive and avoid open areas. Prefers forested habitats with understory of blueberry or mountain laurel and rarely ventures into the open.



APPALACHIAN COTTONTAIL Sylvilagus obscurus 39–43cm, 2–6cm, 756–1038g

Restricted to Appalachian highlands. Identification vs. Eastern Cottontail outlined above. Differentiated from New England Cottontail only by range and genetics. Upperparts are pinkish buff; belly is white or buff. Back is

overlaid with a black wash, creating a penciled look. Cheeks are grizzled. Rounded ears are fringed with black hairs. Usually shows a distinct black (never white) spot between ears. Feeds on grasses, shrubs, ferns, forbs, and even pine needles, unique among cottontails. Quite prolific, with a single female averaging 24 young per year in several litters from March to September. Occurs in dense cover within high elevation boreal forests.

EUROPEAN RABBIT Oryctolagus cuniculus 34-45cm, 4-8cm, 1.3-2.2kg

A small, non-native species restricted to islands of Pacific coast. Upperparts generally grayish and interspersed with black, brown, and sometimes red hairs. Underparts are pale gray. Tail almost completely white, with some dark hairs on upperside. Relatively short ears lack black tips. Domestic breeds vary from black to white. Mainly crepuscular. Most common in drier areas with sandy or lighter soils near sea level.

CAPE HARE Lepus capensis 64-70cm, 7-10cm, 3.0-5.6kg

Non-native species with declining distribution. Different from native *Lepus* in having dorsal hairs white at base. Slender body with rusty- to yellow-brown upperparts in summer with black hairs interspersed; white below. Grayish upperparts in winter. Center of tail black above; tail all white below. Predominantly nocturnal. Populations are presently known from Ontario and the Hudson River Valley. Uses open, cultivated fields.

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PLATE 14 Northern Hares

NORTHERN HARES – These snow-adapted species are generally brown in summer and white in winter. Their smaller ears distinguish them from jackrabbits. Skull characters are needed to distinguish some species in winter.



SNOWSHOE HARE *Lepus americanus* & 40–44cm, 2–5cm, 0.9–1.7kg; \$\varphi\$ 42–52cm, 3–8cm, 0.9–2.2kg

Smaller than other *Lepus*; base of winter hairs brown (not white). Summer pelage rusty brown above and grayish below; ears tipped in black; nostrils and tail white. Winter pelage white with black-tipped ears

and yellowish underpaws. Some populations in Oregon and Washington are brown all year. Mostly nocturnal, but can be seen around dawn or dusk. Uses dense thickets in coniferous and mixed forests in the north, and deciduous forests in the south of its range. Active year-round, with breeding occurring from March–July. Litter size ranges from 1–8 and gestation is 34–40 days.



ALASKAN HARE Lepus othus 56-59cm, 6-10cm, 3.9-7.2kg

Restricted to coastal Alaska. Larger than Snowshoe Hare with longer ears (more than 73mm) and winter pelage that is completely white to the base, except black ear tips. Summer pelage is reddish brown or brownish gray with a white or gray tail. Distinguished from Arctic Hare by geo-

graphic range, by brownish (not grayish or white) summer pelage, and by having more strongly recurved incisors, a heavier rostrum, and a longer upper tooth row. Claws very stout to allow for digging through hard snow crust to reach plants beneath. Inhabits tundra and dense alder thickets, from sea level to 600m.



ARCTIC HARE Lepus arcticus 56-63cm, 4-10cm, 2.5-3.8kg

Restricted to northeastern Canada. Larger than Snowshoe Hare with winter pelage that is completely white to the base, except black ear tips. Summer pelage gray in southern subspecies; remains white in northern subspecies. Distinguished from Alaskan Hare by range, summer color,

and skull characters described above. Moves quickly in a series of hops, each of which may cover 1.2m, and can run up to 64km per hour, as well as swim. Normally solitary, but can form huge groups of up to 300 animals. Lives in tundra. May retreat below timberline in winter, found from sea level to 900m in summer.

WHITE-TAILED JACKRABBIT *Lepus townsendii* & 56–62cm, 7–10cm, 2.6–4.3kg; \$\varphi\$ 58–65cm, 7–10cm, 2.5–4.3kg

White phase White-tailed Jackrabbits are distinguished from Snowshoe Hares by larger body size, longer ears, and hair that is dark at the base. White winter pelage may be tinged with buff on ears, face, back, and feet. Ear tips are black. Tail is white, sometimes with a buff dorsal stripe. Southern populations remain brown in winter. (See page 47 for summer pelage.) Primarily nocturnal and solitary except during the breeding season, which may begin as early as February in southern part of range. Young are born fully haired, with incisors erupted and eyes open. Widest elevational range of any hare, from sea level up to 4000m.



WHITE-TAILED JACKRABBIT



PLATE 15 Jackrabbits

 $J_{\mbox{\scriptsize ACKRABBITS}}$ – The enormous ears of these hares help them keep cool in their hot, arid habitats.



ANTELOPE JACKRABBIT Lepus alleni 55-67cm, 5-8cm, 2.7-5.9kg

Large ears tipped in white. Only found in Mexico and southern Arizona. Back is yellowish brown darkened with black hairs; sharply demarcated sides are gray; underparts are white. Throat patch is orangish yellow. Large ears nearly naked except long white hair fringing the edge.

Nocturnal and crepuscular, rarely vocalizes. Does not drink water. Stands on hind feet and reaches high to forage on leaves, buds, and bark. Rests under bushes during the day. Favors desert plains with grasses, mesquites, and *Acacia* but can persist in areas with little vegetation from sea level to 1500m.



WHITE-TAILED JACKRABBIT *Lepus townsendii* ♂ 56–62cm, 7–10cm, 2.6–4.3kg; ♀ 58–65cm, 7–10cm, 2.5–4.3kg

Tail is white, sometimes showing a buff dorsal stripe. Ear tips are black. Summer upperparts are yellowish brown (*campanius* subspecies east of continental divide) or gravish brown (*townsendii* subspecies west of

divide); underparts are white or pale gray with a darker throat. Northern populations molt to white in winter (see previous plate). Larger than Black-tailed Jackrabbit, and females slightly larger than males. Nocturnal. Feeds primarily on succulent forbs and grasses in summer, and uses wider variety of shrubs in winter. Introduced to Wisconsin. Uses open grassland, sagebrush, and meadows, especially on mountain slopes and ridges.



BLACK-TAILED JACKRABBIT *Lepus californicus* 46–63cm, 5–11cm, 1.3–3.3kg

Black upper tail and ear tips. Upperparts and sides are brown to dark gray, underparts pale gray. Tail gray below and black above; black color may extend as a line up lower back. Long legs allow leaps of up to 2m

vertically and 6m horizontally during escape maneuvers. Mostly nocturnal. Will feed in groups in open pastures and rangeland. Introduced to many eastern states. Uses agricultural and range lands, especially areas with cacti and low shrubs, although complete elevation range is sea level to almost 4000m.



WHITE-SIDED JACKRABBIT *Lepus callotis* ♂ 52–53cm, 5–9cm, 1.5–2.2kg; ♀ 54–57cm, 5–9cm, 2.5–3.2kg

Only found in Mexico and Hidalgo County, New Mexico. White sides unique. Back is pale brownish red; sides, rump, thighs, and underparts are white. Black hairs are mixed throughout upperparts. Tail is white

below and black above; some black tail hairs are tipped in white. White-tipped ears are sparsely haired with a dusky spot along posterior border. Pair-bonding occurs during breeding season from April–August. Litter size is small, 1–4 with an average of 2. Like many hares, constructs daytime resting places called shelter forms, usually surrounded by clumps of grass. Nocturnal. Prefers level desert grasslands with little shrub cover.





PLATE 16 Porcupine and Sewellel



NORTH AMERICAN PORCUPINE *Erethizon dorsatum* 60–130cm, 17–25cm, 3.5–18kg

The only mammal in North America with quills. Males are larger, but females have longer tails. Slow and with poor eyesight, this large rodent is well protected from predators by its quill armor. Defends itself by

erecting (not throwing) its quills, lowering its head, and backing up toward the intruder with its tail flailing. Dens in burrows, rocky crevices, and hollow trees. Eats a variety of plant material, but is especially fond of the cambium layer of coniferous trees, with hemlocks being a particular favorite. Will strip bark off trees and leave piles of feces beneath. Evidence of their feeding includes girdled trunks and branches contrasting markedly with uneaten parts of the trees. They also feed on a variety of smaller shrubs and canes. In spring, when new growth is available, porcupines feed more on the ground using succulent stems of wildflowers, sedges, and grasses. In summer they sometimes move into agricultural fields to feed on ripening crops, especially corn. In winter, when other food is scarce, they add acorns to their diet. Maximum lifespan is 10 years. Porcupines are solitary, although communal dens are known in the wintertime. Breeding may occur in almost any month, depending on location. The long gestation period is 204-215 days, and the single young weighs 400-500g at birth. Extirpated from many areas in the eastern and midwestern United States. Recently reintroduced in some areas. Rare to common in a variety of habitat types including forest, tundra, chaparral, and rangelands, from sea level to high mountains in the west.



SEWELLEL Aplodontia rufa 24-47cm, 19-55cm, 0.8-1.2kg

An odd, medium-sized burrowing rodent with small eyes and ears and long whiskers and claws. The fur is dark brown, and there is a pale spot below each ear. Somewhat resembles a giant pocket gopher. The tail is short and furred. Thought to be the most primitive rodent species and

placed in its own family, the Sewellel has a distinctive triangular, flattened skull with high, conical cheek teeth. Although it rarely ventures far from its 15cm burrow entrance, it can climb trees in search of food. Strictly vegetarian, it is known for eating plants such as rhododendron and stinging nettle that other animals typically avoid. Extensive burrow systems include a toilet chamber. Typically remains underground in winter, eating cached foods. They are coprophagous, reingesting soft fecal pellets to maximize nutritional value from stored food items. The sole member of the rodent family Aplodontiidae. Also called mountain beavers, but they are neither montane nor aquatic. Nocturnal and secretive, and essentially solitary. After mating early in the year, a single litter of 2 or 3 is born in the spring after a gestation period of about a month. The young remain in the natal burrow throughout the summer, although lactation lasts only about 2 months. The young then disperse in the fall, and establish burrows of their own. Maximum lifespan is about 6 years. Endangered in California. Spends most of its life in underground burrows dug into the soil of moist forests with densely vegetated understories.





PLATE 17 Large Aquatic Rodents



ROUND-TAILED MUSKRAT Neofiber alleni 16–23cm, 10–17cm, 200–300g

A small muskrat with a round black tail. Pelage is glossy rich brown to black, with dense underfur that is gray to brown on the back, grading to grayish or buff on the belly. Smaller than the Common Muskrat, but much

larger than any mice or voles. Builds dome-shaped grass houses 18–60cm in diameter at the surface of the water, with a pair of underwater entrances. Nocturnal feeders on aquatic grasses. Breeding is year-round and 2 or 3 young are born after a gestation period of 26–29 days. A single female can produce 4–6 litters per year. Lives in freshwater marshes in Florida and Georgia, where it prefers water depths of 30–45cm.



COMMON MUSKRAT Ondatra zibethicus 41–62cm, 18–30cm, 700–1800g

A medium-sized, brown, aquatic rodent. Back is dark brown, underside is slightly paler. Black tail is vertically flattened. Long, coarse, glossy guard hairs cover the short, dense, silky underfur. Partially webbed hind feet are

larger than the forefeet. Fringes of stiff hairs along the sides of the toes further enhance swimming ability. Larger-bodied in the north of their range. Clearly larger than the Round-tailed Muskrat and smaller than the Coypu or Beaver. Uses cut vegetation to build round-ed houses about 2m in diameter and 1m high; also dens in holes dug into the shore. Crepuscular and nocturnal feeder on a variety of aquatic plants. Common in brackish and freshwater lakes, rivers, and swamps.



COYPU Myocastor coypus 86-106cm, 30-43cm, 6.7-9.0kg

A large, brown, aquatic rodent (also known as the Nutria) with a rounded tail. Larger than muskrats and smaller than Beaver. Coarse, brown outer fur covers a softer, denser underfur. Typically burrows into banks, but also eats and rests on small platforms above water in dense vegetation. A

nocturnal feeder on aquatic plants, this exotic species can seriously damage wetlands and crops. Introduced from South America for fur farming in Louisiana and Oregon; now widespread in marshes and lakes in much of the south and northwestern United States.



AMERICAN BEAVER *Castor canadensis* 100–120cm, 23–32cm, 16–30kg

Unmistakable large, aquatic rodent with a sizeable, flat, paddle-shaped, scaly tail. Our largest rodent. Pelage is brown with shiny guard hairs and grayish underfur. Hind feet are webbed. Incisor teeth are large, orange, and

ever-growing. Distinctive flattened tail is used as a rudder; also slapped against the top of the water as an alarm. Eats the leaves and inner bark of many tree species, preferring willow and aspen. Survives long, harsh winters by huddling in its insulated lodge, storing fat in its tail, and retrieving and eating underwater food caches. Lives in small family groups. The presence of a Beaver family in an area is easily detected by the saplings and small trees they cut down, strip of bark, and use to build dams and dome-shaped lodges. Typically nocturnal, most often seen around dawn or dusk. Once trapped to extinction in many areas, the Beaver has come back, and is now common in many areas, sometimes considered a pest. Lives in a variety of rivers and lakes.





PLATE 18 **Marmots**

 $M_{\rm ARMOTS}$ – These large, chunky squirrels have short stubby tails. Because of their terrestrial and diurnal habits, they can be easy to observe. Often leave feces on rocks or logs. All retreat to their burrows for protection, and to hibernate. These vegetarians are typically found near open, grassy habitats.



ALASKA MARMOT *Marmota broweri* ♂ 58–65cm, 15–18cm, 3.0–4.0kg; ♀ 54–60cm, 13–16cm, 2.5–3.5kg

A dark marmot with a black nose and top of the head. Tail is short. Typically hibernates September to June. Only marmot in the Brooks mountain range, not known from south of the Yukon river. Found near boulder slopes

fields and talus slopes.



YELLOW-BELLIED MARMOT *Marmota flaviventris* ♂ 49–70cm, 15–22cm, 3–5kg; ♀ 47–67cm, 13–22cm, 1.6–4.0kg

A small gray marmot with yellow on the belly and neck. There is a white band across the nose. Top of head is black. Hibernates to avoid cold and snow; timing of hibernation depends on age, sex, and local weather. Uses

meadows adjacent to talus slopes or rock outcrops.



HOARY MARMOT Marmota caligata 62-85cm, 17-25cm, 5-6kg

A large gray marmot with a relatively long tail. Hairs on the rump are tinged buff. The tail is brownish. Face is marked with white in front of the eyes and a dark band on snout. Dark streaks also mark the side of the head and neck. Typically hibernates from September to May. Alpine-montane

specialist except in Alaska where it ranges down to sea level, not known from north of the Yukon river. Lives in treeless meadows where rocky outcrops and talus provide burrows.



OLYMPIC MARMOT Marmota olympus 68-78cm, 19-25cm, 5-7kg

A large, drab brown marmot from the Olympic Peninsula, Washington (yellow area on map). Browner than the Hoary Marmot, but otherwise similar in having a long tail, white nose, and white band in front of the eyes. Coat bleaches yellowish in the summer. Males are larger. Typically hibernates from Sep-

tember to May or June. Prefers montane slopes with rock talus and lush meadows between 1700 and 2000m.

VANCOUVER ISLAND MARMOT *Marmota vancouverensis* 58–75cm, 16–30cm, 3.0–6.5kg

A dark marmot from British Columbia (see red area on map of Olympic Marmot) with white on the face, chest, and belly. Males are larger. Typically hibernates October to April or May. Endangered because of restricted range. Lives in alpine and subalpine meadows from 1000 to 1460m altitude.



WOODCHUCK Marmota monax 41-67cm, 10-15cm, 3-4kg

A grizzled grayish or brown marmot with reddish-brown underparts. Feet are typically blackish brown, but are pinkish in Alaska. The subspecies *M. m. ochracea* from northwest Canada and Alaska is reddish cinnamon in color. Males are larger. Widespread and common in meadows and along

forest edges.





PLATE 19 Eastern and Tropical Tree Squirrels

 $\label{eq:trees} {\bf TREE \ sQUIRRELS} - {\rm These \ familiar \ diurnal \ squirrels} \ are \ grouped \ by \ their \ large \ bushy \ tails \ and \ tree-climbing \ habits. \ Many \ species \ have \ a \ variety \ of \ color \ morphs.$



EASTERN GRAY SQUIRREL Sciurus carolinensis 38–52cm, 15–24cm, 338–750g

A small gray squirrel with a bushy tail edged in white. Belly is whitish. Gray back may have a red-brown tinge. Black-morph individuals and albinos can be quite common in some areas. Makes leaf nests the size of

bushel-baskets. Feed on acorns, other nuts, flowers, seeds, buds, bark, and fungi. Abundant, diurnal, and considered game animals in many states. Breeding begins in January–February and a 40-day gestation period results in 1–6 blind, hairless young being born in February and March. The most commonly seen mammal in the eastern United States. Introduced in many western cities. Favors hardwood or mixed forests, including residential areas.



EASTERN FOX SQUIRREL Sciurus niger 45–70cm, 20–33cm, 696–1233g

A large squirrel with a bushy tail edged with brown or orangish brown. Usually twice the size of the Eastern Gray Squirrel, with a more colorful coat and a brownish tinge to the tail. The most typical color phase has rusty-

gray upperparts with a rusty- yellow or orange belly. Other color morphs include an all-black form, a southeastern form that is black or dark brown with a white nose and ears, and a gray form with rusty limbs, a black head and a white nose and ears. Makes leaf nests like the Eastern Gray Squirrel. Introduced to some parts of California, Colorado, Oregon, and Washington. Generally abundant, although the subspecies from the eastern shore of Maryland is considered endangered. These savannah animals prefer open, parklike habitats with scattered trees and an open understory.

RED-BELLIED SQUIRREL Sciurus aureogaster 42-57cm, 21-31cm, 375-680g

A colorful squirrel introduced to the Florida Keys in 1938. It is either gray or frosted with white. The underside and sides up to its shoulders are mahogany red. Tail is mixed with black and white. Throughout its range in Latin America, this squirrel is variable in coloration, and black melanistic animals are common. Shy denizen of the treetops. In North America, known only from wooded areas on Elliott, Sand, and Adams Keys.



MEXICAN FOX SQUIRREL Sciurus nayaritensis 49-61cm, 24-30cm, 628-814g

A unique, vividly colored, reddish or orangish squirrel. Dark tail is incredibly bushy and edged in white. Winter pelage has a broad band of blackish hair running down the back; body is yellowish gray, and belly, feet, and

eye ring are orangish yellow. In summer the back is a grizzled mixture of pale orangish yellow and black; underparts are tawny. Unlike most tree squirrels, it does not bury nuts or cache foods, as it is primarily a tropical species that barely reaches into the U.S. Frequently spends time foraging on the ground feeding on roots, bulbs, and buds, when acorns and other seeds are unavailable. Inhabits partially open pine-oak forests in the Chiricahua Mountains of Arizona.





PLATE 20 Western Tree Squirrels



ABERT'S SQUIRREL Sciurus aberti 64-58cm, 19-28cm, 540-971g

This squirrel has tufted ears and white on the underside of a broad tail. New ear tufts are grown in October, and may be inconspicuous by summer. The back is gray, with a rusty band. Some animals in central Colorado are uniform brown. North of Grand Canyon, the subspecies S. a. kaibabensis

has dark underparts and all-white tail, and was once considered a distinct species. Elsewhere the tail is only white on the underside and the belly is white. The back and belly color are usually separated by a black line. There is also a dark melanistic form. Forages on seeds, buds, and cambium of the ponderosa pine. Small twigs stripped of bark underneath pines are a clear indication of their presence. Conspicuous during the breeding season in spring, when groups of males chase females. Lives chiefly in ponderosa pine forests.



ARIZONA GRAY SQUIRREL Sciurus arizonensis 45–57cm, 20–31cm, 527–884g

A gray squirrel with a black tail that is washed in white above and marked with an orange or rusty-brown center stripe below. Back and sides are salt-and-peppered steel gray, often mottled with brown or rusty yellow.

Underparts are white. Females have only a single litter per year, and average litter size is 3. Although particularly fond of walnuts, they feed on acorns, juniper berries, flowers, buds, and pine seeds. Rarely seen except when they come down to the ground to forage. Shy and secretive, they rarely vocalize, and tend to slip away undetected when disturbed. Uncommon in dense, mature, riparian broadleaf forests of Arizona, New Mexico, and Mexico, primarily in the pine-oak woodland zones of various mountain ranges below the Mogollon rim.



WESTERN GRAY SQUIRREL Sciurus griseus 51-77cm, 24-38cm, 500-950g

Largest native tree squirrel along the Pacific coast, this gray squirrel has a long pepper-gray tail with white edging. Silver-gray back contrasts with pure white belly. A patch behind the ears is pale reddish brown. Feet are

dusky. Pelage is more silvery and ears are relatively larger than in the Eastern Gray Squirrel. Forages extensively on the ground for acorns, maple seeds, catkins, green vegetation, and fungi, as well as for pine nuts in the canopy. They scatter-hoard acorns in the fall by making many small holes in the ground. Stick nests, called dreys, are used for rearing young, and tree holes are used as sleeping chambers. Maximum longevity in the wild is 8–10 years. Shy and intolerant of humans, making it difficult to see even though it is diurnal. Threatened in the north of its range. Uses oak-conifer woodlands.

EASTERN GRAY SQUIRREL Sciurus carolinensis

Introduced into some residential areas in the west. Tail is typically browner than the Western Gray Squirrel, lacking any silvery tint. (See page 54 for more details.)





PLATE 21 Red and Flying Squirrels

 $T_{AMIASCIURUS}$ – Small red, diurnal tree squirrels. Discard pine cones to form middens under favorite perches. Retire in tree holes and ball nests. Give cicada-like buzz call in spring; territorial bark and chatter year-round. A third species lives in Baja California, Mexico.



DOUGLAS'S SQUIRREL Tamiasciurus douglasii 270-350mm, 100-156mm, 141-312g

Less reddish than the Red Squirrel with a gray to orange eye ring and belly. Brownish or reddish-gray sides; there is a chestnut-brown band down middle of back. Black ear tufts and side stripe are more prominent in winter.

Uses coniferous and mixed forests.



RED SQUIRREL Tamiasciurus hudsonicus 270-380mm, 90-150mm, 140-250g

Redder than Douglas's Squirrel with a white eye ring and belly. In summer a distinct black stripe forms between the rusty olive-brown back and white belly. In winter this stripe fades, but other colors are brighter; feet

and ventral surface become more gray. Mt. Graham, Arizona, subspecies is Endangered. Common in coniferous forests and southern mixed forests.

 $\label{eq:FLYING_SQUIRRELS} - \mbox{UIRRELS} - \mbox{UIRRELS} - \mbox{UIRRELS} - \mbox{UIRRELS} - \mbox{UIRRELS} - \mbox{UIRRELS} + \mbox{UI$



SOUTHERN FLYING SQUIRREL *Glaucomys volans* 120–140mm, 80–120mm, 46–85g

Hair on the belly is white at both the base and the tip. Back is brown, grayish or tawny; edge of the wing membrane is blackish. Nests are found in tree holes, or constructed of leaves and Spanish moss. Forage in trees

and on the ground for lichens, fungi, sap, flowers, buds, bark, seeds, nuts, fruits, and animal matter including insects, birds, mammals, and carrion. Common in low-elevation hardwood forests, less so in mixed and coniferous forests. Also found in parks and wooded residential areas.



NORTHERN FLYING SQUIRREL *Glaucomys sabrinus* 190-300mm, 90-140mm, 38-123g

Hairs on belly are white at tips but dark gray at base. Otherwise like Southern Flying Squirrel except larger size. Often has pale patches of fur at the base of ears and a dark tail tip. Feed on fungi, fruit, nuts, seeds,

small invertebrates, bird eggs, and occasionally on small mammals and birds. Known to visit bird feeding stations. Often common, but Endangered in North Carolina and Virginia. Most common near water in coniferous forests, less in mixed and pure hardwood forests.





PLATE 22 Prairie Dogs

 $\label{eq:Prairie} Prairie \ DOGs - These sandy-colored squirrels live in extensive colonies of underground burrows. Conspicuous with their diurnal feeding and barked alarm calls. All species are vulnerable to human persecution because of an exaggerated and often unwarranted reputation as pests. The four species are distinguished by the color of their back and tail tip.$



GUNNISON'S PRAIRIE DOG *Cynomys gunnisoni* & 320–390mm, 40–60mm, 460–1300g; \$ 310–340mm, 50–60mm, 465–750g

Has a gray tail tip with a white border. Head and back are sandy-colored, belly is white. Smallest and least specialized of the prairie dogs, it lives in colonies that are smaller than other prairie dogs, with less modified

mounds and more vegetation between holes. Ground-squirrel like in appearance and behavior, with a contact call between individuals that is a raspy chatter. Hibernates from October or November until March or April. Lives in montane valleys and high plateaus in the southern Rockies.



WHITE-TAILED PRAIRIE DOG *Cynomys leucurus* ♂ 350–390mm, 40–70mm, 850–1650g; ♀ 320–370mm, 50–60mm, 705–1050g

A buff or gray-colored prairie dog with a white tail tip. Has a dark brown spot above the eye and on the cheek. Contact call between individuals is a laughing bark. Typically hibernates from October to April. Mothers and

young pups occupy burrow systems together. Young born in April–May after 30-day gestation period, and emerge during May–June. Males live apart and defend territories, allowing females entry only during the March–April breeding season. Lives in mountain meadows. May venture into semidesert areas in the north of the range.



UTAH PRAIRIE DOG *Cynomys parvidens* & 300–370mm, 50–60mm, 460–1250g; \$ 290–370mm, 50–60mm, 410–790g

A small reddish or cinnamon-colored prairie dog with a white tail tip. Burrow entrances are marked by a mound of dirt. Nest chambers are close to the surface, but they hibernate in winter in deeper chambers,

100–200cm below the surface. Feeds mainly on herbs and grasses. Population densities range from 0.4 to 12 per hectare, depending on habitat condition, but widespread human persecution has driven them out of 90% of their historic range. This endangered species is now limited to grasslands and flat plains in southern Utah.



BLACK-TAILED PRAIRIE DOG *Cynomys ludovicianus* 3 360–430mm, 70–90mm, 575–1490g; 9 340–400mm, 60–90mm, 765–1030g

A large prairie dog with a black tail tip. Contact call between individuals is a "we-oo." Burrow entrances are surrounded by a large mound of dirt shaped into domes. Dormant in winter, but does not truly hibernate, and

can be seen above ground on warm winter days. Clips vegetation very short around colonies for an unobstructed view. Has the most complex social behavior of all prairie dogs. Prior to settlement of the west, very large colonies called "towns" were huge, with the largest estimated to contain 400 million individuals covering 65,000km². Lives at high densities where not persecuted. Prefers shortgrass to mid-grass prairies.







PLATE 23 Large, Spotted Ground Squirrels

LARGE, SPOTTED GROUND SQUIRRELS – These four large, spotted ground squirrels are often conspicuous with their diurnal habits. All put on considerable weight leading up to the late summer or fall start of their hibernation. Coloration and tail size are the key to distinguishing the different species. A recent revision of squirrel taxonomy split these out of *Spermophilus* and into two new genera.



ROCK SQUIRREL Otospermophilus variegatus 470–500mm, 190–230mm, 450–875g

Has the bushiest tail of any ground squirrel. Back is typically a buff gray, and is marked with flecks of white; this spotting sometimes producing a wavy striped appearance, but never the white shoulder markings of *O*.

beecheyi. Often has varying amounts of black on the back; this may be across the head, shoulders, back, or entire body. Head varies from pinkish buff to brown. Has conspicuous white crescents above and below the eyes. Tail not as bushy as tree squirrels. Rarely climbs trees. Males are larger. Hibernation is short and intermittent. Typically colonial. Lives in rocky canyons, cliffs, and hillsides.



CALIFORNIA GROUND SQUIRREL Otospermophilus beecheyi 360–500mm, 140–230mm, 350–885g

A large, spotted squirrel with a mantle of light gray running from the ears back onto the shoulders. This gray streak is inconspicuous or absent in some subspecies. Back is brown; dorsal buff flecking is heaviest on rump

and flanks. Belly is pale gray. Bushy tail is dark gray above and paler below. Colonial, but each animal has its own entrance to the interconnected burrow system. Hibernates in winter, timing depends on local weather. Common in successional habitat including roadsides, chaparral, and open grassy areas.



COLUMBIAN GROUND SQUIRREL Urocitellus columbianus 320-410mm, 80-120mm, 340-812g

A large ground squirrel with a reddish-brown nose and forelegs. Back is grayish with indistinct buff spotting. Bushy tail is reddish and edged with white and some black hairs. Hibernates for more than two thirds of the

year. Males emerge first, and breeding begins when females emerge in early spring. Males first breed at age 3, and females in their second year. Both sexes are territorial. Food items include fruit, bulbs, seeds, and flowers as well as occasional insects and carrion. Lives in colonies in alpine meadows and grassy lowlands.



ARCTIC GROUND SQUIRREL Urocitellus parryii 330-490mm, 80-150mm, 530-816g

Unique with reddish-brown back that is flecked with whitish spots. Spring-summer pelage is reddish-brown while fall-winter fur is grayish, with a cinnamon-brown head color. Males are larger. Both sexes get much

heavier just before hibernation. Northernmost ground squirrel, it hibernates for seven winter months. Feed on leaves, seeds, and berries as well as carrion and insects. Burrows are limited to areas where permafrost is below 1m, allowing for deep tunnels. Alarm calls include a shrill whistle or sharp "cheek-chick" call. Found in tundra and mountain meadows above the timberline.





PLATE 24 Bushy-tailed, Flecked Ground Squirrels

BUSHY-TAILED, FLECKED GROUND SQUIRRELS – These large ground squirrels have pale flecks on their back that do not form distinct spots. The color and size of their tail distinguishes the different species. All are diurnal seed and leaf eaters. A recent revision of squirrel taxonomy split these out of *Spermophilus* and into two new genera.



FRANKLIN'S GROUND SQUIRREL Poliocitellus franklinii 355-410mm, 120-158mm, 340-950g

A large ground squirrel with a gray head and a long, gray, bushy tail. Underparts dull whitish or buff. Body and ears are smaller than the tree squirrels. Gives loud whistle alarms and musical trills. Hibernates August-

September until April–May. Colonies in a variety of habitats including tall grass, shrub land, and woodland edge.



BELDING'S GROUND SQUIRREL *Urocitellus beldingi* & 270–315mm, 60–75mm, 300–450g; \$ 265–295mm, 60–75mm, 230–400g

Tail is moderately bushy, reddish, and black-tipped. There is a broad, brown band that runs down the center of the back, contrasting slightly with the grayish sides. Has a narrow, white eye ring. Extensive hibernator, so that

all foraging, growth and reproduction occurs in three frantic spring and summer months. Typical alarm call is a trill of 5–8 short whistles. Uses short grass habitats in alpine meadows, along roadsides, and in cultivated fields.



UINTA GROUND SQUIRREL Urocitellus armatus 270-320mm, 43-81mm, 250-600g

Uniform speckled brownish or grayish back with a grayish undertail. Head and neck are always gray, back varies from grayish to brownish to cinnamon-buff. Not as buff as the Wyoming Ground Squirrel, with gray (not buff)

under the tail. Larger than the Piute Ground Squirrel, with a longer tail. Gives a variety of calls including chips, churrs, and squeals. Uses sagebrush, grassy meadows, and sometimes cultivated lawns.



WYOMING GROUND SQUIRREL Urocitellus elegans 253-307mm, 59-79mm, 286-411g

A flecked, drab-colored ground squirrel with a buff undertail. Flecks may be pale pinkish buff, clay-colored, or pinkish cinnamon. Underparts are cinnamon and gray-colored. Distinguished from the similar Belding's and Uinta

ground squirrels by having a buff (not reddish or grayish) underside of the tail with a white edging. Churr and chip calls are higher pitched than in Richardson's Ground Squirrel. Uses mountain meadows above 1500m and talus slopes above the timberline.



RICHARDSON'S GROUND SQUIRREL *Urocitellus richardsonii* 3 283-337mm, 65-88mm, 290-745g; \$ 264-318mm, 55-82mm, 120-590g

A flecked, drab ground squirrel with a white-edged tail. Gray fur is washed with cinnamon buff above and pale buff or white below. Tail is bordered by white, and clay-colored or light brown below. Distinguished from the simi-

lar Belding's and Uinta ground squirrels by having a brownish (not reddish or grayish) underside of the tail with a white edging. Churr and chip calls are lower pitched than in Wyoming Ground Squirrel. Hibernates from September to March.

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PLATE 25 Thin-tailed, Unmarked Ground Squirrels

THIN-TAILED, UNMARKED GROUND SQUIRRELS – Small squirrels with plain backs without flecks or spotting. Color and size of their thin tails distinguish species. Like other ground squirrels, they are diurnal leaf and grain eaters that retire to burrow systems. Recently recognized as being part of a new genus.



ROUND-TAILED GROUND SQUIRREL Xerospermophilus tereticaudus 202–278mm, 60–112mm, 110–170g

This small squirrel has whitish cheeks, and a darker top of the head. Undertail is buff or cinnamon. Pelage is plain, and two distinct color morphs are known with the back being either cinnamon or drab gray-brown. Sides of head

are dull white. Belly is white. Smaller than the Mohave Ground Squirrel with white cheeks and a buff undertail. Has a thinner tail than other ground squirrels, and no spots or flecking. Does not hibernate, but may enter torpor in the winter. Call with high-pitched whistles or peeps. Uses sandy flat areas in the Sonoran and Mohave deserts.



MOHAVE GROUND SQUIRREL Xerospermophilus mohavensis 210–230mm, 57–72mm, 70–300g

A small spotless squirrel with brownish cheeks and a white undertail. Tail has short hairs and is creamy white underneath. Larger than the Round-tailed Ground Squirrel with a shorter tail that has a white (not buff or cin-

namon) undersurface, and brown cheeks. Has a thinner tail than other ground squirrels, and no spots or flecking. Often holds tail over back to display the creamy white underside. Hibernates in winter. Uses level sandy areas with sparse shrub growth in the Mohave Desert.

UROCITELLUS TOWNSENDII SPECIES GROUP – Small squirrels with short ears and unmarked pelage. Color is grayish washed with pinkish buff above and buff-white below. The sides of the head and hind legs are tinted with reddish buff. Underside of tail is light cinnamon. In addition to geographic range, they can be distinguished from other ground squirrels by their lack of flecking, and thin tail. These three species were originally considered conspecific, and were only recently split by genetic studies. There are no known morphological differences to distinguish them.



TOWNSEND'S GROUND SQUIRREL Urocitellus townsendii 200-232mm, 39-54mm, 125-325g

Has 36 chromosomes. Hibernates from June till February. Uses sagebrush and agricultural areas north of the Columbia River and south of the Yakima River (red area on map).

MERRIAM'S GROUND SQUIRREL Urocitellus canus 190-217mm, 37-42mm, 100-250g

Has 46 chromosomes. Hibernates from August till March. Uses grasslands and pastures with big sagebrush and western juniper (see yellow area on map of Townsend's Ground Squirrel).



PIUTE GROUND SQUIRREL Urocitellus mollis 201-233mm, 44-61mm, 84-205g

Has 38 chromosomes. Hibernates for most of winter. Uses agricultural areas and desert communities.

gray-brown morph

ROUND-TAILED GROUND SQUIRREL

cinnamon morph

MOHAVE GROUND SQUIRREL

> TOWNSEND'S, MERRIAM'S AND PIUTE GROUND SQUIRRELS

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PLATE 26 Small, Spotted Ground Squirrels



THIRTEEN-LINED GROUND SQUIRREL Ictidomys tridecemlineatus 170–310mm, 60–132mm, 110–270g

Back is marked with 13 alternating stripes that are either solid pale or dashed and dark. Tail and back are mixed brown and white. Has a white eye ring. Heaviest just before hibernation in September and October. Emerges

from hibernation in March or April. Rarely ventures far from escape burrow. Warning call is a soft, trilled whistle. Often seen standing upright on a roadside or other mowed area



MEXICAN GROUND SQUIRREL *Ictidomys parvidens* 280–380mm, 110–166mm, 137–330g

Has nine rows of squarish white spots on its brown back. Larger than *I. tridecemlineatus* with no solid white stripes. Belly is whitish or buff. Tail is moderately bushy. Head is brown, tip of nose is often cinnamon or yel-

lowish. Has a white eye ring. Males are larger. Northern populations hibernate. Previously known as *Spermophilus mexicanus*. Lives alone or in colonies in grassy habitats or arid areas with brushy vegetation.



SPOTTED GROUND SQUIRREL Xerospermophilus spilosoma 185–253mm, 55–92mm, 100–200g

A small, drab ground squirrel with light spotting and a bushy tail. Some populations are more spotted than others. Short round tail is dark, with a black tip and a cinnamon underside. Belly is light-colored. Color of back

is variable and blends in with the local substrate including: cinnamon drab, smoke gray, and brownish morphs. Northern populations hibernate from July–Sept to April. Use desert scrublands and grasslands.



WASHINGTON GROUND SQUIRREL Urocitellus washingtoni 185–245mm, 32–65mm, 120–300g

A small, brownish-gray squirrel with distinct whitish spots. Found only in Washington and Oregon (yellow area on map). Grayish-white color on the belly and sides changes abruptly to the darker dorsal color, forming a later-

al line between the two colors. Underside of tail, nose, and lower legs are pinkish cinnamon (not rufous as in the Idaho Ground Squirrel). Also has smaller ears (10–13mm). Extensive hibernators, typically only active above ground from late February to early summer. Threatened by hunting and habitat destruction. Uses dry open sagebrush or grassland habitat.

IDAHO GROUND SQUIRREL Urocitellus brunneus 209-258mm, 39-62mm, 120-290g

A small, lightly spotted squirrel with russet-colored legs, nose, and tail. Only found in Idaho (see red area on map of Washington Ground Squirrel). The two known subspecies can be distinguished, and may actually be different species. *U. b. brunneus* from Adams and Valley counties is reddish gray with a buff-white eye ring. *U. b. endemicus*, from Gem, Payette, and Washington counties is grayish brown with a creamy white eye ring and russet on the legs and base of tail. Lives in burrow systems dug in select mountain meadows.

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PLATE 27 Stripy Ground Squirrels

ANTELOPE SQUIRRELS – These small, striped squirrels are recognized by their single pair of white stripes that run from shoulder to rump. Unlike chipmunks, they have no facial stripes. They often carry their tail arched forward over their back. All are diurnal and call with long, high-pitched trills.



HARRIS'S ANTELOPE SQUIRREL Ammospermophilus harrisii 216–267mm, 67–92mm, 113–150g

Underside of tail is grayish from mixing of black and white hairs. Back is pale brown to blackish. Eye ring and belly are whitish. Often sits erect on hind feet. Runs with tail held vertically. Burrows under shrubs in a variety

of desert habitats.



TEXAS ANTELOPE SQUIRREL Ammospermophilus interpres 220–235mm, 68–84mm, 99–122g

Underside of tail is white with two dark bands. Back and basal third of tail is gray. Last two thirds of tail is grayish black. Shoulders, hips, and outer legs are yellowish brown. Belly is white. Uses rocky and shrubby areas

around desert mountain ranges.



WHITE-TAILED ANTELOPE SQUIRREL Ammospermophilus leucurus 188–239mm, 42–87mm, 96–117g

Underside of tail is white with one dark band. Subspecies vary from grayish brown to cinnamon. Fur is longer and grayer in winter. Uses a variety of shrubby desert habitats.



NELSON'S ANTELOPE SQUIRREL Ammospermophilus nelsoni 230–267mm, 67–78mm, 142–179g

Coloration is generally buff rather than gray. Underside of tail is creamy white. Upperparts are a dull yellow-brown and underparts and eye ring are whitish. Only antelope squirrel in range. Inhabits gentle slopes with shrubby cover.

GOLDEN-MANTLED GROUND SQUIRRELS – Their conspicuous light and dark side stripes and colorful heads identify these two small ground squirrels. They are larger than chipmunks and lack face stripes. The two species are distinguished by range and the distinctiveness of their colorful hood. Recently placed in their own genus.



GOLDEN-MANTLED GROUND SQUIRREL Callospermophilus lateralis 245–295mm, 70–120mm, 175–350g

A small ground squirrel with a dorsal stripe and well defined golden hood. Head and neck may be golden brown, tawny, or russet-colored. Winter pelage is graver. Does not overlap (yellow area on map) with the larger

Cascade Golden-mantled Ground Squirrel.

CASCADE GOLDEN-MANTLED GROUND SQUIRREL Callospermophilus saturatus 286-315mm, 92-118mm, 200-300g

Small ground squirrel with a dorsal stripe and poorly defined russet hood. Sometimes considered subspecies of Golden-mantled Ground Squirrel (see red area on map of Golden-mantled).




PLATE 28 Eastern and Rocky Mountain Chipmunks

 $\label{eq:Chipmunks} Chipmunks - This group of small, striped squirrels is easy to recognize, but it is very difficult to distinguish between the 22 different species. Easterners have it easy, with only one to choose from. Western naturalists should consider geographic range and subtle color differences. The Eastern Chipmunk hibernates in the winter while western species rely on underground stores of fruits and seeds to survive the winter.$



LEAST CHIPMUNK Tamias minimus 185–216mm, 78–113mm, 32–50g

A very small chipmunk. The subspecies *T. m. silvaticus* shows coloration typical of many central and northern forms. The subspecies *T. m. scruta-tor* from far western United States has gray on the rump, central dorsal stripe, and head. Southwestern forms are paler brown (see page 74). Runs

with tail held vertically. Typically flicks tail up and down when perched. Calls short and infrequent. Most abundant in coniferous forests and tundra, also found in woodlands, meadows, scrublands, and sagebrush desert.



EASTERN CHIPMUNK *Tamias striatus* 215–285mm, 80–115mm, 80–150g

This red-rumped rodent is the only chipmunk in most of eastern North America. Our largest chipmunk. Color of back varies from pale brown in southern Ontario, to dark red Appalachian forms, and brightly colored ani-

mals in the southwest of their range. Vocalizes with a series of chips and a high-pitched alarm call. Common in eastern deciduous forests.

CLIFF CHIPMUNK Tamias dorsalis

T. d. utahensis from Utah has a more distinct dark stripe down the center of its back than other subspecies. Identifiable by pale gray color of back. (For more details, see page 74.)



RED-TAILED CHIPMUNK Tamias ruficaudus 223–248mm, 100–121mm, 53–62g

Has a long tail that is red on the underside. Winter form is paler, but still has red tail. Some suggest that the northern subspecies *T. r. simulans* should be elevated to full species based on the morphology of their particular dense conjecture forests.

genital bones. Common in dense coniferous forests.



YELLOW-PINE CHIPMUNK Tamias amoenus 186–238mm, 72–109mm, 36–50g

A mid-sized, yellowish chipmunk. Larger than the Alpine and Least chipmunks, smaller than other chipmunks. Has brighter colors than the Least Chipmunk, with a reddish (not yellowish) undertail. Common in chaparral,

meadows, and rocky outcrops.



UINTA CHIPMUNK Tamias umbrinus 210–240mm, 84–119mm, 51–74g

A brownish chipmunk with brown and white dorsal stripes. Difficult to distinguish by sight. Some consider it conspecific with Palmer's Chipmunk. Has less red than the Panamint Chipmunk and is larger than the Least or

Yellow-pine chipmunks. Holds tail horizontal when running. Has five-syllable call. Common in montane coniferous forests, especially above 1830m.





PLATE 29 Southwest Chipmunks



GRAY-COLLARED CHIPMUNK Tamias cinereicollis 208–242mm, 90–109mm, 55–70g

Prominently marked with gray on the cheeks, shoulders and rump. Dorsal stripes are darker than those of the Gray-footed Chipmunk. Hind feet are pinkish buff. In winter the flanks and tail edges are paler, and the belly has

more gray. Runs with tail held horizontally. Often sits on logs slowly waving tail from side to side while "chucking." Alarm call is a shrill "chipper." Climbs trees more than other chipmunks. Has a limited range in montane coniferous forests between 1950 and 3440m.



GRAY-FOOTED CHIPMUNK Tamias canipes 210–264mm, 91–115mm, 65–75g

Hind feet are gray on the dorsal surface. Stripes on back are a dark rusty color (not with a solid black center like the Gray-collared Chipmunk). Has a grayer head than the Colorado Chipmunk, with gray (not orange) shoulders.

Females are slightly larger. Vocalizes from hiding spots with a light "chipper" or a low repeated "chuck." Most active at dawn on rocky slopes with thick brush.



CLIFF CHIPMUNK *Tamias dorsalis* & 204–226mm, 82–100mm, 54–64g; \$ 212–235mm, 89–105mm, 58–67g

Gray back has indistinct stripes. Center dorsal stripe dark, others faint. White patch behind ears. Sides are brownish, underparts are creamy white. Tail is brownish orange below. Call is a series of chips with a terminal pulse.

Common in a variety of habitats with cliffs or boulders. (For Utah form, see page 72.)

LEAST CHIPMUNK Tamias minimus

The southwestern subspecies are paler than those in the Rockies. Distinguished from other southwestern chipmunks by small size, dull color, and lack of gray. Runs with tail held vertically, often flicks tail up and down. (For more details, see page 72.)



COLORADO CHIPMUNK *Tamias quadrivittatus* 212–245mm, 80–118mm, 54–80g

Has bright, contrasting stripes, a grayish forehead, and orangish shoulders. *T. q. australis* from southern Arizona has some gray on shoulders, but is distinguished from the Gray-collared Chipmunk by being smaller and

having an orange wash on shoulder. *T. q. quadrivittatus* from northern Arizona, Utah, and Colorado has brighter orange flanks than the similar Uinta Chipmunk, with more red on the tail underside and darker dorsal stripes that extend all the way to the base of the tail. Uses rocky slopes in ponderosa pine forests.



HOPI CHIPMUNK Tamias rufus 197-221mm, 81-95mm, 52-62g

Stripes are tawny and underside of tail is reddish. Where they overlap, the larger Colorado Chipmunk has darker stripes, and the smaller Least Chipmunk has browner stripes. Tail is carried horizontally when running. Uses rocky areas in pinyon-juniper woodlands.

UINTA CHIPMUNK Tamias umbrinus

T. u. adsitus from the Kaibab Plateau is similar to the sympatric Hopi Chipmunk, but has darker dorsal stripes. (For more details, see page 72.)

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PLATE 30 Southern California Chipmunks



LODGEPOLE CHIPMUNK *Tamias speciosus* & 220–222mm, 79–100mm, 51–61g; \$ 197–229mm, 67–102mm, 55–69g

A brightly colored chipmunk with broad, pure white outer dorsal stripes. Outermost dark stripes are poorly distinguished. Underside of tail has a black tip. Sides are reddish brown. Top of head and rump are grayish. Win-

ter pelage is grayer overall, with browner dark dorsal stripes. Larger than the Yellow-pine Chipmunk, with less distinct outermost dark stripes. Smaller than the Long-eared Chipmunk, with relatively smaller ears. Climbs trees more than most chipmunks. Common in open coniferous forests.



MERRIAM'S CHIPMUNK Tamias merriami 240-255mm, 100-115mm, 70-80g

Large chipmunk with a bushy tail. Contrasting dorsal stripes are light gray and brown. Duller, but very similar to California Chipmunk; genital bones may be needed for certain ID. Distinguished from Townsend's Chipmunk

by having gray (not brown) cheeks. Edging on tail is buff-colored, not white like in the Longeared Chipmunk. Darker on coast (see page 78). Calls with "chips" and a trill from elevated perches in pine and oak forests.



CALIFORNIA CHIPMUNK Tamias obscurus 200–250mm, 70–120mm, 60–84g

Large chipmunk with a bushy tail. Head is grayish on top and striped in white on the sides. Back has brown and gray stripes. Striping is less distinguished in winter pelage. Overlaps slightly in range with the very simi-

lar Merriam's Chipmunk; genital bones needed for certain ID. Stands on hind feet to give "chip" vocalization. Common in sandy and rocky areas with sparse pinyon pine, juniper, and scrub oak vegetation (yellow area on map).

PALMER'S CHIPMUNK Tamias palmeri 210-223mm, 87-101mm, 50-69g

A small chipmunk from the Spring Mountains of southwest Nevada. Has only three (not the usual five) dark stripes on back. The center pair of pale stripes is grayish, the outer pair and belly are creamy white. Colors are more muted in the winter. Only the larger Panamint Chipmunk overlaps in range. These two are also distinguished by the grayer shoulders of Palmer's Chipmunk. May be conspecific with *T. umbrinus*; genital bones are shown for certain ID. Emits chippering, chip, and chuck calls along cliffs. Found in rocky coniferous habitat above 2000m elevation (see red area on map of California Chipmunk).



PANAMINT CHIPMUNK *Tamias panamintinus* & 230–239mm, 85–100mm, 74–89g; \$ 230–245mm, 90–101mm, 81–105g

A pale-colored chipmunk with a grayish head, rump, and thighs. Back has contrasting pale and brown stripes. The center pair of pale stripes are grayish, the outer pair are creamy white. Head is somewhat flattened. Colors are

brightest in spring, dullest in late winter. The subspecies from the Kingston mountains is smaller and darker. Redder than the Least Chipmunk. Has paler facial stripes and less contrasting dorsal stripes than Palmer's, Lodgepole, Yellow-pine, and Uinta chipmunks. Genital bones are shown for certain ID. Call rate lower (eight syllables) than Palmer's Chipmunk. Lives in pinyon pine and juniper habitat at high elevations (1500–2600m).





PLATE 31 Northwestern Coastal Chipmunks

CONFUSING CALIFORNIA CHIPMUNKS – These species are difficult to tell apart. Four (*T. ochrogenys, senex, siskiyou,* and *townsendii*) were once lumped together in the *Tamias townsendii* species group. Geographic range and color patterns are useful, but genital bones (from the skeleton) and voice are the only 100% reliable methods to distinguish all species. To aid in comparisons, we have placed the duller coastal morphs and the brighter inland morphs on different pages.



TOWNSEND'S CHIPMUNK Tamias townsendii 230-280mm, 95-120mm, 90-118g

The only chipmunk on the coast in its range, has indistinct dorsal stripes and brownish cheeks. The coastal form is dark brownish or olivaceous in color, with indistinct pale and dark lines on the back. Winter animals dark-

er with buff-white stripes while summer animals are brighter. See next plate for details on the brighter inland form. Call has two to three syllables per chip. Lives in forests and recently cleared areas.



YELLOW-CHEEKED CHIPMUNK Tamias ochrogenys 233–297mm, 97–130mm, 60–118g

Has a less bushy tail, a darker back, and more distinct dorsal stripes than other *townsendii-*group chipmunks. The center stripe on back is the largest. Tail is dark rufous to bright orange ventrally and the same color as the rest

of the body dorsally. Winter pelage is long, silky, dense and more dull-colored with dark tawny olive to blue-gray tones. Vocalizes with a unique sounding low-frequency two-syllable "chip." Thrives in dark, moist redwood forests.



SONOMA CHIPMUNK Tamias sonomae 220–264mm, 100–126mm, 63–77g

A brightly colored chipmunk with a bushy tail that is slightly edged in buff. The outer pair of pale dorsal stripes are dull whitish washed with cinnamonbuff molting to gravish in the winter; the dark dorsal stripes are black (rarely

fuscous). Dorsally, tail is blackish mixed with tawny. Ventrally, tail is tawny, bordered with black and tipped with a small amount of pale buff. Call a low, labored, blunt "pok" sound. Lives in chaparral, small brushy clearings in forests, and streamside thickets. (See page 80 for the inland forms and genital bones.)



SHADOW CHIPMUNK Tamias senex 223-281mm, 94-122mm, 90-120g

A dark olive chipmunk with one pair of pale dorsal stripes brighter than the other in the summer. Tail is relatively thin. The dark dorsal stripes scarcely reach the rump. Inland populations are brighter-colored (see page 80).

Calls with a rapid series of three to four syllables, sometimes stretching to 10 syllables. Primarily arboreal in humid coastal redwood forests (dull morph), and more arid inland forests.

MERRIAM'S CHIPMUNK Tamias merriami

Large chipmunk with a bushy tail. Distinguished from Townsend's Chipmunk by having gray (not brown) cheeks. Edging on tail is buff-colored, not white. Brighter inland (see page 76 for more details). Calls with "chips" from elevated perches in pine and oak forests.

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TOWNSEND'S CHIPMUNK Tamias townsendii

Larger than the overlapping inland chipmunks (*T. amoenus* and *minimus*). Paler than the coastal *townsendii* subspecies, with more reddish or orangish color. The pale body stripes fade out both near the head and rump, becoming more or less obscured by tawny or grayish shades. (See *also* the coastal chipmunks, page 78.) Lives in coniferous forest and brush.

SHADOW CHIPMUNK Tamias senex

Orangish, with a gray rump and bright white outer dorsal stripe. The sides are clay color to tawny; rump and thighs are gray; underparts are creamy white. Well-defined dark body stripes are brownish black; middle stripe is darkest. The middle pair of pale, back stripes are grayish white to cinnamon; outer pair are brighter, but fade to duller toward the rump. More details on the previous plate. Uses humid coastal forests (dark morph, see page 78) and arid inland forests (brighter morph).

SONOMA CHIPMUNK Tamias sonomae

A brightly colored chipmunk with a pale-edged tail. Back is cinnamon-buff with blackish dorsal stripes. The medial pale stripes are smoke gray and the outer pair is creamy white. The rump and thighs are gray mixed with cinnamon-buff. Underparts are creamy white. Dorsally, the tail is black, sprinkled with pale buff. Ventrally the tail is tawny and is bordered with fuscous black and edged with buff in the summer and grayish white in the winter. Lives in chaparral, small brushy clearings in forests, and streamside thickets. (See page 78 for more details.)



ALPINE CHIPMUNK Tamias alpinus 166–184mm, 63–81mm, 27–45g

Our smallest chipmunk has a short, broad tail that is frosted above and has black at the tip. Tail is shorter and flatter than *T. minimus* with larger ears and paler dorsal coloration. Smaller than *T. amoenus*, with duller coloration, more grayish hind feet, and tail with more black at tip. Winter ani-

mals are grayer above, with less tawny sides. Lives in rock-bordered alpine meadows and on talus slopes near timberline of the highest peaks of the Sierra Nevada.



LONG-EARED CHIPMUNK *Tamias quadrimaculatus* & 230–239mm, 85–100mm, 74–89g; \$ 230–345mm, 90–101mm, 81–105g

A reddish chipmunk with distinct stripes and large, slightly tufted ears. On face, pale and dark stripes contrast strongly, and the pale malar stripe connects with the large creamy-white ear patches. The top of the tail is black-

ish brown overlaid with grayish white; the undertail is tawny brown, bordered with mixed dark and pale gray fur. Winter animals have a grayish-brown top of the head, rump, and thighs. Summer pelage has less gray and more cinnamon in the upperparts. Call a sharp "whssst" or "pssst." Forages on ground or in bushes of chaparral and forests.



SISKIYOU CHIPMUNK Tamias siskiyou 250–268mm, 98–117mm, 65–85g

A large, dull-colored chipmunk with a small range. Outer lateral stripes on dorsum are grayish or brownish and paler than the inner stripes. Yellow-pine Chipmunk, the only sympatric chipmunk, is much smaller with lateral dorsal

stripes that are white. Vocalizes with an intense one-syllable call that starts at a low pitch, rises, and then falls again. Uses moist coniferous forests and second-growth forests usually dominated by Douglas fir.





PLATE 33 NORTHERN THOMOMYS

GOPHERS - These small rodents are well adapted to life underground with their reduced eyes and ears and enlarged front feet and claws. They also dig with their incisors, and can close their lips around these front teeth, allowing them to continue chewing a new hole without getting a mouthful of dirt. Burrow systems are conspicuous, while the animals themselves are rarely seen. They can transport food in their fur-lined cheek pouches. The three North American genera are distinct by having 0 (Thomomys), 1 (Cratogeomys) or 2 (Geomys) grooves in their upper incisors. All of the Thomomys on this plate have skulls lacking a sphenoidal fissure (see page 85).



CAMAS POCKET GOPHER Thomomys bulbivorus 220-328mm, 56-99mm, 375-543g

Largest of the Thomomys, with a very restricted range. Dull sooty brown on the back, and dark gravish brown below, often with an irregular-shaped white patch on the throat. The ears and nose are blackish. Tips of the

upper incisors angle distinctly forward in the front of the mouth, rather than pointing downward, giving the animal a bucktoothed appearance. Restricted to the Willamette Valley, and nearby tributaries in Oregon.



NORTHERN POCKET GOPHER Thomomys talpoides 165-260mm, 40-75mm, 60-160g

A widespread and variable gopher with dark patches behind the ear. Color can be brown or gravish brown to yellow-brown. A small Thomomys, with short soft fur that is less glossy than in most other species. Often has white

markings under chin. Lack of a sphenoidal fissure is a feature in the skull, which separates it from other potentially overlapping gophers (see skull illustrations on page 85). This species is associated with "Mima Mounds," mounded areas up to 2m high and 20m in diameter in grassland areas. The larger the mounds, the more gophers using an area. Uses a variety of open habitat types, even forests with widely spaced trees.



WYOMING POCKET GOPHER Thomomys clusius 161-184mm, 50-70mm, 46-88g

Small gopher with pale yellow color, lack of dark-colored patches behind and below ears, and presence of a fringe of white hair on ears. Often associated with loose gravelly soil and greasewood habitats. Extremely limited

distribution (red area on map), where it is the smallest and palest gopher.

IDAHO POCKET GOPHER Thomomys idahoensis 167-203mm, 40-70mm, 46-88g

Very small gopher that is pale yellowish in Idaho and Montana, but darker brown in Wyoming (see yellow area on map of Wyoming Pocket Gopher). Reddish individuals are rare. Differs from others in its range in lacking dark ear patches and contrasting gravish cheeks. Lacks the white ear fringe of the neighboring Wyoming Pocket Gopher. Seems to favor shallow and stony soils.



WESTERN POCKET GOPHER Thomomys mazama 191-233mm, 53-78mm, 75-125g

Richly colored gopher with pale to dark reddish-brown back and gray underparts tipped with buff. Some individuals on dark soils are darker colored. Has long ears for a gopher. Below the ear is a black patch of fur five to six times the area of the ear. Uses deep humic volcanic soils of alpine meadows and small glacial prairies.





PLATE 34 Cratogeomys and Southern Thomomys



BOTTA'S POCKET GOPHER *Thomomys bottae* & 170–280mm, 62–92mm, 110–250g; \$ 150–240mm, 55–73mm, 80–160g

One of the world's most variable small mammals, usually has a unique purple tinge to the flanks. Ranges from dark blackish brown through various shades of reddish and yellowish browns, pale grays, and yellows, to nearly

white. Ventral coloration usually mirrors that of back. Patches of white on throat, chest, or abdomen are not uncommon. Body color is tied to soil color. Dark patches behind ear are most evident in lightly colored individuals. Skull has an obvious sphenoidal fissure. Typically larger than the Southern Pocket Gopher and smaller than Townsend's Pocket Gopher. Lives in virtually any friable soil, from rich valleys to rocky montane slopes and desert outwash areas. Wide range of habitat types from desert up to coniferous forests, but mainly in open areas where soils are deep enough for burrows (meadows, stream sides, etc.).



SOUTHERN POCKET GOPHER *Thomomys umbrinus* & 210–250mm, 65–80mm, 110–175g; \$ 180–230mm, 55–70mm, 80–120g

Typically has a unique darkened, bluish mid-dorsal band. Color varies from dark, rich reddish brown to blackish brown. Skull has a sphenoidal fissure. Only has three pairs of pectoral mammae, as opposed to four pairs nor-

mally found in Botta's Pocket Gopher. Known in United States only from Pajarito, Santa Rita, Patagonia, and Huachuca mountains in Arizona, and Animas Mountains in New Mexico. Inhabits desert scrub and grasslands through intermediate elevation oak and pine-oak woodlands, to grassy meadows in high elevation pine and fir forests.



TOWNSEND'S POCKET GOPHER *Thomomys townsendii* & 232-315mm, 60-99mm, 201-417g; \$ 226-287mm, 58-92mm, 122-308g

Larger than other Great Basin pocket gophers, nose is usually darkened. Color varies from pale grayish tan through cinnamon to very dark brown. In some areas a white blaze on the top of the head is fairly common. The nose

is sooty black, gray, or dark brown, and most animals also have a black spot behind each ear. Typically, the tops of the feet and tail are white and there is a white chin patch. Skull has a sphenoidal fissure. Uses deep, moist soils of river valleys and prehistoric lakebeds.



MOUNTAIN POCKET GOPHER *Thomomys monticola* 190–227mm, 55–95mm, 75–105g

A uniformly brown gopher with relatively large and pointed (not rounded) ears. Behind the ears there is a large black patch about three times the size of the ear. There is no sphenoidal fissure in the skull. The snout is dark-

er than the face. Favors montane meadows, pastures, and rocky slopes of pine, fir, and spruce in the Sierra Nevadas.



YELLOW-FACED POCKET GOPHER Cratogeomys castanops 220-315mm, 60-95mm, & 385-410g; \$ 225-290g

Large eyes and a single groove in the upper incisors distinguish this species from all other pocket gophers. The upperparts vary from pale yellowish-buff to dark reddish-brown, and the underparts are whitish to bright

orange. All hairs are grayish at the base, usually with slightly darker hues on the back. It uses deep sandy soil with few rocks, in both grasslands and more arid habitats.



YELLOW-FACED POCKET GOPHER

reddish morph



PLATE 35 **Geomys**

TRICKY TEXAS GOPHERS – The first five species of long-tailed gophers are virtually indistinguishable by appearance, and were originally identified by genetic differences. They can be distinguished from other overlapping gophers by size and by skull characters (all lack sagittal crest and knob on zygoma).



BAIRD'S POCKET GOPHER *Geomys breviceps* 192–222mm, 54–67mm, 78–150g

Limited to sandy soils, or sandy loams in prairie grasslands and oak savannas (yellow area on map).

ATTWATER'S POCKET GOPHER Geomys attwateri 192-235mm, 51-70mm, 102-170g

Limited range in Texas (see red area on map of Baird's Pocket Gopher), where it occupies friable soils in grasslands.



KNOX JONES'S POCKET GOPHER Geomys knoxjonesi 203–282mm, 57–104mm, 160–185g

Restricted to areas of western Texas and eastern New Mexico with deep, sandy soils (yellow area on map). Favors yucca grasslands, although can now be found along grassy roadsides, and in lawns and pastures.

CENTRAL TEXAS POCKET GOPHER Geomys texensis 185-272mm, 51-80mm, 125-165g

Smaller than nearby Attwater's, Plains, and Texas Pocket Gophers. Favors deep brown loamy sands or gravelly sandy loams in live-oak, mesquite, ash, and juniper habitats (see red area on map of Knox Jones's).



PLAINS POCKET GOPHER Geomys bursarius 225-325mm, 60-121mm, 120-250g

Sparsely haired tail is about one third of body length. Inhabits deep sandy or loamy soils in most Great Plains habitats, as well as roadsides, lawns, and pastures.



TEXAS POCKET GOPHER Geomys personatus 216–360mm, 62–125mm, 156–400g

Medium-sized, drab brown gopher with soft, short pelage that is pale to whitish on the underparts. Very similar to Attwater's, but skull has a distinct sagittal crest, and it differs in habitat, occupying only deep, sandy and river batterne (red even on mar)

soils in coastal and river bottoms (red area on map).

DESERT POCKET GOPHER Geomys arenarius 218-302mm, 52-106mm, 165-254g

Distinguished from the other pocket gophers in its range by having two grooves on the upper incisors. Inhabits sandy and disturbed soils along the upper Rio Grande Valley (see yellow area on map of Texas Pocket Gopher), where it occupies desert scrub and man-made habitats.



SOUTHEASTERN POCKET GOPHER *Geomys pinetis* 215–324mm, 57–120mm, 135–208g

Only gopher in range. Inhabits deep, sandy soils in long-leaf pine forests. Can be a pest in orchards and lawns.

KNOX JONES'S POCKET GOPHER

PLAINS POCKET GOPHER

TEXAS POCKET GOPHER

Texas Pocket Gopher sagittal crest no knob on zygoma

Plains Pocket Gopher no sagittal crest no knob on zygoma

Desert Pocket Gopher no sagittal crest knob on zygoma

gopher mounds

б

SOUTHEASTERN POCKET GOPHER

Rock

how to sex a gopher



PLATE 36 Western Desert Perognathus

POCKET MICE – These small, nondescript mice are quite diverse, and sometimes hard to tell apart. All have relatively long feet, but are poor jumpers compared to their cousins the kangaroo rats. Pocket mice are typically distinguished by the amount of spiny guard hairs present (i.e., spiny or smooth) and by subtle differences in the markings on their bodies and tails. They use their fur-lined cheek pouches (also known as pockets) to carry seeds back to underground larders.



WHITE-EARED POCKET MOUSE *Perognathus alticolus* 130–183mm, 70–97mm, 16–24g

Rarest of the *Perognathus*, this species resembles Great Basin Pocket Mouse, but is restricted to isolated mountain ranges bordering the Mojave Desert. With white or yellowish hair on the ears, it also differs from San

Joaquin and Little Pocket Mouse in having a lobed antitragus and a somewhat longer, darker crest on the tail. Nocturnal and secretive, little is known of their natural history, but captive animals fed on seeds and green vegetation. Found in open grassland and upland arid shrub communities between 1000 and 2000m.



SAN JOAQUIN POCKET MOUSE *Perognathus inornatus* 128–160mm, 63–78mm, 7–12g

Medium-sized mouse whose tail averages longer than head+body. Pelage is soft, with upperparts yellowish to pink overlaid with blackish hairs; the extent of the overlay determines the overall tone in various subspecies. Lateral line

is moderately well marked, and underparts are white, with tail faintly bicolored. Posterior third of sole of hind foot is haired, and whiskers are rather short. Uses arid annual grassland, savanna, and desert scrub, with sandy washes, fine soils, and scattered vegetation below about 600m.



ARIZONA POCKET MOUSE *Perognathus amplus* 135–173mm, 75–88mm, 9–14g

Small pocket mouse with orangish-tan upperparts sprinkled with black to varying degrees depending on soil color, and white or pale tan underparts. Tail is longer than head and body, slightly bicolored, and lacks a terminal

tuft. Although not true hibernators, they spend cool winter months in their burrow, feeding on stored seeds. Solitary and nocturnal, they forage between small shrubs or bunch-grasses in flat habitats with fine-textured soils, venturing into open areas only when the moon is dark.



LITTLE POCKET MOUSE *Perognathus longimembris* 110–151mm, 56–86mm, 6–11g

Smallest pocket mouse in its range, with coloration varying from gray to reddish-brown to cream dorsally, with paler buff or white hairs on undersurface. Tail relatively longer than that of San Joaquin Pocket Mouse, hind

foot averages shorter than that of Arizona Pocket Mouse. The subspecies that uses sandy habitats in southern California (*P.I. pacificus*) was once thought extinct, but a few endangered populations were rediscovered in 1993. Uses open grassland, shrub-steppe, and coastal sage habitats, in addition to very arid desert areas.





PLATE 37 Great Plains Perognathus



OLIVE-BACKED POCKET MOUSE Perognathus fasciatus 125–142mm, 57–68mm, 8–14g

Resembles other *Perognathus* in having soft pelage, with no spines or bristles, and somewhat hairy soles of feet. The olive-colored back distinguishes it from the otherwise similar Plains Pocket Mouse, and a yellow-

ish lateral stripe separates the pure white belly. The only pocket mouse occurring northward into Canada east of the Rockies, it is a resident of grassland, shrub-steppe, and desert scrub habitats of northern Great Plains and intermontane west.



PLAINS POCKET MOUSE *Perognathus flavescens* 117–155mm, 50–89mm, 7–16g

Small, soft-furred pocket mouse that is somewhat larger than Silky and Merriam's Pocket Mouse, with a relatively longer tail, and smaller buffy patches behind the ears. Occupies sand dunes and other stabilized, sandy

soils in the Great Plains and mountain states. Normally detected only by tracks in the sand, they can be seen at night by careful observation with good lights. Found from grassland and desert scrub up through oak woodlands and into pinyon-juniper communities.



MERRIAM'S POCKET MOUSE *Perognathus merriami* 95-121mm, 42-61mm, 5-9g

Tiny pocket mouse with yellowish-orange fur tinged with black on the back, and underparts that are white or pale buff and clearly separated from the darker sides. Very similar to Silky Pocket Mouse, but with a relatively

longer tail, shorter, slightly coarser pelage that is paler and more yellowish, and slightly smaller buffy spots behind the ears. Common in short-grass prairies, desert scrub, and open, arid, brushy areas from sea level to 1800m.



SILKY POCKET MOUSE *Perognathus flavus* 100–130mm, 44–60mm, 5–10g

This is one of the smallest pocket mice, and among the smallest rodents in North America. Looks essentially identical to Merriam's Pocket Mouse. Yellowish or reddish brown on back and sides, and white on the belly, with

buffy patches behind each ear. With a diet of mostly dry seeds, they minimize water loss by foraging only on cooler, more humid nights. Occupies grassy and shrubby habitats in western and southern plains and southwestern intermontane areas.



GREAT BASIN POCKET MOUSE *Perognathus parvus* & 160-181mm, 85-97mm, 21-31g; \$ 160-190mm, 85-90mm, 16-29g

This is the largest *Perognathus*. Differs from others in having hind feet longer than 20mm, buffy hair on the inside of the ears, a lobed antitragus, an olivaceous lateral line and a bicolored tail that is is dark above and has

only a slight terminal tuft. Capable of surviving on dry seeds with no free water, they will take insects and succulent vegetation when available. Occupies arid and semiarid sandy areas of sagebrush, steppe, open shrub, woodland, deserts, and dry grasslands.





PLATE 38 LIOMYS AND SPINY CHAETODIPUS



CALIFORNIA POCKET MOUSE Chaetodipus californicus 190-235mm, 103-143mm, 18-29g

Large pocket mouse with whitish spinelike stiff hairs on rump. Differs from San Diego and Spiny Pocket Mouse in larger size, longer ears (average 13mm), and relatively longer tail. Uses arid grassland and desert and coastal scrub communities as well as montane chaparral (yellow area on map).

SAN DIEGO POCKET MOUSE Chaetodipus fallax 176-200mm, 88-118mm, 17-22g

Medium-sized pocket mouse with broad region of yellowish to orangish hair on its sides that contrasts with its dark brown back. Has a number of stiff bristly hairs or spines in the rump region, but fewer than Spiny Pocket Mouse, Uses sparse, low, desert shrublands up to dense. high, coastal, sage-scrub vegetation (see red area on map of California Pocket Mouse).



NELSON'S POCKET MOUSE Chaetodipus nelsoni 182-193mm, 104-117mm, 14-18g

Drab gray, medium-sized mouse with harsh pelage and a distinctly tufted tail that is longer than the head and body. Soles of hind feet are black. Numerous and prominent spines on the rump; distal ends of the rump

spines usually dark-colored dorsally; entire rump spine is pale-colored laterally. White spots below the ears. Uses rocky places in Chihuahuan desert shrub vegetation with rocky soils and cactus, creosote, sotol, and lechuguilla provide scattered cover. Avoids sandy soils.



SPINY POCKET MOUSE Chaetodipus spinatus 164-225mm, 89-128mm, 13-18g

Upper pelage is drab brown and shaggy. Hairs are dark grav near base. pale tan in middle, black at tips. Lateral line is faint or absent. Underparts are buff-white. Ears are small (average 10mm) and dusky, and there is a

small white spot at the base of each ear. Tail is bicolored, with a distinct crest near the tip. Spines are located mostly on the rump, but scattered spines occur as far forward as the shoulder region. Inhabits rough desert landscapes of boulders, washes, rocky slopes, coarse soil, and sparse vegetation.



ROCK POCKET MOUSE Chaetodipus intermedius 157-188mm, 84-112mm, 10-20g

Medium-sized mouse with drab grayish-brown fur on back, a pale orangebrown line on the sides, and white underneath. Comparatively harsh fur with weak "spines" on the rump, and soles of hind feet are naked to the

heels. Tail is longer than the head and body and distinctly tufted at the tip. Uses rocky gulches, canyons, or boulders and rarely found on sandy or silty soils.



MEXICAN SPINY POCKET MOUSE Liomys irroratus ♂ 216-262mm, 106-138mm, 40-60g; ♀ 207-251mm, 102-131mm, 35-50g

Liomys is easily distinguished from all other pocket mice by ungrooved upper incisors. Gravish brown with white underparts, separated by buff stripe between the darker upperparts and paler underside. Fur on back

has a harsh appearance caused by the mix of stiff spiny hairs and soft slender hairs. Unique spoon-shaped claw on hind foot. Uses dense brushy areas along old river terraces, or in subtropical palm forests in extreme south Texas.

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PLATE 39 Smooth Chaetodipus



BAILEY'S POCKET MOUSE *Chaetodipus baileyi* & 206–240mm, 76–140mm, 25–38g; \$ 176–228mm, 86–125mm, 24–37g

Large, with grayish fur washed with yellow on back and rump, whitish underparts, and a long bicolored tail with a strong terminal crest. Inhabits Sonoran Desert and favors pebbly soils marking transition from sandy per (see red area on map)

flats to rocky slopes (see red area on map).

BAJA CALIFORNIA POCKET MOUSE *Chaetodipus rudinoris* 198–223mm, 90–113mm, 30–47g

Identical in appearance to Bailey's Pocket Mouse. This species was recently described based on strong genetic differences of populations west of the Colorado River in California and from throughout the Baja California Peninsula (see yellow area on map of Bailey's Pocket Mouse).



LONG-TAILED POCKET MOUSE Chaetodipus formosus 172–211mm, 86–125mm, 17–25g

Medium-sized mouse with soft pelage and no stiff bristly hairs on rump. Tail is long, with a distal crest and conspicuous terminal tuft. Smaller than Bailey's Pocket Mouse and with longer ears than Desert Pocket Mouse.

Uses dry and rocky areas, such as lava beds, desert scrub, dry stream beds, and boulderstrewn hillsides in Great Basin and Mojave and Colorado deserts.



HISPID POCKET MOUSE *Chaetodipus hispidus* 198–223mm, 90–113mm, 30–47g

Large pocket mouse, with distinctly coarse, but not spiny, pelage. The tail is only slightly shorter than the body and distinctively bicolored with no terminal tuft. Upperparts are olive-buff and separated from white underparts

by a distinct orangish-yellow stripe. Occupies grassland habitats from desert areas up through pinyon-juniper zones.



CHIHUAHAN POCKET MOUSE *Chaetodipus eremicus* 170–215mm, 90–115mm, 15–23g

Slightly larger and lighter in color than the very similar Desert Pocket Mouse; best distinguished by geographic range. The two were only recently recognized as distinct species from genetic evidence.



DESERT POCKET MOUSE Chaetodipus penicillatus 155–185mm, 83–110mm, 13–20g

Medium-sized pocket mouse lacking spines on rump, with yellowish-brown to yellowish-gray upper pelage and whitish underparts. Tail is long, bicolored, and strongly crested. Uses sandy soils with creosote, mesquite, or

palo verde vegetation, especially along desert washes. Rocky soils tend to be avoided.

BAILEY'S POCKET MOUSE and BAJA CALIFORNIA POCKET MOUSE

LONG-TAILED POCKET MOUSE

> HISPID POCKET MOUSE

CHIHUAHAN POCKET MOUSE DESERT POCKET MOUSE



PLATE 40 Kangaroo Mice and Small Four-toed Kangaroo Rats

KANGAROO MICE – With their huge hind feet and long tails, kangaroo mice are miniature versions of five-toed kangaroo rats. They differ by size, and by having a fat deposit in the tail that makes it appear wider in the middle, and with well furred soles on their hind feet. The two species of kangaroo mice are distinguished mainly by color. They are nocturnal seed eaters, and can transport food in their fur-lined cheek pouches.



DARK KANGAROO MOUSE *Microdipodops megacephalus* 138–177mm, 67–103mm, 10–17g

A dark-colored kangaroo mouse. Brownish, blackish, or grayish dorsal pelage distinguish it from the Pale Kangaroo Mouse. Also, the dorsal surface of the tail is darker than the body, and has a black tip. The hind foot

is less than 25mm. Hair on the underparts is dark at the base and white-tipped. Uses Upper Sonoran sagebrush desert, on fine gravelly soils.



PALE KANGAROO MOUSE *Microdipodops pallidus* 150–173mm, 74–99mm, 10–17g

A pale pinkish-cinnamon-colored kangaroo mouse. Dorsal surface of tail is same color as the body, and lacks a dark tip. Hind foot is more than 25mm. Belly fur is pale pinkish cinnamon at the base. Uses valley bottomlands

with stabilized dunes with fine sand in Upper Sonoran life zone dominated by saltbush and greasewood.

KANGAROO RATS – Aptly named rats with enormous hind feet, miniature front feet, and long tails. They have large eyes, a white racing stripe along their flanks and tails, and clearly marked dermal glands on neck between shoulder blades. Species are typically identified by their size, the number of toes on the hind feet (four or five), and characteristics of their tail. All spend the day in burrows and the night foraging for seeds, which may be transported in their fur-lined cheek pouches. May leap up to 2m in a single bound.



MERRIAM'S KANGAROO RAT *Dipodomys merriami* 195–282mm, 120–182mm, 33–54g

A relatively small, four-toed, slender-footed, and usually buff-colored kangaroo rat. The tail is much longer than head and body, ending with a dusky to dark tuft at the tip. Body has dorsal and ventral dusky stripes, and the

underparts are white. Smaller than most four-toed kangaroo rats, with a dark (not white)tipped tail. Different from the San Joaquin Valley Kangaroo Rat by range, body size, and color pattern on the tail. The subspecies from the San Bernardino Mountains (*D. m. parvus*) is Endangered. Occupies a wide variety of soil types and habitats in the Southwest.



SAN JOAQUIN VALLEY KANGAROO RAT *Dipodomys nitratoides* 211–253mm, 120–152mm, 40–53g

A small, four-toed kangaroo rat with yellowish-brown upperparts and white underparts. Facial crescents are dusky and meet over the bridge of the nose. Upper and lower tail stripes are sooty blackish, meeting along the

terminal third, thus interrupting the white side stripes. Inner aspect of the hind legs to heel are dull fulvous, and the underparts of the thigh stripes are white. Uses alkaline plains sparsely covered with grass, or saltbush and other arid vegetation.

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PLATE 41 Large Four-toed Kangaroo Rats



BANNER-TAILED KANGAROO RAT *Dipodomys spectabilis* & 315-349mm, 185-208mm, 110-132g; \$ 310-345mm, 180-205mm, 98-130g

A large, spectacular four-toed kangaroo rat with a long, white-tipped tail. It is yellowish-brown above and white underneath, with a long tail covered

with short hairs at the base and long hairs at the tip. Spots above the eye and behind the ear, hip stripes, forelimbs, dorsal surface and sides of hind feet, lateral tail stripes, ventral surface, and tip of the tail are pure white. Young animals are grayish on the back and slightly brighter on the sides. Active year-round, but may remain in burrows on cold or rainy nights. Lives in desert grasslands with scattered shrubs, and makes large mounds that contain extensive burrow systems.



DESERT KANGAROO RAT *Dipodomys deserti* 305–377mm, 180–215mm, 83–148g

Similar to *D. spectabilis*, but slightly paler overall and with paler, less contrasting dorsal and ventral stripes on tail. Large hind feet are covered with relatively long hairs, and have four toes. Indistinct white spot over eye, and

another behind ear that extends across the shoulder to the white underparts. Indistinct white band across the hips and an indistinct darker spot at the base of the whiskers. Soles of hind feet are nearly white. Color of upper parts varies from pale fawn to grayish black, depending on subspecies. Uses loose sandy soil in the most arid areas of North America, from below sea level in Death Valley to 1700m.



TEXAS KANGAROO RAT *Dipodomys elator* 260–345mm, 161–205mm, 65–90g

Tail is thick and long with dark stripes above and below, and white stripes on the side that end in a white tuft. Similar to Ord's Kangaroo Rat, but that species has five toes on the hind feet and a dark terminal tail tuft. Belly

is white, back is a buff color interspersed with black. Nose and eye rings are black; white thigh patches are present and meet at the base of the tail. Nocturnal and active mainly on moonless or cloudy nights. Now inhabits only three counties in central Texas; humaninduced land change has driven them to local extinction in north-central Texas and south-western Oklahoma. Uses clay and clay-loam soils with sparse vegetation, in what were originally mesquite grasslands.



CALIFORNIA KANGAROO RAT *Dipodomys californicus* 260–340mm, 152–217mm, 60–85g

Medium-large kangaroo rat with relatively broad face, darker upperparts and white belly. Tail has broad, dark dorsal and ventral stripes and a distinct white tuft. Typically has four toes on the hind feet, but five-toed indi-

viduals are occasionally found. Larger and darker than Merriam's Kangaroo Rat, and smaller and darker than the Desert Kangaroo Rat. Heermann's Kangaroo Rat is very similar, but has five toes. Burrows can be seen under boulders, bushes, and stumps in well-drained soils. Active even in rain and snow, they store only small amounts of seeds in scattered caches. Uses chaparral and other shrub, but is restricted to places where open areas are available.



TEXAS KANGAROO RAT

CALIFORNIA KANGAROO RAT



PLATE 42 Mid-California Five-toed Kangaroo Rats



HEERMANN'S KANGAROO RAT *Dipodomys heermanni* 250–313mm, 160–200mm, 70–80g

Medium-large kangaroo rat with relatively broad face and moderate-sized ears. Has five toes on the hind feet. Dorsal pelage varies from tawny-olive strongly overwashed with black to orangish yellow. Tail crest may be dark

and only slightly crested, blackish and very scantily haired or white tipped. Ears are smaller (12–15mm) than those of the Narrow-faced Kangaroo Rat. Smaller than the Giant Kangaroo Rat and larger than the San Joaquin Valley Kangaroo Rat. The subspecies *D. h. morroensis* from the Morro Bay area is Endangered, and typically lacks a hip stripe. They excavate their own burrows and also use abandoned ground squirrel tunnels. Occurs in wide range of habitats from Lower Sonoran to Transition zone.



GIANT KANGAROO RAT *Dipodomys ingens* 312–348mm, 157–197mm, 93–195g

Largest of the kangaroo rats. Has a dusky-colored nose, whitish cheeks, and blackish eyelids. Lateral white stripes along the tail are only slightly narrower than the dorsal and ventral dark stripes. Has five toes on the

hind feet. Tail tuft is dark in appearance because of a mix of pale and dark hairs. This Endangered species is restricted to southwestern San Joaquin Valley and adjacent arid areas of the Inner Coastal ranges of California. Primarily nocturnal, they sometimes forage in the daylight, especially at dusk. Burrows are frequently remodelled by changing entrances. Uses sandy loamy soil on level and gently sloping ground vegetated with annual grasses and forbs and widely scattered shrubs from 200–800m.



NARROW-FACED KANGAROO RAT *Dipodomys venustus* 293–336mm, 175–210mm, 68–97g

Large, dark-colored, five-toed kangaroo rat with black nose that merges into a black band at the base of the whiskers. Top of head and back are darker, sides and thigh patches are yellowish brown. Ears are large and

nearly black, with pale spots at the base and at the top of the fold. The subspecies (*D. v. elephantinus*) in southern parts of the Gabilan Mountains, California, has lighter ears and less distinctive facial markings, and was previously considered a separate species. Darker than the Agile Kangaroo Rat, with bolder face markings, larger ears, longer tail, and longer rostrum. Darker than Heermann's Kangaroo Rat, and with much larger ears. Small geographic range along the California coast up to 1770m in elevation. Uses slopes with chaparral, oaks, or digger pine on sandy soils.





PLATE 43 Southern California Five-toed Kangaroo Rats



DULZURA KANGAROO RAT *Dipodomys simulans* 273–302mm, 160–181mm, 55–70g

Intermediate in size, with long, bicolored tail that has a blackish crest and tuft. Has five toes on the hind feet. Upperparts vary from pale grayish brown to dark reddish brown, depending on geography. Smaller than the

Agile Kangaroo Rat. Longer ears (15–20mm) than Stephens's Kangaroo Rat. Extends from Baja California, Mexico, into southern California. Nocturnal, but active at both dusk and dawn as well as occasionally during the day. Good swimmers, they use their large hind feet to their advantage in the water. Uses coastal chaparral and grasslands on gravelly or sandy soil from sea level to 2300m.



STEPHENS'S KANGAROO RAT *Dipodomys stephensi* 277–300mm, 164–180mm, 45–73g

Medium-sized five-toed kangaroo rat with yellowish-brown upperparts overlain with black hairs. Narrow lateral white tail stripes are indistinctly demarcated from the dark stripes (not sharply demarcated broad lateral

stripes as in the Agile Kangaroo Rat). Has smaller ears (12–14mm) and occupies more open habitats than the Agile and Dulzura kangaroo rats. Seriously Endangered by agricultural and urban development, now restricted to Riverside, San Bernardino, and San Diego counties, California. Found in sparse grasslands and coastal sage-scrub habitats from 85–850m.



AGILE KANGAROO RAT *Dipodomys agilis* 277–320mm, 170–195mm, 63–79g

Intermediate-sized five-toed kangaroo rat with large ears and dark reddishbrown upperparts. The belly is white, and the long, bicolored tail has a blackish crest and tuft, with broad, sharply demarcated white lateral

stripes. Pelage of young animals is darker than adults, with hairs on tail not elongated into a crest. Larger than the Dulzura Kangaroo Rat, with longer ears (16–19mm) than Stephens's Kangaroo Rat. Active mainly at night, and solitary except during the breeding season from March to July. Found primarily in areas of loose soil in open chaparral and coastal sage-scrub from 500–2300m.







PLATE 44 Other Five-toed Kangaroo Rats



CHISEL-TOOTHED KANGAROO RAT Dipodomys microps 245–295mm, 135–175mm, 40–70g

Medium-sized, narrow-faced, small-eared, kangaroo rat with incisors that are flattened anteriorly and not strongly incurved. Has five toes on the hind feet. Metallic gray pelage, darker tail stripes, and a more prominent face mask

distinguish it from Ord's Kangaroo Rat. Long whiskers maintain contact with the ground even when the animal is in midair. Hind feet and tail are shorter than those of Panamint Kangaroo Rat. Eats more leaves than other kangaroo rats, and is one of few mammals adapted to feed on *Atriplex* saltbush. Occupies desert valleys dominated by saltbush in the Great Basin.



PANAMINT KANGAROO RAT Dipodomys panamintinus 285-334mm, 156-202mm, 57-95g

Medium-sized five-toed kangaroo rat with pale, clay-colored upperparts tinged with pale ocher. Thigh patches are large and colored like the back. Facial crescents and end of nose are broadly blackish, but are not con-

tinuous (or just barely continuous) over the sides of the nose. Inner sides of legs are dusky pale brownish and underparts are white. Tail has a ventral stripe that may extend to the end of the tail vertebrae. Has a longer tail than the Gulf Coast Kangaroo Rat and longer feet (42–48mm) than Ord's Kangaroo Rat. Lower incisors are rounded and curved like most other kangaroo rats, but unlike the Chisel-toothed Kangaroo Rat. Uses coarse sand and gravelly desert flats with scattered desert scrub vegetation.



ORD'S KANGAROO RAT *Dipodomys ordii* 208–365mm, 100–163mm, 50–96g

Medium-sized, relatively short-tailed five-toed kangaroo rat. Color of back may be brownish, reddish, or blackish, depending on the subspecies. The belly is white. Has shorter hind feet (39–44mm) than the Panamint Kan-

garoo Rat. The Chisel-toothed Kangaroo Rat has chisel-shaped lower incisors; the Gulf Coast Kangaroo Rat has an orange cast to the pelage and a shorter, less-crested tail. Nocturnal and active year-round, Ord's Kangaroo Rat is more often seen on cloudy nights and rarely on cold or snowy nights. Occupies variety of habitats associated with fine-textured, sandy soils including semiarid grasslands, mixed grasslands, and scrublands.



GULF COAST KANGAROO RAT Dipodomys compactus 205–266mm, 104–135mm, 44–60g

Medium-sized kangaroo rat with a short tail. Found only in southern Texas. Coastal island forms are orangish yellow or grayish cream on the back; mainland animals are reddish yellow on the back. This color covers the

entire back and is purest on the sides and flanks. Upperparts are lightly washed with black. Ears, underside of feet, and dorsal and ventral tail stripes are similar to the dorsal color. Cheeks are white. Tail is shorter and less hairy than Ord's Kangaroo Rat. Has five toes on the hind feet. Uses sparsely vegetated areas with sandy soil, such as open mesquite savanna. In areas where their range overlaps with Ord's Kangaroo Rat, Gulf Coast Kangaroo Rats are more likely to be in softer soil areas where the vegetation is lower and the landscape generally more open.





PLATE 45 Jumping Mice

JUMPING MICE – Superficially look like the unrelated kangaroo rats with their long tails and large feet. These nocturnal mice have grooved upper incisors and a tricolored pelage with distinct colors on the back, sides, and belly. Sexes are similar. Not seen in winter because all species hibernate for most of the cold months.



WOODLAND JUMPING MOUSE Napaeozapus insignis 210–255mm, 125–160mm, 15–30g

Redder than the Meadow Jumping Mouse with a white tail tip. Pelage is smooth (not grizzled) and the color becomes more orangish toward southern portion of range. No whitish border on ears. Only three cheek teeth on

each side of upper jaw. True to their name, these nocturnal mice are able to jump up to 4m. The long tail acts as a balance during jumping, and the large hind feet provide the power. They do not make runways, although they will use those of other species. Feeds on fungi, insect larvae, and fruit. Found only in or along wooded areas; rarely in open habitats.



MEADOW JUMPING MOUSE Zapus hudsonius 180–235mm, 100–135mm, 12–30g

Yellowish mouse with a bicolored tail that lacks a white tip. Four cheek teeth. Yellow fur is less grizzled than in the Western Jumping Mouse, with a more distinctly bicolored tail and no white fringe on the ear. Slightly

smaller than other *Zapus*. Primarily nocturnal, and escapes by making short leaps; shorter than those of the Woodland Jumping Mouse. Colorado and Wyoming subspecies (*Z. h. preblei*) is threatened. Found in grassy or weedy fields and occasionally along the edge of woods.



WESTERN JUMPING MOUSE Zapus princeps 215–245mm, 130–150mm, 18–25g

Pelage grizzled dorsally, with pale yellowish-buff lateral line. Ears have a slight whitish border; tail less distinctly bicolored. Due to the short active season, they have only a single litter of 2–8 young after an 18-day ges-

tation period. After nursing for 30 days, the young must put on enough fat to hibernate in the next 45 days. They manage this by feeding on grass seeds and forbs, although early in the active period they feed on invertebrates and fungi as well. Found in high mountain meadows and in wetter streamside habitats.



PACIFIC JUMPING MOUSE Zapus trinotatus 210–250mm, 110–155mm, 20–30g

Brightly contrasting colors on back with a brownish (not white) border to the ears. Pelage tricolored, back dark brown, sides yellowish orange, and belly whitish. Distinct area of buff hair forms a lateral line. Fall pelage paler

and less contrasting. Tail sparsely haired. Their erratic and evasive locomotion has led to their description as nervous or high-strung. Feeds mainly on grass seeds, and leaves characteristic piles of stem cuttings. Found in wet meadow habitats of the Pacific Northwest.



PACIFIC JUMPING MOUSE


PLATE 46 Eastern and Central Woodrats

WOODRATS – Also known as packrats, these soft-furred, nocturnal rats have long tails and relatively large ears. Characters of the tail or throat often distinguish species.



EASTERN WOODRAT *Neotoma floridana* & 305–450mm, 130–180mm, 220–385g; \$ 300–400mm, 130–170mm, 175–260g

A medium-sized woodrat, grayish-brown dorsally and white ventrally. Differs from Allegheny Woodrat primarily in having a skull with a maxillovomerine notch, and by geographic range. Worn summer pelage may

appear cinnamon-orange. Head becomes grizzled in older animals. Larger than Mexican Woodrat, with throat and breast hair that is white to base. Paler in color than Southern Plains Woodrat. Dens constructed of sticks, often around large rock or log. Key Largo subspecies, *N. f. smalli*, is Endangered. Found primarily in wooded areas, but also in hedgerows and rocky outcrops in grasslands.



ALLEGHENY WOODRAT *Neotoma magister* & 370–465mm, 145–215mm, 230–485g; \$ 350–445mm, 140–210mm, 230–455g

Only woodrat in range. Slightly larger, and with slightly hairier tail than Eastern Woodrat; skull needed for certain identification. A large woodrat, cinnamon brown with gray dorsally and gray or white ventrally. Juveniles are

grayer; summer animals are darker. Does not build complex stick dens, but makes grass and bark nests in crevices and abandoned buildings, and nearby latrine sites with large accumulations of feces are a sure sign of their presence. Rare and declining, apparently because of a disease transmitted from large Raccoon populations. Found along cliffs, caves, and talus slopes of the Appalachian Mountains.



MEXICAN WOODRAT Neotoma mexicana 290-415mm, 105-205mm, 150-255g

Smallish woodrat with sparsely haired tail and throat hairs gray at base. Back may be grayish brown or rufous brown; white below with a bicolored tail. Color is less gray than Southern Plains Woodrat. A dusky line usually

borders the mouth. May build stick dens; more typically uses crevices, tree cavities, or buildings for nests. Mexican Woodrats have the weakest instinct for collecting items, the behavior that led to the name packrat. Food includes berries, seeds, and green vegetation. Found on rocky outcrops or cliffs and rocky slopes in mountainous areas and woodlands.



SOUTHERN PLAINS WOODRAT *Neotoma micropus* & 335-410mm, 130-175mm, 210-315g; \$ 310-380mm, 130-165mm, 180-275g

Steel-gray back with throat hairs white to base. Bicolored tail is relatively short and sparsely haired. Fur soft, dense, darker than in the Eastern Woodrat, and less colorful than the Mexican Woodrat. Belly is pale gray;

throat and chest are white. Feet are white. Dens are built from sticks, manure, and cactus joints around desert vegetation. Breeding occurs in spring and fall and a litter of 2 or 3 is born after a gestation period of 30–39 days. Young are weaned at 30 days, disperse in 6 months, attain adult size at 9 months, and live up to 27 months. Found on rocky hillsides and grassy lowlands with desert scrub vegetation.





PLATE 47 Furry-tailed Woodrats



WHITE-THROATED WOODRAT Neotoma albigula 280-400mm, 75-185mm, 135-285g

Throat hairs are white to base. This medium-sized woodrat has a brown back and a bicolored tail. Tail has long hairs, but is not bushy. The soft short pelage often has blackish hairs interspersed with the brown. Ears

are relatively long and feet are white. Large stick dens are constructed of cactus and the woody stems of mesquite, juniper, and other shrubs. Breeds year-round, with a gestation period of 38 days and litter sizes of 2 or 3. The young weigh about 10g at birth, and lactation lasts about 20–25 days. Found in a wide variety of habitats ranging from low desert to rocky slopes on mountainsides from sea level to 2500m (red area on map).

WHITE-TOOTHED WOODRAT *Neotoma leucodon* & 335–410mm, 130–175mm, 210–315g; \$ 310–380mm, 130–165mm, 180–275g

Identical in appearance to the White-throated Woodrat, but found only east of the Rio Grande in Texas, New Mexico, and Mexico. Recently described from genetic data; no morphological, ecological, or behavioral differences have been reported. Nocturnal and terrestrial, but capable of climbing in shrubs and cacti. Builds conspicuous stick nests at the base of shrubs or trees, or between boulders. Some nests are huge, up to 4m in diameter and 1m high. Occurs in arid woodlands and pastures, juniper woodlands, oak forests, and cactus shrublands (yellow area on map of White-throated Woodrat).



STEPHENS'S WOODRAT Neotoma stephensi 275-310mm, 115-150mm, 115-180g

Small woodrat with dusky-gray pelage and a semi-bushy tail. Western animals are darker, with throat hair dark to base and a nearly black tail; eastern animals are lighter in color with throat hairs that are white at the base

and a tail with fewer black hairs. Belly is creamy in color. Dusky dorsal color extends to just below ankle, feet are white. Tail is bushier than in all woodrats except the Bushy-tailed Woodrat. This woodrat is one of the few mammals specialized to feed on conifer needles, specializing in juniper twigs. Dens are almost always found at the base of junipers. Also occurs in ponderosa pine, agave, and cactus habitats.



BUSHY-TAILED WOODRAT *Neotoma cinerea* 3 310–470mm, 130–225mm, 180–585g; \$ 275–410mm, 120–195mm, 165–370g

Large woodrat with bushy, squirrel-like tail. Ears are large, thinly haired, and almost translucent. Back varies from pale gray to blackish brown and belly is buff to whitish; animals in cooler climates have darker coloration.

Fur is long and dense. Whiskers are long. Some subspecies have white hair along mid-ventral line, others have white throats. Nocturnal and active year-round, these are classic packrats, carrying a wide variety of items back to the nest. Dens are haphazard accumulations of sticks, bones, and other material, often dropped in cracks and crevices. Urination spots often conspicuous. Found in wooded, mountainous habitats in the Northwest.







DUSKY-FOOTED WOODRAT Neotoma fuscipes 335-470mm, 160-240mm, 205-360g

Has sooty-colored hairs on the top of hind feet. Medium-sized woodrat with brownish-gray back, pale to white belly, and a faintly bicolored tail. Pelage darker near coast. Constructs fairly elaborate stick nests on the ground,

in the vegetation, and on rocky slopes. Found mainly in scrub and woodland communities (see red area on map).

BIG-EARED WOODRAT Neotoma macrotis 335-470mm, 160-240mm, 205-360g

Externally in appearance like Dusky-footed Woodrat. This species was only recently split from *N. fuscipes*, the two differ mostly in genetic and obscure morphological characters; Bigeared Woodrat has a larger vomer, narrow presphenoid relative to the basisphenoid, and a flower-like glans penis. Behavior and ecology like Dusky-footed Woodrat (see yellow area on map of Dusky-footed Woodrat).



ARIZONA WOODRAT Neotoma devia 255-325mm, 110-160mm, 72-144g

Has very large petal-like ears and dark gray throat fur. Small body size with pale coloration. Belly is white. Range restricted to Arizona and northwest Sonora. Smaller and paler in color than the Desert Woodrat. Builds dens

at the base of cliffs and on rocky outcroppings, and covers them with cactus. Found in both low deserts and mountain areas south of Grand Canyon and east of Colorado River.



DESERT WOODRAT Neotoma lepida 245-352mm, 101-162mm, 85-186g

Feet are white, ears are large, and throat hairs are dark. Smallish woodrat, pale gray-brown dorsally, with a distinctly bicolored tail. Larger and darker than the Arizona Woodrat. Smaller than Bryant's Woodrat, with finer hairs,

and paler coloration. Builds sloppy stick nests around cacti, or on rocky crevices. Found in desert scrub in many of the drier deserts of North America (see red area on map).

BRYANT'S WOODRAT Neotoma bryanti 284-387mm, 132-179mm, 105-209g

A large rat like the Desert Woodrat but darker. Pelage is relatively stiff and coarse. Its bicolored tail is black above, not brown, and relatively longer than the Desert Woodrat. This woodrat prefers coastal sage scrub, and also occurs on many islands of the Baja peninsula (see yellow area on map of Desert Woodrat).

ROOF RAT Rattus rattus 325-455mm, 160-255mm, 115-350g

Scaly, sparsely haired, uniformly dark tail that is longer than the head and body. This dark rat has a brownish-gray back and a grayish belly (not white like woodrats). Introduced from Europe with earliest colonists. Widespread in south and coastal areas. Frequents urban areas, buildings, and warehouses.

BROWN RAT Rattus norvegicus 315-460mm, 120-215mm, 195-485g

Similar to Roof Rat, but with tail shorter than head and body. Scaly tail and dark belly distinguish it from woodrats. A later introduction that has outcompeted Roof Rats in many areas. Widespread from southern Canada throughout United States in both urban and old field habitats.





PLATE 49 Grasshopper Mice and Oryzomys

GRASSHOPPER MICE – **ONTCHOMTS** – These are among the most predaceous rodents, feeding mainly on insects and scorpions at night. They are characterized by a relatively short tail, and have a loud, pure tone vocalization that is audible to humans. The three species are nearly identical, and best distinguished by geographic range.



NORTHERN GRASSHOPPER MOUSE Onychomys leucogaster 120–190mm, 30–60mm, 25–50g

Large grasshopper mouse with relatively short tail. Back may be grayish or cinnamon-buff; underside is white. Tail tip may be white. Found in arid and semiarid habitats throughout western North American shrub steppes

and grasslands.



SOUTHERN GRASSHOPPER MOUSE *Onychomys torridus* 130–160mm, 40–60mm, 20–40g

Differs from Chihuahuan Grasshopper Mouse only in genetic details, but ranges do not overlap. Compared with the Northern Grasshopper Mouse, is smaller with a relatively long tail. Grayish or pinkish-cinnamon above;

white below. Occurs in arid habitats throughout Sonoran and Mojave deserts, plus chaparral in California (yellow area on map).

CHIHUAHUAN GRASSHOPPER MOUSE Onychomys arenicola 120–160mm, 35–55mm, 20–35g

Differs from Southern Grasshopper Mouse only in genetic details, but ranges do not overlap. Smaller than the Northern Grasshopper Mouse, with a relatively larger tail. Occurs in low desert-scrub habitats in Chihuahuan Desert, and extending slightly northward (see red area on map of Southern Grasshopper Mouse).

ORYZOMYS – Previously known as rice rats, this genus of nocturnal, mostly aquatic rats is diverse in the neotropics (more than 36 species), but only two species reach the United States. Semiaquatic feeders on seeds, vegetation, and occasionally invertebrates. They are mouselike in appearance, with coarse pelage that is neither bristly nor spiny. They have long tails with visible rings under sparse hair.



COUES'S ORYZOMYS Oryzomys couesi 390–410mm, 130–140mm, 65–70g

Large brown *Oryzomys* with long tail. Back is dark brown, sides are pale brown, and belly is even paler. Builds nests of leaves, twigs, and vines in cattails or small trees over the water. Uses a variety of marshy habitats.



MARSH ORYZOMYS *Oryzomys palustris* & 195–260mm, 95–120mm, 45–80g; \$ 190–255mm, 85–115mm, 40–60g

Small grayish *Oryzomys* with tail about equal to head and body length. Has a dark mid-dorsal stripe, the belly and feet are whitish, and the tail is bicolored. Active all year. Makes grapefruit-sized nest of grasses. Some con-

sider the silvery-gray subspecies *O. p. argentatus* of Florida Keys to be full species. The subspecies *O. p. natator* in the lower Florida Keys is Endangered. Found in marshy areas of Atlantic coast and southern United States.







NORTHERN PYGMY MOUSE *Baiomys taylori* 87–123mm, 34–53mm, 6–10g

North America's smallest rodent. Varies from reddish brown through gray to almost black above, and white to creamy buff or gray below. Tail is covered with short hairs, and may be uniformly gray or paler ventrally. Incisors

are ungrooved. Uses a variety of habitats including prairie, mixed-desert shrub, post oak savanna, and pine oak forests.

 $\mathbf{H}_{\mathbf{ARVEST}}$ \mathbf{MICE} – Mice in this genus are distinguished by their small size and the single groove on each upper incisor.



FULVOUS HARVEST MOUSE *Reithrodontomys fulvescens* 134–189mm, 73–116mm, 6–25g

Small fulvous mouse. Upperparts vary from reddish-yellow buff to tawny to pinkish cinnamon or salmon. The pelage is mixed medially with blackish hairs that sometimes form a darker band down the midline from nose to

tail. Underparts vary from white to gray, often tinged with buff or pale pinkish cinnamon. Tail is brown to dark brown above and only indistinctly bicolored. Feet are grayish white to buffwhite and ears are varying shades of brown, often with a tawny or reddish-yellow tinge on the inner surface. The pelage is coarser than in other harvest mice, with a streaked salt-and-pepper effect from the black guard hairs. Larger and brighter than Eastern Harvest Mouse. Less gray than Plains Harvest Mouse with a relatively shorter tail that is not bicolored. Often trapped near rocky outcrops and cacti. Constructs baseball-size nests of grasses and sedges in vegetation off the ground. Uses grassy fields with shrubs, especially mesquite grassland, grassland, pine-grass ecotones, and grass-brush habitats.



EASTERN HARVEST MOUSE *Reithrodontomys humulis* 107-128mm, 45-60mm, 10-15g

Small, brown mouse with a relatively short tail. Upper parts are rich brown, sometimes faintly washed with gray, and with a dark mid-dorsal stripe. Sides are paler than the dorsum, with an obvious lateral line present.

Underparts are ash-colored and often have a cinnamon or pinkish wash. Tail is slender, sparsely furred, bicolored, and shorter than the head and body. Ears are fuscous or fuscousblack in color, and feet are grayish white. Similar to *R. fulvescens*, but tail is shorter and more bicolored. Uses broom sedge, grassy or weedy areas, tangled patches of briar, roadside ditches, brackish meadows, and wet bottomlands.



PLAINS HARVEST MOUSE *Reithrodontomys montanus* 54–146mm, 20–69mm, 6–13g

Small, grayish mouse with a diffuse dark stripe down the middle of its back and a short bicolored tail. Remainder of fur on back is grayish brown and the underside is white. Tail is shorter than head and body, bicolored, with

a sharp dark line above and paler color below. Tail is sparsely haired, but does not appear scaly. There is a bright tuft in front of the ears and a spot behind them. Similar to Eastern Harvest Mouse, but larger and paler, with paler ears. Uses grassy areas in the Great Plains.



EASTERN HARVEST MOUSE

PLAINS HARVEST MOUSE



PLATE 51 House and Western Tiny Mice



WESTERN HARVEST MOUSE *Reithrodontomys megalotis* 118–170mm, 50–96mm, 8–15g

Small mouse with a relatively long, bicolored tail. Fur is bristly and relatively short. Feet are whitish. The ears are comparatively small and buff to reddish brown. The tail is about as long as the head and body and dis-

tinctly bicolored, with relatively long hairs that tend to obscure the scales. Juveniles are grayish brown: subadults are brighter than juveniles but duller than adults. The thick winter pelage is paler and the tail is more distinctly bicolored. Some animals east of the Mississippi River and in the San Francisco Bay area have a buff pectoral spot. Larger than Plains Harvest Mouse, with longer hair and a more distinctly bicolored tail. Larger than Eastern Harvest Mouse, with a relatively longer tail. Has a less pointed, more bicolored tail than Salt-marsh Harvest Mouse. Makes spherical nest of grasses and other plant fibers, lined with softer material, with an opening near the bottom. These are often on the ground, but may be up in the shrubs, or sometimes even underground in the burrows of other animals. Feeds on herbs, seeds, and insects, including ground beetles when available. They can climb in the shrubbery to reach flowers and seeds. Although they do not make food caches, they do lay down body fat in the fall. They do not hibernate, but can become torpid for short periods, relying on fat stores to get them through periods of extreme weather. This species is very widespread and tolerant of a wide range of habitats, ranging from arid deserts and sand dunes through fallow fields, woodland clearings, and disturbed habitats such as roadsides and fence rows from sea level to 4000m.



SALT-MARSH HARVEST MOUSE *Reithrodontomys raviventris* 118–175mm, 56–95mm, 7–15g

A small reddish mouse from the San Francisco Bay area. The subspecies from the south end of the bay (R. r. raviventris) has dark, cinnamon-colored back with a tawny lateral line and a pale to cinnamon belly. Mice from the

north end of the bay (*R. r. halicoetes*) have paler upperparts with no lateral line and a white belly. Similar to Western Harvest Mouse, but with a more unicolored tail. They may have 2 or 3 litters per year, but populations are small due to habitat destruction. Known for its docile behavior, this species is endangered and restricted to salt marshes bordering San Francisco Bay. Although they are good swimmers, they prefer the dense cover offered by pickleweed, a key component of these salt marshes.

HOUSE MOUSE Mus musculus 130-200mm, 65-100mm, 18-23g

Small, nearly unicolored grayish-brown mouse with dark underparts. Tail is dusky and unicolored. Most likely to be confused with the Harvest Mouse, which has grooved incisors and typically has reddish back and lighter belly, or *Peromyscus*, which has white underparts. This cosmopolitan, introduced species is most common around human habitations, but may inhabit old fields and nearby disturbed habitats as well.





PLATE 52 Northern Deermice

 $P_{EROMTSCUS}$ MICE – Mice in this diverse group are characterized by brownish backs, white bellies, and long tails. Their large eyes and ears are adaptations to their nocturnal habits. The different species are distinguished by details of their measurements, and body and tail coloration.



WHITE-FOOTED DEERMOUSE *Peromyscus leucopus* 150–205mm, 65–95mm, 15–25g

Small, grayish to brownish mouse, frequently with dark stripe along midback, and white underparts. Tail sparsely haired and indistinctly bicolored, tuft of hairs on tip less than 5mm long. Very similar to other species of

Peromyscus: North American Deermouse typically has a distinctly bicolored tail (although not in the northeastern United States); Cotton Deermouse has a longer hind foot; Oldfield Deermouse is smaller and pale cinnamon to almost white in color, and Brush, White-ankled, Piūn, Saxicoline, Northern Rock, and Texas Deermouse all have longer tails. Favors warm dry forests at low to mid-elevations. This is the most common *Peromyscus* in eastern mixed deciduous and coniferous forests, and it also frequents the edges of agricultural areas, where it forages in the fields.



NORTH AMERICAN DEERMOUSE Peromyscus maniculatus 120–225mm, 50–125mm, 10–30g

The most widespread, geographically and ecologically variable mouse in North America. Has large black bulging eyes, relatively large, naked ears, fine, smooth-lying fur, and white feet. The well-haired, sharply bicolored tail

is tipped with a tuft of short, stiff, hairs something like a watercolor brush. Juveniles are gray, subadults are yellowish brown. The two main forms include a long-tailed, large-eared forest dweller and a short-tailed, small-eared, open-country form. Generally has darker, richer colors in humid regions and paler, drabber colors in arid regions. Differs from White-footed Deermouse by having a distinctly bicolored tail that is about as long as the head and body length; from Northwestern Deermouse by having a shorter tail and foot; from Brush and White-ankled Deermouse by having a shorter tail; from California Deermouse by being smaller; from Cactus and Merriam's Deermouse by being darker in color with more hair on tail and more distinctly bicolored tail; from Canyon Deermouse by having darker color, shorter tail, and shorter, less soft pelage; and from Piõn and Northern Rock Deermouse by hav-ing smaller ears. Found in almost all habitat types within its range.



NORTHWESTERN DEERMOUSE *Peromyscus keeni* 181–236mm, 92–114mm, 10–30g

Large mouse with dark colors, long tail, and dense fur. Similar to North American Deermouse, but significantly larger, and with a longer tail. Agile jumpers, they also are capable of climbing into lower vegetation. The breed-

ing season is April–June, and litters of 4–7 are normal. This is the most common deermouse along the Canadian Pacific coast, where it occupies habitats ranging from coastal lowlands to sub-alpine forests. Tends to be more common in edge habitats, and less so in dense coniferous forests. They frequently occupy buildings, especially in rural areas during winter.





PLATE 53 Southeastern Peromyscus and Relatives



COTTON DEERMOUSE *Peromyscus gossypinus* 142–206mm, 55–97mm, 17–46g

Medium-sized *Peromyscus*, dark golden brown above with white underparts and feet. Mid-dorsal area is dusky. Soles of feet have prominent ridges. Tail is shorter than head and body, sparsely haired and dark on

upper surface but fading to white underneath. Young animals are grayer. Larger than Oldfield and North American Deermouse. Also larger than White-footed Deermice of the same age. The subspecies from Key Largo (*P.g. allapaticola*) is endangered. Good climbers and swimmers, they prefer somewhat wet habitats, especially bottomland hardwood forests, hammocks, and swamps, although they also inhabit drier upland habitats, and sometimes enter buildings.



OLDFIELD DEERMOUSE *Peromyscus polionotus* 110–150mm, 40–60mm, 10–15g

Small *Peromyscus* whose inland forms are fawn-colored or brownish gray dorsally, slightly darker along the midline with hairs that are slate-gray at the base. Underparts are white with hairs pigmented at the base, and the

bicolored tail has a dark dorsal stripe. Beach forms are paler and have underparts that are white to the base of the hairs, and a dark tail stripe that is reduced or absent. Many coastal subspecies are Endangered because of the declining health of the Gulf states' coastal dune ecosystem. Inhabits open, sandy habitats in early successional stages of abandoned fields, and grassy dunes along the coast.



FLORIDA DEERMOUSE *Podomys floridanus* 178–220mm, 80–101mm, 27–47g

Large mouse; brownish above, and white below, with orange lateral areas separating the two. Larger than other *Peromyscus* in range, with bigger ears and feet. Has orange color on cheeks, shoulders, and sides. Has a dis-

tinctive skunklike odor. Known to frequent burrows of gopher tortoises, where they build side tunnels off the main burrow. They reproduce year-round with litters of 1–5 weighing 2–3g each after a gestation period of about 23 days. The diet includes acorns and other plants such as paw-paw, plus insects. Uses sandy uplands with prickly pear cactus and longleaf pines.



GOLDEN MOUSE Ochrotomys nuttalli 140–190mm, 67–97mm, 18–27g

Medium-sized mouse with golden upperparts and creamy-colored underparts and feet. Pelage is very soft and hairs are very fine. Attractive and relatively docile. Degree of brightness of color varies by subspecies. Tail

semi-prehensile and used in climbing, as this species is fairly arboreal and builds nests and feeding platforms in vines, trees, and Spanish moss. They feed on seeds, nuts, and berries of plants such as Sumac, cherry, dogwood, blackberry, and greenbrier, as well as occasional invertebrates. Uses densely forested lowlands and floodplain communities, often including honeysuckle, greenbrier, or other vines. Rarely encountered in or near human habitations.





PLATE 54 FAR WEST PEROMYSCUS



CALIFORNIA DEERMOUSE Peromyscus californicus 220-285mm, 117-156mm, 33-55g

The largest Peromyscus; has long, dense, fine fur that varies from yellowish brown to gray with a blackish-brown back and grayish below. The tail is indistinctly bicolored, well haired, and longer than the head and body. Uses chaparral and oak woodland, redwood forests, and coastal sage scrub.



CANYON DEERMOUSE Peromyscus crinitus 162-191mm, 79-118mm, 13-23g

Small to medium-sized mouse with relatively long ears. The tail is as long as the head and body and thinly haired with a distinct "pencil" of hairs at the tip. Venter is white, sometimes with a buff pectoral or anal patch.

Feet are white. Tail is more tufted and densely haired than in Merriam's or Cactus Deermouse. Uses arid grasslands and shrublands, and slickrock deserts of west.



CACTUS DEERMOUSE Peromyscus eremicus 169-218mm, 92-117mm, 18-40g

Medium-sized mouse with long, soft, silky pelage and large ears. Body is pale gray washed with reddish brown above and whitish on the underparts. The head is grayish, and the lateral line is pale yellowish buff. Smaller and

grayer than the California Deermouse with a lateral line and less hair on the tail. Usually smaller than the Merriam's Deermouse and lighter in color, with white (not creamy) underparts and without a cinnamon-colored pectoral patch. Lacks the densely-haired tail with tufted tip of the Brush or Canyon Deermouse. Uses low desert areas and rocky foothills with scattered vegetation and sandy soils (see red area on map).

NORTHERN BAJA DEERMOUSE Peromyscus fraterculus 169-218mm, 92-117mm, 18-40g

Like Cactus Deermouse but lives in Southern California and Baja Peninsula. Recently described as a unique species based on genetic data, no morphological or ecological differences between the Cactus and Northern Baja Deermouse are known (see yellow area on Cactus Deermouse map).



MERRIAM'S DEERMOUSE Peromyscus merriami 185-225mm, 95-120mm, 20-30g

Small to medium-sized mouse, somewhat darker above than the Cactus Deermouse, with creamy underparts. Usually larger than the Cactus Deermouse, darker on the back, with a creamy (not white) venter. Has a less densely

haired tail than the Canyon Deermouse without a tufted tip. Occurs in bosques - dense thickets of mesquite, often mixed with cholla, prickly pear, palo verde, vines, and grasses.



BLACK-EARED DEERMOUSE Peromyscus melanotis 140-170mm, 50-73mm 17-28g

Like the North American Deermouse (plate 52) but occurs in southeastern Arizona and New Mexico. Differs from most other Peromyscus by being smaller, with a shorter tail and in having black preauricular hairs at ante-

rior base of ear. This species was recently described from genetic data, and can only be distinguished from the North American Deermouse by having a slightly smaller black tuft, a broader and more rounded braincase, and a longer and more slender rostrum.

CALIFORNIA DEERMOUSE

CANYON DEERMOUSE

CACTUS DEERMOUSE and NORTHERN BAJA DEERMOUSE

MERRIAM'S DEERMOUSE



PLATE 55 **Peromyscus truei** and boylii Groups





PIÑON DEERMOUSE Peromyscus truei 171-231mm, 76-123mm, 15-50g

Medium-sized mouse with large ears and a hairy tail. Ears are longer than the hind feet, and relatively larger than other *Peromyscus*. The tail has a dark dorsal stripe and is tipped with long hairs. Favors rocky slopes with pinyon pine and juniper.

NORTHERN ROCK DEERMOUSE *Peromyscus nasutus* 194–198mm, 98–102mm, 24–32g

Fairly large, gray-brown mouse with a long, hairy, bicolored tail and large ears. The underparts are paler. Quite similar to *P. boylii*, but with slightly larger ears (17-28 mm). Smaller than *P. gratus* with slightly longer feet

(22–28mm) and ears. The tail sheath is much more likely to break in *P. nasutus* than in *P. boylii*. Tail has more fur than most other *Peromyscus*. Uses boulder-strewn regions in pinyon-juniper and oak woodland zones.



SAXICOLINE DEERMOUSE *Peromyscus gratus* 171–231mm, 76–124mm, 19–33g

Has a brownish to brownish-black back and a long tuft of hairs on the tail tip. The underparts and hind feet are whitish. The tail is longer than the head and body, brownish on top, whitish underneath, and covered with

short hairs except for long hairs on tip. Fur is darker in populations living on lava flows. Slightly larger than Northern Rock Deermouse, with a slightly longer tail, and slightly shorter hind feet (20–26mm) and ears (17–23mm). Uses a variety of rocky areas.



TEXAS DEERMOUSE *Peromyscus attwateri* 187–218mm, 96–112mm, 25–35g

Medium-sized *Peromyscus* with large hind feet and ankles that are usually dark or dusky, and ears that are medium-sized compared to other *Peromyscus*. The tail is bicolored, well tufted, and equal in length to head and independent of the state of the

body. Uses cedar glade, juniper-grass, and oak-juniper forests.



BRUSH DEERMOUSE *Peromyscus boylii* 175–210mm, 89–115mm, 22–36g

Has unique broad, bright orange lateral line extending from the cheek to the hindquarters. The back is medium brown and the sides paler brown, grading to white or cream on underparts. Ankles are dusky gray. Ears and

hind feet are similar in size. Tail is bicolored, longer than the head and body, well haired, and tufted at end. Has smaller ears (16–20mm) than the Northern Rock Deermouse. Uses rock outcroppings and brushy or forested areas in elevations more than 2000m. Rock ledges, boulders, brush piles, and fallen trees are typical of its habitat.



WHITE-ANKLED DEERMOUSE *Peromyscus pectoralis* 185–219mm, 92–117mm, 24–39g

Medium in size, with ears shorter than the hind feet, ankles that are usually white, and a tail that is hairy and coarsely ringed. Similar to Texas Deermouse, but slightly paler, with a more distinctly bicolored tail and smaller hind feet

(less than 24mm). Uses rocky situations in arid mountain regions and in Texas Hill Country.





PLATE 56 **Sigmodon**

COTTON RATS – SIGMODON SPP. – Vaguely volelike in general appearance but larger, cotton rats also make runways in grassy areas. These medium-sized rats have stocky bodies with somewhat harsh fur. The three central digits on the hind foot are larger than the other two. The generic name refers to the S-shaped pattern of the cusps of the cheek teeth.



HISPID COTTON RAT Sigmodon hispidus 224–365mm, 81–166mm, 110–225g

Pelage is grizzled with blackish or dark brownish hairs interspersed with buff or grayish hairs. Sides are only slightly paler and underparts are pale to dark grayish, sometimes faintly washed with buff. No orange eye or nose

ring. Juveniles are covered with short, darker pelage by one week of age. Smaller than the Arizona Cotton Rat, with smaller feet (32–34mm). Tail short, scaly, and sparsely haired. Uses habitats with grasses especially little bluestem and bushy beardgrass.



YELLOW-NOSED COTTON RAT Sigmodon ochrognathus 132–264mm, 80–114mm, 51–106g

Small cotton rat with a yellowish patch on each side of the nose. Back is muddy gray and underparts are silvery or whitish. Color of the inside of the pinna of the ear the same as the dorsum. Dorsal guard hairs and under-

hairs are grayish with a tinge of yellow, whereas those of the venter are grayish white. Small hind feet (less than 30mm) are buff-gray, and tail is hairy and blackish above, grayish below. Uses grassy patches in montane situations, especially dry rocky slopes.



ARIZONA COTTON RAT Sigmodon arizonae 200–349mm, 85–156mm, 125–211g

Look like grizzled rats with scaly tails. They are similar to, but slightly larger than Hispid Cotton Rats with a hind foot larger than 34mm. Local populations sometimes increase rapidly after summer rains. Breeding begins

in earnest then, although they probably breed year-round except in the driest conditions. Females produce a litter of 2–10 precocial young after a gestation period of about 27 days and weaning occurs after 15–25 days. Common in grassy areas around ponds, drainages, riparian areas, irrigated fields, and weedy or brushy areas.



TAWNY-BELLIED COTTON RAT Sigmodon fulviventer 223–270mm, 94–109mm, 200–222g

The largest *Sigmodon* has a back that is pepper and salt in color and underparts that are washed with buff. Tail is dark and usually covered with just enough hairs to hide the scales, which are smaller than those of the

Hispid Cotton Rat. Builds grass nests connected to feeding areas by runways through the grass. Litter size is 4–6 after a gestation period of 35 days. Young leave the nests after just a week, and are capable of breeding at about 6 weeks of age. Uses grass and grass-shrub habitats.

HISPID COTTON RAT

YELLOW-NOSED COTTON RAT

ARIZONA COTTON RAT

TAWNY-BELLIED COTTON RAT

HISPID COTTON RAT



PLATE 57 Arborimus Voles

 $A_{RBORIMUS \text{ VOLES}}$ – These small, reddish voles almost never descend to the ground from their arboreal homes. Therefore, they are rarely seen and poorly known. Long thought to be a subgenus of heather voles, these tree voles differ in having longer tails, smaller ears, longer feet, and wider and shorter teeth.



RED TREE VOLE Arborimus longicaudus 158–206mm, 60–94mm, 25–47g

Slightly larger than White-footed Vole, with pelage that is thick, long, and soft. Back is red and lacks a medial stripe. Animals from the northern Oregon coast are larger, with brownish-red backs and pale gray undersides;

southern and inland animals are brighter colored with undersides washed in reddish orange. Tail is long, hairy, and black to brown. Eyes are small and ears are pale and hairless. Distinguished from Sonoma Tree Vole by not being as brightly colored and by having nasal bones that extend beyond the maxillaries. Home ranges are small, sometimes restricted to a single tree. Their preference for old-growth forest has resulted in population declines as the forests are logged. Secretive and nocturnal, they spend most of the time in the tops of tall conifers, eating needles of Douglas fir.



SONOMA TREE VOLE Arborimus pomo 158–187mm, 60–83mm, 25–47g

Like the other *Arborimus*, but with reddish fur that is gray at the base. Many hairs are tipped slightly with black. Belly is white (with gray base to hairs) and often washed with reddish orange. Skin on tail is black and covered

with reddish fur. Tail is well haired, thick, and more than half the head and body length. Ears are almost hairless. More brightly colored than Red Tree Vole, with nasal bones that do not extend beyond the maxillaries. Nests are hard to spot, as they are very high (10–30m) in trees, most commonly Douglas fir, grand fir, and sitka spruce. Males may be more terrestrial than females, as their nests are occasionally found on the ground. They feed almost exclusively on fir needles and bark, which they collect daily and store on top of the nest. They feed in the nest during the day, and forage for fresh needles at night. Solitary, but more than one nest may be found in a single tree. Very arboreal in coniferous trees at the forest edge adjacent to meadows, fields, and canyons.



WHITE-FOOTED VOLE Arborimus albipes 149-182mm, 57-75mm, 17-29g

Small wooly mouse with white feet and fur that is long, soft, and a warm brown color. Belly is gray and sometimes washed with pale brown. Long, thinly-haired tail is black on top and white below. Feet are usually white on

top, and ears, which are usually hidden by the fur, are hairless. They are herbivorous, feeding on both herbaceous material and roots. Litters of 2–4 young are produced year-round. Nocturnal, they may also be capable of burrowing as they are the most terrestrial of the *Arborimus*, found in riparian alder habitats along small streams.





PLATE 58 Red-backed Voles

RED-BACKED VOLES – *Mrodes* **SPP.** – Aptly named, with a chestnut-brown to reddishbrown stripe on the back that grades to dark gray or buff-gray on the sides and belly. Pelage is long and soft in winter and short and coarse in summer. This genus was historically known as *Clethrionomys*.



WESTERN RED-BACKED VOLE *Myodes californicus* 121–165mm, 34–56mm, 15–40g

A brownish vole with a faint red stripe down center of back. Tail is long and indistinctly bicolored, dusky above and whitish below. The subspecies *C. c. californicus* from the coast is darker with its red stripe largely

obscured by black hair. Inland animals are typically paler. Dorsal stripe not as obvious as in the Southern Red-backed Vole. Tail is longer and more bicolored than in the Northern Redbacked Vole. Underground nests are built in burrows, under logs, or deep in the litter. Mostly nocturnal, but may be active throughout the day in some areas. They feed mainly on fungus and lichens, but some conifer seeds and insects are also eaten. Favors very old (200-year) stands of western coniferous forests with little undergrowth. Forages mostly under surface of the forest floor.



SOUTHERN RED-BACKED VOLE Myodes gapperi 116-172mm, 30-50mm, 6-42g

Brilliantly colored, can easily be distinguished by broad, reddish band running from forehead to rump. Nose, sides of head, and body are gray, often with a yellowish cast. Belly colors range from silvery white to pale yellow-

ish, and the tail is bicolored. There are two distinct color phases in northern and eastern subspecies with either bright reddish or more grayish-brown dorsal bands. This dorsal stripe is brighter and more distinct than in other *Myodes* species. Feet are pale drab gray. Active year-round, mostly at night and dusk. Breeding season is March–November. Uses natural runways along and beneath logs, rocks, and roots of trees. Found in mesic coniferous, deciduous, and mixed forests with abundant litter of stumps, rotting logs, and exposed roots.



NORTHERN RED-BACKED VOLE *Myodes rutilus* 127–161mm, 30–48mm, 23–40g

This species is very similar to the Southern Red-backed Vole, but has a duller red back with slightly more red hairs on the sides. The tail is relatively thick and short. Active year-round but breeding season is

April–September, somewhat shorter in the northern part of the range. Litter size is 6–8, young develop rapidly, and those born early in the year may breed in the year of their birth. Feeds on seeds, berries, mushrooms, lichens, leaves, and some insects. Although population size varies widely, they do not show regular cycles. Replaces House Mouse as inhabitant of buildings in the far north. Occurs in both taiga and tundra habitats, all essentially north of the range of the Southern Red-backed Vole.





PLATE 59 Coastal Microtus

 $M_{ICROTUS}$ voles – The most common and diverse of the voles, typically live in grasslands where they form runways between their nests and feeding areas. Voles are stout-bodied mice with long, loose pelage and short tails. The ears are so short and rounded as to be almost concealed by the pelage.



GRAY-TAILED VOLE *Microtus canicaudus* 140–168mm, 32–45mm, 35–55g

Small but robust vole with large eyes. Yellowish-gray or brown above, venter is grayish white. Feet are gray, and short tail is gray with a brownish dorsal stripe. Has shorter tail and paler fur than Townsend's Vole; has larg-

er eyes and is more robust than Creeping Vole. Breeding occurs from March to November and litters of 4 or 5 young are born after a gestation period of 21 days. Development is rapid, and females are capable of breeding at 18 days of age, shortly after weaning. Uses low-elevation grasslands, including agriculture planted in small grains or legumes.



CALIFORNIA VOLE *Microtus californicus* 139–207mm, 38–68mm, 30–81g

Medium-sized vole with tail of moderate length and belly fur that is pale with gray at the base. Grizzled brownish with scattered black hairs above. Long tail is bicolored. Feet are pale. Occurs at lower elevations than Montane

Vole; has shorter and less bicolored tail than Long-tailed Vole; larger than Creeping Vole, and has six plantar tubercles; slightly larger than Townsend's Vole. The subspecies near Inyo County, California (*M. c. scirpensis*), is Endangered. Prefers low-elevation grasslands and wet meadows, but also found in coastal wetlands and open oak savannas with good ground cover.



CREEPING VOLE Microtus oregoni 130-153mm, 30-41mm, 17-20g

Small vole with short, dense dorsal fur that is sooty gray to dark brown or almost black with a mixture of yellowish hairs. Belly is a dusky gray to white. Eyes are especially small, tail is short, almost black on top and gray underneath. Small size and tiny eyes distinguish it from other voles. Has

five plantar tubercles on feet. They feed on herbs and grasses in addition to fungi. Most of their time is spent underground, and nests are in burrows or under tree roots or rotting logs. Occupies grassy and herbaceous sites within moist coniferous forests, including recent clearcuts.



TOWNSEND'S VOLE *Microtus townsendii* 169–225mm, 48–70mm, 47–83g

One of the largest voles, with dark brownish fur and large ears. Tail is long, and blackish or brownish. Feet are brownish or blackish with brown claws and six plantar tubercles. Ears are large and broad and extend above the

fur. Large size distinguishes it from other voles. They are good swimmers, capable of crossing small streams. Nests are on or above the ground, often in slightly higher areas, to avoid flooding. Found in wet meadows and marshes with dense grass and sedge cover, from sea level to 1800m.





PLATE 60 Other Western Voles



MONTANE VOLE *Microtus montanus* 140–220mm, 24–64mm, 18–90g

Small vole, grizzled brown to blackish above, often with buff tint. Belly fur is white to gray, not buffy like Prairie Vole. Moderately long, bicolored tail, but shorter than that of Long-tailed Vole. Feet are dusky or silver gray, dark-

er than in the White-footed Vole, but lighter than in the Meadow Vole. Back hairs are paler than those of Meadow Vole, although the best way to distinguish these two is to count the elements on the upper second molar, which has 4 elements in the Montane Vole but 5 in the Meadow Vole. Experienced field workers can evaluate this trait with live animals by obtaining a dental impression on wax; amateurs should take care to avoid getting vole tooth impression on their fingers. Adult males often have oily skin glands on hips in breeding season, unlike most other voles. Found in dense woods, wet meadows, and stream sides and, especially, mesic grasslands.



LONG-TAILED VOLE *Microtus longicaudus* 155–202mm, 49–81mm, 36–59g

Small, thick-bodied, grayish vole with long bicolored tail. Feet have six plantar tubercles. Ears are large and haired, and eyes are large. Color of back from ashy gray to brownish gray. Numerous black-tipped hairs occur on the

back, but the sides are more grayish. Color and long tail distinguish it from other voles. The breeding season is May–October, and females produce litters of about 5 young. The diet includes fruits, seeds, fungi, bark, and leaves. Occurs in mountain-top habitats with coniferous and hardwood forests, brushy thickets, forest meadow ecotones, and riparian areas.



NORTH AMERICAN WATER VOLE *Microtus richardsoni* 234–274mm, 66–98mm, 72–150g

North America's largest vole. Has long pelage that is grayish brown or dark reddish brown on the back, often darkened with black-tipped hairs. Underparts are grayish with a white or silvery-white wash. Bicolored tail is dusky

above and grayish below. Has five plantar tubercles on the feet. Large hind feet (more than 23mm) distinguish it from other voles. Active throughout the day, but more so at night. Semiaquatic, and uses subalpine and alpine meadows close to water, especially swift, clear spring-fed or glacial streams with gravel bottoms, and along the edges of high-elevation ponds between 1500 and 2300m.



SAGEBRUSH VOLE *Lemmiscus curtatus* 103–142mm, 16–30mm, 17–38g

Tiny vole with drab buff to ash-gray pelage that is lax, long, and dense. Base of hairs are dark gray. Tail is short, indistinctly bicolored with a dusky line above, and silvery white to buff below. Feet are white or light gray to

pale buff, with six plantar tubercles. They have both indistinct surface runways and tunnels under the snow. Nests are in complex burrow systems, or under logs. The diet is strictly limited to green vegetation. Lives in colonies in semi-brushy canyons dominated by sagebrush or rabbit brush mixed with bunchgrass at elevations from 300 to 3700m.





PLATE 61 Northern Voles



TAIGA VOLE *Microtus xanthognathus* 152–226mm, 38–53mm, 85–158g

Large vole with grayish-brown fur and a characteristic yellowish-orange nose, which distinguishes it from the Root Vole. Has small, dark, beadlike eyes, small ears, and short tail. Occurs in riparian, boreal, and sphagnum

forest habitats near streams and other moist areas.

INSULAR VOLE Microtus abbreviatus 136-176mm, 25-32mm, 45-79g

Large, short-tailed vole from Arctic islands. Nearly identical to Singing Vole, but slightly larger. Adults are brownish dorsally, with pale yellowish sides, rump, tips of ears and face, and a buff-colored belly. Restricted to a few offshore Alaskan islands, where it frequents moist, well-drained lowlands and ryegrass areas of beach ridges.



SINGING VOLE Microtus miurus 125–168mm, 20–36mm, 22–60g

Smallish, short-tailed vole. Usually quite buff in color on the flanks and venter, with rather enlarged claws. Differs from other voles in combination of short tail, buff venter, and long claws. In late summer, sits in exposed places and makes a metallic churring sound, hence the name Singing Vole.

Often associated with willow in well-drained tundra, and extends up into subalpine and alpine zones.



EASTERN HEATHER VOLE Phenacomys ungava 122-155mm, 26-41mm, 25-40g

Small vole with grizzled brown fur with a yellowish wash. The tail is short, and the ears are hardly visible above the fur. Ear tips, nose, and rump are usually more tawny or yellowish than those of other voles. Uses open dry

country and especially deciduous shrubby habitat such as willow thickets, poplars, or birch meadows.



WESTERN HEATHER VOLE *Phenacomys intermedius* 130–153mm, 26–41mm, 15–41g

Small, short-tailed vole with long and silky fur that is speckled gray to brownish on the back and paler whitish to silver-gray on underparts. The tail is thin, sparsely haired, and distinctly bicolored (dark gray above, white

below). Unique with stiff orange hairs in ears. Whiskers reach the shoulders. Uses boreal habitats including open coniferous forests, riparian areas, and moist alpine and subalpine meadows.



ROOT VOLE Microtus oeconomus 152-225mm, 30-54mm, 25-80g

Medium-sized for genus with short ears and a short tail. Upper parts range from dusky gray through rich buff to tawny, cinnamon brown, or rusty brown. All color morphs have a mixture of black-tipped hairs. Sides are paler, and underside is white, sometimes washed with dark buff. Tail is bicolored.

Larger than Singing Vole, and has broader skull. Slightly larger than Meadow Vole, and lacks rounded posterior loop on second upper molar. Uses moist mountain meadows of the Arctic tundra, especially near streams, lakes, and marshes.





PLATE 62 Typical Voles



MEXICAN VOLE Microtus mexicanus 123-144mm, 25-34mm, 18-42g

Small vole with grizzled cinnamon-brown upperparts and buff to cinnamon underparts. Relatively short tail distinguishes it from Meadow Vole and Long-tailed Vole. Females have only four mammae, rather than six or eight as in Prairie Vole and some other voles. Belly is tannish rather than whitish

as in Montane Vole. Litter size is low for voles, averaging 2.4. Diet is strictly green leaves and stems of grass. Presence can be detected by runways through the grass, which connect feeding areas with burrow systems. Normally found in grassy meadows in coniferous forests, but occupies drier habitats than most other voles.



PRAIRIE VOLE Microtus ochrogaster 130–172mm, 24–41mm, 37–48g

Small vole with long, coarse fur that is grizzled grayish brown from hairs with black and brownish-yellow tips. Sides are slightly paler. Belly is a neutral gray or is washed with whitish or pale cinnamon. Tail is strongly bicolored, and longer than that of Woodland Vole and Southern Bog Lemming.

Differs from Meadow Vole in having shorter tail, five toe pads, coarser fur, and venter without silver-tipped hairs. Population size can be judged by the number of runways, both aboveground and underground. Can be active anytime, but more nocturnal in hot summertime. Occurs in all types of prairie habitats, plus agricultural areas such as fencerows and fallow fields.



BEACH VOLE Microtus breweri 165–215mm, 35–60mm, 45–63g

An insular offshoot of the Meadow Vole, the Beach Vole is slightly larger, paler, and more grizzled. Frequently has a white blaze on forehead or elsewhere on face. Nests are built aboveground in beach grass and underground in sandy soil. Has small litters (3 or 4), longer life span (13 weeks),

better parental care, and is less aggressive than the Meadow Vole. The breeding season is April–October, the gestation period is 3 weeks and lactation lasts 2 weeks. Breeding is continuous and females can produce a litter every 3 weeks if conditions are good. Limited to Muskeget Island, Massachusetts, where it prefers beach grass stands.



MEADOW VOLE Microtus pennsylvanicus 140–195mm, 33–64mm, 33–65g

A robust vole with a relatively short tail and compressed muzzle. Dull brown above with a gray belly. Immatures slightly darker than adults. Winter pelage is thicker and finer than the sparser, coarser summer coat. Dis-

tinguished from other voles by unique dental characters: five closed triangles on first lower molar, three transverse loops and no triangles on third lower molar, four closed triangles with a posterior loop on second upper molar, and three closed triangles on third upper molar. The subspecies *M. p. dukecampbelli* known only from Cedar Key, Florida, is Endangered. This is the most prolific mammal on Earth, and occupies moist grassy fields and meadows over much of northern North America.





PLATE 63 Eastern Voles and Bog Lemmings



WOODLAND VOLE Microtus pinetorum 111–139mm, 12–29mm, 14–37g

Tiny reddish vole with reduced eyes and ears and large foreclaws for its semifossorial life. Tail is short and facial vibrissae are well developed. Fine fur is chestnut-colored above and on the sides and paler gray or silvery

below. Tail is bicolored, but colors grade gently and no sharp distinct line is noticeable, distinguishing it from other reddish voles. Whiskers are well developed. Incisors are not grooved. They build underground runways and burrows with nest chambers lined with dried leaves and grasses. Common in eastern forests with good litter cover or grassy areas.



ROCK VOLE Microtus chrotorrhinus 140-185mm, 42-64mm, 30-48g

Medium-sized vole with yellowish-orange or pale yellowish wash on snout, and occasionally on rump as well. Smaller than the otherwise similar Taiga Vole, which occurs only to the northwest of the Rock Vole. Breeding season is March–October, and litters of 3–6 are produced regularly, as the

females breed again immediately after giving birth. Feeds extensively on bunchberry, and their presence can be detected by the accumulation of cut vegetation that they cache under flat rocks along streams. Uses hardwoods and mixed deciduous coniferous forests with rocks, frequently near streams or other water sources.

BOG LEMMINGS – *STNAPTOMTS* – Smaller than voles, but with a relatively large head and facial hairs surrounding the snout, which can be erected to make the face appear larger than it really is. Although the head is relatively large, the rostrum is short. Both have grooved incisors, which are sharper in S. *borealis*.



SOUTHERN BOG LEMMING Synaptomys cooperi 94–154mm, 13–24mm, 21–50g

Similar to *S. borealis*, but with dark brown above and pale gray on underside. Also has six mammae instead of eight, as in *S. borealis*. Active throughout the year, mostly at dawn and dusk, but forages throughout the

night and less during the day in the hotter months. They make runways similar to other voles in grassy habitats. Occurs in a wide variety of habitats including clearings in woodlands, grasslands, mixed deciduous/coniferous woodlands, spruce-fir forests, and freshwater wetlands.



NORTHERN BOG LEMMING Synaptomys borealis 110–140mm, 17–27mm, 27–35g

Small lemming with grizzled gray to brown pelage on the back and pale gray underneath. Fur has a coarse, ruffled appearance and the short tail is bicolored. Distinguished from *S. cooperi* by having buff-colored hairs at

base of the ears, sharper incisors, and more mammae. Unlike most voles, population sizes are usually low. Occurs in a variety of habitats that are wet with many sedges and grasses including spruce-fir forests, wet meadows, sphagnum bogs, and alpine tundra.




PLATE 64 NORTHERN LEMMINGS

NORTHERN LEMMINGS - In good years, their populations can explode and large numbers of animals can be seen running across the low tundra, dispersing out of overpopulated areas. This has led to the myth of suicidal, cliff-jumping lemmings. Most Dicrostonyx lemmings have a seasonal molt from summer brown to winter white coat and a unique bifurcated claw on the forefeet for digging through snow.



NEARCTIC BROWN LEMMING Lemmus trimucronatus 130-180mm, 18-26mm, 45-130g

A brown northern lemming, without stripes or collars. Relatively large with tawny brown to cinnamon on backs and sides. Has a shorter tail than bog lemmings or voles. Uses subalpine tundra above timberline.



UNGAVA COLLARED LEMMING Dicrostonyx hudsonius 125-166mm, 12-16mm, 35-85g

Only striped and collared lemming in eastern Canada. Distinguished from Nearctic Collared Lemmings in summer by having a dull reddish patch of hair around the ears, and in having browner (less steel-grav) pelage. Found in tundra habitats, including rocky hillsides and alpine meadows (red area on map).



RICHARDSON'S COLLARED LEMMING Dicrostonyx richardsoni 115-150mm, 9-15mm, 35-90g

A brownish collared lemming. Younger animals have a thin black stripe on back from tip of nose to base of tail. Nearctic Collared Lemmings tend to be more grayish. Occupies tundra habitats (yellow area on map of Ungava Collared Lemming).



NEARCTIC COLLARED LEMMING Dicrostonyx groenlandicus 110-177mm, 10-20mm, 30-50g

A gravish collared lemming. Summer coat is grayish-buff to dark gray, with aspects of buff to reddish brown above. Richardson's Collared Lemmings are darker reddish brown. Occurs only on Arctic tundra.



NELSON'S COLLARED LEMMING Dicrostonyx nelsoni 108-142mm, 11-21mm, 45-55g

Superficially similar to Ungava Collared Lemming and much smaller than Unalaska Collared Lemming. Dorsal stripe variable from distinct to indistinct (red area on map).

OGILVIE MOUNTAINS COLLARED LEMMING Dicrostonyx nunatakensis 128-130mm, 11-13mm, 35-45g

An endemic lemming known only from the Ogilvie Mts in the Yukon Territory (not illustrated). Pale gray-brown back and no reddish rump contrasts with nearby Nearctic Collared. Uses rocky alpine tundra at base of a glacial circue (yellow area on map of Nelson's Collared Lemming).

UNALASKA COLLARED LEMMING Dicrostonyx unalascensis 130-165mm, 11-18mm, 50-60g

Only lemming on Umnak and Unalaska isles of the Aleutian Archipelago, Alaska (not illustrated). Like Nearctic Collared Lemming, but larger and does not turn white or develop winter digging claws. Pelage is soft and medium rusty brown with a distinctive mid-dorsal stripe.





PLATE 65 **GHOST AND LEAF-NOSED BATS**



PETERS'S GHOST-FACED BAT Mormoops megalophylla 73-98mm, 20-28mm, 15-16g

Bizarre-looking face with wartlike protuberances on nose and leaflike appendages on chin. Dorsal fur long and lax, with each hair containing four different color zones, the second of which tends to be reddish in mature adults. Forearm 46–56mm. Widely distributed in riparian zones in arid lands up to 3000m.



CALIFORNIAN LEAF-NOSED BAT Macrotus californicus 85-99mm, 28-41mm, 12-22g

Long ears (more than 25mm), grav fur, and a distinct, leaflike appendage on the tip of the nose. Tail extends slightly beyond edge of tail membrane. Forearm 46–55mm. May form colonies ranging in size from a few individuals

to over 1000. Found in Lower Sonoran lifezones.



MEXICAN LONG-TONGUED BAT Choeronycteris mexicana 81-103mm, 6-10mm, 10-25g

Medium-sized leaf-nosed bat with grayish to brownish fur, an elongated muzzle, and a prominent nose leaf. Similar to long-nosed bats, but has a well-developed tail membrane, enclosing a short, conspicuous tail. Fore-

arm 43-49mm. Lacks lower incisors. Forms small colonies in caves, mine tunnels, buildings, and culverts.



MEXICAN LONG-NOSED BAT Leptonycteris nivalis 76-88mm, no tail, 18-30g

The only leaf-nosed bat occurring in Texas, this species may overlap with the Lesser Long-nosed Bat in New Mexico, where it differs by being larger, with gravish fur, a wider tail membrane and shorter wings. Forearm

56-60mm. Emory Peak Cave in Big Bend National Park has housed as many as 10,000 of these bats in mid-summer. The Mexican Long-nosed Bat is classified as an Endangered species; its migratory movements, specialized feeding, and roosting habits make it a conservation risk.



Lesser Long-Nosed Bat

Leptonycteris yerbabuenae 75-85mm, no tail, 15-25g

Lack of tail distinguishes this species from the Californian Leaf-nosed and Mexican Long-tongued bats. Forearm 51-54mm. Summer migrant into southern Arizona and New Mexico, this species occasionally visits hum-

mingbird feeders in search of nectar. The Lesser Long-nosed Bat is classified as an Endangered species; its migratory movements, specialized feeding, and roosting habits make it a conservation risk.

HAIRY-LEGGED VAMPIRE BAT Diphylla ecaudata 67-93mm, no tail, 24-43g

This rare bat has a nose leaf that is greatly reduced and no tail. The incisors are prominent, with very sharp cutting edges. Fur on the back is dark brown, and the belly is slightly paler. Forearm 50–56mm. Normally roosts solitarily in caves or mine tunnels. This species only eats blood, and specializes in feeding on roosting birds. Known in the United States only by a single specimen from Val Verde County, Texas.

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PETERS'S GHOST-FACED BAT

CALIFORNIAN LEAF-NOSED BAT

LESSER LONG-NOSED BAT

MEXICAN LONG-NOSED BAT

MEXICAN LONG-TONGUED BAT

no lower incisors

typical bat genitalia



male



HAIRY-LEGGED VAMPIRE BAT



PLATE 66 Molossid Bats

 $F_{REE-TAILED\ BATS}$ – This family of bats, the Molossidae, is distinguished by having a tail that extends well beyond the terminal edge of the tail membrane. Their unique large ears are an adaptation for the echolocation of insect prey in their high-altitude, high-speed hunts.



MEXICAN FREE-TAILED BAT *Tadarida brasiliensis* 85–109mm, 30–39mm, 10–15g

The most common member of the family has deeply furrowed lips, and ears that are not joined at the midline. Forearm 36–46mm. It forms summer nursery colonies of millions of individuals in large caves.



POCKETED FREE-TAILED BAT Nyctinomops femorosaccus 99-118mm, 34-45mm, 14-17g

Similar to Mexican Free-tailed Bat, but differs in having ears joined at the base. Forearm 45–50mm. Can be found near large, open-water sources.



BIG FREE-TAILED BAT Nyctinomops macrotis 120–160mm, 40–57mm, 22–30g

Large bat with wrinkled lips. Upperparts range from pale reddish brown to almost black, but individual hairs are white at the base. Large ears are joined at the base. Forearm 58–64mm. Inhabits rugged, rocky canyon wastern United States

country in southwestern United States.



GREATER BONNETED BAT *Eumops perotis* 159–187mm, 55–72mm, 45–73g

The largest bat in North America is darker than Underwood's Bonneted Bat, and lacks long guard hairs on the rump. Forearm 72–83mm. Males have a well-developed throat gland that emits a thick, smelly musk in the Baseta is aliffield arruines in rungful darker land of the arid acuthytest.

breeding season. Roosts in cliffside crevices in rugged canyonlands of the arid southwest.



UNDERWOOD'S BONNETED BAT *Eumops underwoodi* 160–165mm, 50–64mm, 40–65g

Large bat with slightly shorter ears than the Greater Bonneted Bat, and has a distinctive fringe of bristle-like guard hairs on the rump. Forearm 65–77mm. They are known only from extreme southern Arizona and Mexico.



FLORIDA BONNETED BAT *Eumops floridanus* & 123–165mm, 40–64mm, 25–47g; \$ 117–156mm, 40–61mm, 28–55g

Medium-sized free-tailed bat with smooth lips and large ears that are joined at the base. Forearm 55–68mm. No other similar-sized free-tailed bats occur in its southern Florida range. Favors old, mature trees as roosting

sites, but will use buildings (see red area on map).

PALLAS'S MASTIFF BAT Molossus molossus 89–104mm, 30–39mm, 10–14g

Small free-tailed bat with dark brown or grayish-brown fur. Individual hairs are white at their base. Short bristles on rump and wrinkles on the upper lip. Forearm 36–40mm. Tends to roost in attics. Limited to a few colonies roosting in buildings on the Florida keys (see yellow area on map for Florida Bonneted Bat).

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PALLAS'S MASTIFF BAT



PLATE 67 Lasiurine Bats

 $\mathbf{TREE}\ \mathbf{BATS}$ – Migratory bats, common throughout the United States in the spring and fall, and widely distributed across North America in the summer. They tend to be solitary, and roost in trees and foliage rather than caves.



EASTERN RED BAT Lasiurus borealis 95-126mm, 45-62mm, 7-16g

A distinctive looking bat with mottled reddish and grayish pelage that extends well over the interfemoral membrane. The ears are low and rounded; tragus is short and blunt. Red bats have a small projection known as a "lacrimal shelf" at the back of the skull. Forearm 37–42mm (yellow area on map).

WESTERN RED BAT Lasiurus blossevillii 92-112mm, 44-52mm, 6-10g

(Not pictured) Recently split from the Eastern Red Bat by genetic data, these two are best distinguished by range (see red area on map of Eastern Red Bat). The Western species differs in being slightly smaller, with fewer frosted hairs on the back and tail membrane.



SEMINOLE BAT Lasiurus seminolus 89–114mm, 35–50mm, 9–14g

Similar to female Eastern Red Bats, this species has broadly rounded ears, long pointed wings, and a densely furred interfemoral membrane. Forearm 37–43mm. Favors Spanish moss as a day roost.



NORTHERN YELLOW BAT Lasiurus intermedius 121–164mm, 51–77mm, 14–20g

Distinguished by yellowish-gray or yellowish-brown pelage, which extends only onto the basal half of the tail membrane. The ears are pointed. A much larger bat than its relative, the Southern Yellow Bat. Forearm 46–50mm.



SOUTHERN YELLOW BAT Lasiurus ega 109-131mm, 42-58mm, 10-14g

Has yellow fur that extends over the basal third to half of the tail membrane, and a short rostrum. Forearm 37–43mm (red area on map).

WESTERN YELLOW BAT Lasiurus xanthinus 102-118mm, 38-56mm, 10-15g

(Not pictured) Recently split from the Southern Yellow Bat based on genetic data, the two are best distinguished by range (see yellow area on map of Southern Yellow Bat). The pelage of the Western Yellow Bat is slightly brighter yellow, especially on the tail membrane.



HOARY BAT Lasiurus cinereus 99–140mm, 40–64mm, 20–35g

Large, dark bat with grizzled fur that is frosted with white and marked with a yellow collar. The frosting gives this bat a hoary appearance. The fur extends across the tail membrane, and the ears are thickened, short, and rounded. The tragus is short and broad. Forearm 46–55mm.



SILVER-HAIRED BAT Lasionycteris noctivagans 90-117mm, 31-50mm, 9-12g

Beautiful dark brown or black bats with frosted hair on the back that extends down onto the basal portion of the tail membrane. The ears are short and rounded, and the tragus is blunt and curved forward. Forearm 37–47mm.





PLATE 68 GIANT-EARED BATS



SPOTTED BAT Euderma maculatum 107-125mm, 47-55mm, 15-22g

Unmistakable, with three white spots on the back, and large, pinkish ears. One of North America's most beautiful bats. Forearm 48–54mm. It feeds on a variety of insects, particularly moths, and has some echolocation calls that sound like clicks to humans. Widespread but rarely seen, the

Spotted Bat lives in the mountain and basin country of western North America from sea level to 3000m, and frequents open ponderosa pine woodlands in many areas.



RAFINESQUE'S BIG-EARED BAT Corynorhinus rafinesquii 80-110mm, 42-54mm, 8-14g

Small bat with large ears, toe hairs that extend beyond the tips of the claws, bicolored belly fur, and two large, fleshy lumps on each side of the snout. Forearm 38–44mm. Agile flyers, they feed on flying insects, main-

ly well after dark, and they return to the roost before dawn. Forms small colonies in a wide variety of roosts, including man-made structures, caves, hollow trees, and under loose tree bark. Most common in forested areas and along streams in the southeastern United States.



TOWNSEND'S BIG-EARED BAT Corynorhinus townsendii 89-116mm, 33-54mm, 9-12g

Has huge ears and a pair of glandular lumps on either side of the nose. The back is pale to reddish brown and the belly is pale buff. The western analogue of Rafinesque's Big-eared Bat, it is distinguished by belly fur

color. Lacks the leaflike lappets of Allen's Big-eared Bat. Forearm 39–47mm. Uncommon and sensitive to disturbance at the roosts. Subspecies from the Ozark Mountains (*C. t. ingens*) and limestone caves of Kentucky, West Virginia and Virginia (*C. t. virginianus*) are Endangered. Forages late, which makes it difficult to observe in flight. Often hunts in edge habitats between forest and open areas.



ALLEN'S BIG-EARED BAT *Idionycteris phyllotis* 103–135mm, 40–53mm, 8–16g

Unique with big ears and small lappets that project forward from the base of each ear, extending over the snout. This small bat looks large, owing to huge ears and long, lax, yellowish-gray to blackish-brown fur. Forearm

41–49mm. In the open, they emit loud clicks at about 1-second intervals, sounds that are audible to humans. It is known from a variety of both arid and wooded habitats in southwestern North America.



PALLID BAT Antrozous pallidus 92-135mm, 35-53mm, 13-29g

A whitish bat with orange shoulders and large, well-separated pinkish ears. The eyes are relatively large, and the large muzzle is bare. Forearm 48–60mm. Gregarious and locally common in the west, this bat has a distinctive odor, which emanates from glands on the muzzle. Unique forag-

ing style allows it to pick up prey, such as scorpions, from the surface of the ground. Breeding takes place in the fall, but females store sperm until ovulation occurs in the spring, resulting in births during May–June. Uses a variety of arid and semi-arid habitats.





PLATE 69 Longer-eared Myotis

 $M \Upsilon o T IS BATS$ – This diverse group of small-bodied bats are among the most common species in North America. They are small, with upperparts generally brownish, and underparts somewhat paler. All are insectivorous, and most roost in colonies, ranging in size from a few dozen to thousands of individuals.



SOUTHWESTERN MYOTIS *Myotis auriculus* 85–101mm, 34–49mm, 6–10g

Medium-sized, with long, brownish ears. Lacks the visible fringe of hairs on the tail membrane that the Fringed Myotis has, and differs from the Long-eared Myotis in having slightly shorter ears (less than 21mm), paler

flight membranes, and hair on the back that is brownish rather than blackish at the base. Forearm 38–40mm. Roosts in small groups in caves. Feeds by hovering and gleaning large insects from tree trunks and buildings. Occurs from desert grasslands up into coniferous forests in southwestern mountains.



FRINGED MYOTIS Myotis thysanodes 80–99mm, 35–45mm, 6–12g

Easily distinguished by long ears and distinct fringe of hairs along posterior edge of tail membrane. Has the shortest ears among this group of long-eared *Myotis*. Forearm 40–46mm. Females and young found in maternity colonies in caves, mines, and buildings at middle elevations from April

to September. Males more likely to roost alone. Occurs in wide range of desert, grassland, and woodland habitats.



LONG-EARED MYOTIS Myotis evotis 87-100mm, 36-41mm, 5-8g

Differs from other long-eared *Myotis* in slightly larger body size, longer (more than 21mm) ears that are glossy dark brown to black, and lack of fringe on tail membrane. Forearm 36–41mm. Roosts singly or in groups of up to 30 under bark, bridges, and rocks, and in buildings, caves,

crevices, hollow trees, mines, and sink holes. Forages in vegetated areas, where it gleans insects from the surface of the vegetation. Favors coniferous forest, but occurs into riparian desert scrub throughout much of western North America.



KEEN'S MYOTIS Myotis keenii 63-93mm, 35-44mm, 4-6g

Small long-eared bat with glossy dark brown fur on back, darker shoulder spots, and ears that extend slightly beyond nose when bent forward. The tail membrane has a few scattered hairs, but no obvious fringe. Forearm 34–39mm. Found individually or in small groups in caves or under the bark

of trees. Hibernates colonially, occasionally with other species. Occupying the smallest range of any North American bat, Keen's Myotis lives in dense pacific coastal forests of British Columbia, extending barely into southeastern Alaska and northwestern Washington.



NORTHERN MYOTIS Myotis septentrionalis 80–96mm, 29–46mm, 4–11g

A long-eared bat with long, sharply pointed tragus. Differs from Long-eared Myotis in having slightly paler ears, and from Keen's Myotis in having slightly paler shoulder spots and lacking the few scattered hairs on the tail mem-

brane. Forearm 35–40mm. Hibernates in caves and mines. Nursery roosts are under loose tree bark, or in buildings. Prefers coniferous forests, but lives in a variety of woodlands.

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PLATE 70 Western Myotis 1



CALIFORNIAN MYOTIS Myotis californicus 70-94mm, 31-42mm, 3-5g

Tiny bat with short ears, relatively short hind feet, and an obviously keeled calcar. Differs from Long-legged Myotis in having shorter forearm and tibia, and less fur on ventral surface of wing membrane. Very similar to Western Small-footed Myotis, but Californian Myotis is slightly more delicate, often

has tricolored pelage, and hair that extends further down the forehead. Forearm 30–35mm. Flies slowly but acrobatically early in the evening, often less than 3m above the ground, and frequently over or near water. Summer roosts include caves, mines, on rocky hillsides, under tree bark, on shrubs, and even on the ground. In winter it hibernates in caves and mines, however, at low elevations some animals may be active year round. Occupies deserts and arid interior mountain basins in western North America.



WESTERN SMALL-FOOTED MYOTIS *Myotis ciliolabrum* 76–90mm, 32–44mm, 3–7g

Dark wing, ears, and black mask around face contrast its paler fur. Color is flaxen above, and nearly white below. Similar to Californian Myotis in having small feet (<9mm) and a keeled calcar, but differs from that

species in appearing slightly more robust, having bicolored pelage with a slight, glossy sheen, a slightly longer rostrum, and less hair on the forehead. Forearm 30–34mm. Breeds in fall, fertilization occurs in spring, young are born May–July and begin to fly about a month later. Often roost colonially. Hibernates in caves or mines, alone or in small groups, and unlikely to be active during winter. Reported to chew their food to a very high degree. Uses high plains east of the continental divide where it occupies rocky outcrops in short grass habitats (yellow area on map).

DARK-NOSED SMALL-FOOTED MYOTIS Myotis melanorhinus 76–98mm, 30–45mm, 4–5g

Like the Western Small-footed Myotis but with darker fur on the forehead and back. Recently recognized as a distinct species. Color is a rich yellow, with buff underparts and black ears, nose, and wings. Feet are short and calcar is obviously keeled. Very tip of tail extends 1.5–2.5mm beyond the tail membrane in some animals. Forearm 30–34mm. An agile but erratic flier, it hunts insects by flying irregular circuits from 1m above the ground to the treetops. Roosts in buildings, bridges, mines or natural caves. Spends the winter in caves or mines where it roosts alone or with up to 5 others. Occurs west of the continental divide, where it occupies rocky areas in coniferous forests from 300 to 3300m (red area on map of Western Small-Footed Myotis).



LONG-LEGGED MYOTIS Myotis volans 76-106mm, 29-49mm, 5-10g

Large-sized *Myotis* with longer, denser fur on the underside of the wing between the knee and elbow than in other species of *Myotis*. Has short, keeled calcar, and short, rounded ears. Color varies from dark brown to reddish buff, with darker ears and membranes. Forearm 35–42mm. Strong fly-

ers, they have been clocked at 15–17kph. Some individuals may return to the same foraging area night after night. Maximum life span is at least 21 years based on capture-recapture records. Roosts in ponderosa pine snags, crevices, cracks, caves, and abandoned buildings, and in winter they hibernate in caves and mine tunnels. Occupies rugged, mountainous terrain, most commonly 2000–3000m. Primarily limited to coniferous forests, but also found in oak and riparian woodlands, extending down into desert areas almost to sea level.

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orangish arid morph

dark northwestern morph

pale morph

CALIFORNIAN MYOTIS







Californian Myotis

WESTERN SMALL-FOOTED MYOTIS

> DARK-NOSED SMALL-FOOTED MYOTIS

Californian Myotis ventral view M. v. longicrus

Long-legged Myotis ventral view

M. v. interior



PLATE 71 Western Myotis 2



CAVE MYOTIS Myotis velifer 83-102mm, 39-47mm, 9-14g

One of the largest species of *Myotis* in North America, with fur varying from light brown to almost black. Has a stubby-nosed appearance, with the ears barely reaching to the end of the nose when bent forward. Forearm 40–45mm. In some caves containing large numbers of these bats the

humidity is very high and the ammonia content of the air from the bats' urine can cause the pelage to bleach to a paler color. Flies stronger and less erratically when foraging than most other species of *Myotis*. Feeds on moths and beetles, and is most active just after dusk and just before dawn. Forms large colonies in caves in lowlands of southwestern North America. Some of these are year-round residents hibernating in the caves during the winter. Other individuals migrate south for the winter, and some may actually seek colder caves at higher elevations for more efficient hibernation.



LITTLE BROWN MYOTIS *Myotis lucifugus* 60–102mm, 25–55mm, 7–13g

An otherwise undistinguished species of *Myotis* that differs from the Yuma Myotis in having glossy fur, from the Indiana Myotis in lacking a keel on the calcar and having longer toe hairs, from the Long-legged Myotis in hav-

ing less fur on the underside of the wing, and from Southwestern, Long-eared, Keen's, and Northern Long-eared Myotis in having shorter ears (less than 16mm). Skull shows a more gradually ascending forehead than in the Yuma Myotis. Forearm 33–41mm. Nocturnal and adept at using echolocation to catch their insect prey in mid-air. They may migrate up to 1000km between summer breeding areas and winter hibernacula. Widespread and common in buildings in summer, and hibernates in sizeable colonies in caves and mines.



ARIZONA MYOTIS Myotis occultus 83-95mm, 34-45mm, 5-10g

Almost identical to Little Brown Myotis, from which it was previously considered a subspecies, but lives in the southwestern United States and Mexico. Fur is slightly paler and redder in the Arizona Myotis, and the skull almost always has a sagittal crest, which is usually lacking in the Little

Brown Myotis. Premolars are reduced, but has otherwise large teeth. Forages over water, skimming low over large open bodies of water to drink or picking up insects. Forms large maternity colonies in buildings or caves. Inhabits most isolated mountain ranges from Arizona to Texas, and occupies a wide range of habitats from upper Sonoran to boreal forests.



YUMA MYOTIS Myotis yumanensis 75-89mm, 29-43mm, 4-7g

Medium-sized *Myotis* with short ears (extend less than 2mm beyond nose when bent forward), and an unkeeled calcar. Very similar to the Little Brown Myotis, but the Yuma Myotis is slightly smaller, with less glossy fur, and paler ears. Skull shows a more abruptly ascending forehead than the Little Brown

Myotis. Forearm 30–38mm. Active at dusk, they are frequently seen foraging low over or near open water in valleys of western mountains. They are less active in the middle of the night, although sometimes they forage again just before dawn, primarily feeding on moths and flies. Commonly found in desert areas, but never far from water sources. They lack special adaptations to desert habitats and quickly dehydrate if kept from water. Summer roosts are found in buildings, under bridges, in crevices of cliffs, and in caves and mines throughout the southwest.





PLATE 72 Eastern Myotis

LITTLE BROWN MYOTIS Myotis lucifugus

Differs from Indiana Myotis in lacking a keel on the calcar and having more and longer toe hairs. (See page 158 for more details.)



GRAY MYOTIS Myotis grisescens 80-96mm, 32-45mm, 4-6g

A large *Myotis* with uniformly-colored gray or brown hairs on the back. Unique in having the wing membranes attached to the ankles rather than to the toes, and the calcar lacks a keel. Forearm 40–46mm. Hind feet are less haired than in the Little Brown Myotis. Females form large maternity

colonies in caves in the summer. Endangered, virtually the entire population hibernates in nine caves in the southeastern United States. The Gray Myotis forages mainly over water and ranges over long distances from summer day roosts. Found primarily in karst areas with underlying limestone caves in the southeast and south-central U.S.



EASTERN SMALL-FOOTED MYOTIS *Myotis leibii* 73–82mm, 29–36mm, 3–7g

The smallest North American *Myotis* differs from other eastern *Myotis* in its smaller size, shorter ears and hind feet, and keeled calcar. Face and ears also darker black than other overlapping bats. Many roosting bats

have orange chiggers on their ears. Small feet have no hair on the toes. Similar to Western Small-footed and Californian Myotis, but range does not overlap with those species. Individual hairs are varying shades of brown, but overlain with a somewhat golden sheen. Forearm 30–35mm. Uncommon and limited to eastern deciduous and coniferous forests.



SOUTHEASTERN MYOTIS *Myotis austroriparius* & 77–89mm, 26–44mm, 5–7g; \$ 80–97mm, 29–42mm, 5–8g

Small bat with somewhat dull, wooly pelage. Usually dull gray to graybrown, but some individuals are a bright orange-brown. Fur on underside is dark brown to black at the base, with contrasting white at tip. No promi-

nent keel on calcar. Toes have long hairs extending beyond tips of claws. Differs from Northern Myotis by having smaller ears, and from Little Brown Myotis in lacking the glossy pelage of that species. Forearm 33–42mm. Prefers caves near water, or even those that contain water. Can be seen foraging near the surface of the water on summer evenings. Occurs in both coniferous and deciduous forests of the southeastern U.S.



INDIANA MYOTIS Myotis sodalis 73-99mm, 29-43mm, 3-10g

Small bat most closely resembling the Little Brown Myotis. Differs from that species in having sparser and shorter hairs on the toes, shorter hind feet, a slight keel on the calcar, a pinkish nose and duller pelage. Forearm 31–40mm. Hibernates in cold caves and mines with high humidity, where

it sometimes forms large colonies. They cluster together tightly in the hibernaculum, with up 450 individuals per square foot of cave ceiling. This Endangered species is sensitive to disturbance in the hibernacula. Summer nursery roosts are under tree bark, especially in hickory trees. Found in a variety of habitats in eastern deciduous forests.





PLATE 73 Other Eastern Bats



WESTERN PIPISTRELLE Pipistrellus hesperus 60-86mm, 25-36mm, 2-6g

Tiny bat with blunt, slightly curved tragus, and small hind foot less than half as long as the tibia. The black face mask contrasts strongly with yellowish, gray-brown body color. Active in the early twilight, this species has

slow erratic flight that looks almost like a butterfly. Forearm 26–33mm. Roosts in crevices and mine tunnels in rocky outcrops near water sources. With expanding human populations, the bats have taken to roosting in stucco cracks near swimming pools as a logical substitute. Found from sea level to 3000m, favors canyons and cliff faces, but occurs in a wide variety of desert scrub and arid grassland habitats as well.



EASTERN PIPISTRELLE *Perimyotis subflavus* 75–90mm, 33–45mm, 6–10g

Small bat with yellowish- to grayish-brown pelage, and a somewhat paler belly. Dorsal hairs are tricolored, and membranes are dark brown. In winter, hibernating individuals sometimes collect droplets of moisture on

them, given them a sparkling appearance. Forearm 31–35mm. Summer roosts are in and on buildings, under shutters, and in attics and lofts of barns. Hangs with a hunched posture while sleeping. Individuals swarm in late summer and early autumn, seeking mates before entering hibernating caves. Uses a variety of habitats, especially open pasture.



BIG BROWN BAT Eptesicus fuscus 87-138mm, 34-56mm, 11-23g

As the name suggests, this is a large brown bat with naked, dark membranes. The tail is enclosed in interfemoral membrane. It has short ears, a keeled calcar, and a forearm length of 39–54mm. Males are solitary in spring and summer, but females gather in small maternity colonies of

20–75 individuals and their young. They use hollow trees, but are equally common in buildings, including barns and churches. Although hibernacula in caves are common, this species also sometimes hibernates in cold buildings. Widely distributed throughout North America, this species occurs in a wide variety of habitats, and frequently roosts in manmade structures.

LITTLE BROWN MYOTIS Myotis lucifugus

Obviously browner than the pipistrelles, smaller than the Big Brown Bat, and not white on the belly like the Evening Bat. (See page 158 for more details.)



EVENING BAT Nycticeius humeralis 83-96mm, 35-40mm, 9-14g

Similar to the Big Brown Bat, but smaller, with reddish to dark brown fur above and somewhat paler below. The ears are blunt and rounded, with a tragus that is short and curves forward. Forearm 34–37mm. One of the few bats that does not use caves, the Evening Bat apparently migrates

southward to overwinter, rather than hibernating. Males remain in the southern part of the range, with only the females moving north to form maternity colonies of 30 to several hundred individuals and their young. They forage over water at dusk and into the early evening. Common in buildings and other man-made structures.



LONG-EARED MYOTIS

KEEN'S MYOTIS

WESTERN SMALL-FOOTED MYOTIS

> CALIFORNIAN MYOTIS

FRINGED MYOTIS

SOUTHWESTERN MYOTIS

> LONG-LEGGED MYOTIS

WESTERN PIPISTRELLE

CAVE MYOTIS

YUMA MYOTIS

PLATES 74 AND 75 Confusing Cave Chiroptera

EASTERN SMALL-FOOTED MYOTIS

NORTHERN MYOTIS

INDIANA MYOTIS

BIG BROWN BAT

LITTLE BROWN MYOTIS

EASTERN PIPISTRELLE

SOUTHEASTERN MYOTIS

GRAY MYOTIS



PLATE 76 Temperate Cats



BOBCAT *Lynx rufus* & 48–125cm, 11–20cm, 7.2–31.0kg; \$ 61–122cm, 9–17cm, 4–24kg

North America's most abundant spotted cat, with a tail tip that is black above and white below. Spots may be inconspicuous. Tail is relatively longer than in the Canadian Lynx. Coat color varies from yellowish to red-

dish brown and is marked with dark brown or black streaks and spots. Underparts are white and spotted. Ears have short (less than 2.5cm) black tufts and a white spot on the back. Primarily a nocturnal hunter of rabbits, and other small prey, Bobcats may be active at any time of day, and are capable of taking a wide range of prey from mice to deer. Territories are marked with exposed feces, urine deposits, and scrapes made with the hind feet. Litters average 3, born after a gestation period of 62 days. Dens are located on rocky outcrops, in brush piles, hollow logs, caves, fallen trees, and dense bushes. Occurs in almost every habitat within range.



CANADIAN LYNX Lynx canadensis 82–95cm, 9–12cm, 7–18kg

This northern species has a tail that is all black at the tip. Upperparts are grizzled grayish brown with a varying degree of spotting. Winter fur is long and thick. Ears have long (4–5cm) black tufts of hairs and a central white spot on the back. Tail is relatively shorter than in the Bobcat; ear tufts and

feet are larger. Females are slightly smaller than males. Threatened because of sensitivity to human disturbance. Specialist hunter of Snowshoe Hares; also hunts other small mammals, beaver, and deer. Larger food items may be cached under snow or brush and visited later. Solitary, except for females with young. Peaks of activity occur at dawn and dusk, but may be active anytime. Breeding season is March–April, with an average of 3 kittens born after 60–70 days. Dens are in hollow logs, stumps, timber clumps, or root tangles. Young remain with mother until next breeding season. Denizen of boreal forests.



COUGAR *Puma concolor* & 1.7–2.5m, 68–96cm, 36–120kg; 2 1.2–1.6m, 27–37cm, 29–64kg

An unmistakable large cat with uniform color and long black-tipped tail. Monotone pelage varies geographically and seasonally from gray to reddish brown. Cubs have a soft, spotted coat. Hunts deer and other large

and medium-sized mammals. Commonly called Mountain Lion or Puma. Subspecies in Florida (*P. c. coryi*) is Endangered. Subspecies from northeastern United States (*P. c. couguar*) is apparently extinct; modern sightings in this area are from escaped captive animals. Population densities low, as each animal needs 100–500km² of home range. Crepuscular and nocturnal, they may cover about 10km per night when hunting. Large prey is cached under brush and leaves, and retuned to on subsequent nights. Ungulates are the main food, but Cougars also take rabbits, beavers, porcupines, opossums, coyotes, bobcats, raccoons, skunks, and occasionally domestic livestock. Uses most habitats in range that offer cover and prey; avoids shrubless deserts and agricultural areas.





PLATE 77 Tropical Cats

 $\label{eq:transformation} \mathbf{TROPICAL} \ \mathbf{CATS} - \mathbf{These} \ \text{four felines range widely in tropical America, but are only found near the borderlands of the United States. Because of their secretive nature they are rarely seen.$

MARGAY Leopardus wiedii & 86-130cm, 33-51cm, 3-7kg; 80-103cm, 32-44cm, 3-5kg

Smallest North American spotted cat, with large eyes and a long tail. Smaller than the Ocelot, with a longer tail, relatively larger eyes, and a more delicate facial structure. Spots may coalesce to a greater or lesser extent. A hunter of small prey on the ground and in the trees. Very agile and acrobatic, and more arboreal than most cats. Ankle joints can turn 180°, allowing mobility on tree trunks and along branches. Margays can jump vertically 2.5m and horizontally 4m, changing direction in mid-air if necessary. Probably never common in Texas, the last record was from 1852. Uses most tropical forest types from sea level to 3000m.



OCELOT *Leopardus pardalis* & 95–137cm, 28–40cm, 7–14kg; § 92–121cm, 27–37cm, 7–11kg

A solidly built spotted cat, with a short tail that barely touches the ground. Larger than the Margay, with a shorter tail and a more robust skull structure. Rare and Endangered in Texas. This nocturnal hunter feeds on a vari-

ety of small prey, especially rodents. May travel 6km per night when hunting. Sleeps in dense thickets during the day. Solitary except when mating, which can occur in any month of the year; 1–3 kittens are born after gestation of 70–80 days. Uses a wide range of tropical habitats with vegetative cover.



JAGUARUNDI Puma yagouaroundi 88–137cm, 32–61cm, 4–9kg

Only small wildcat with a unicolored coat. Two color morphs occur together: reddish brown and dark gray. Young animals may have white markings around their mouth. Tail and neck are relatively long, legs are relatively short. Our most diurnal cat; hunts a variety of small, terrestrial prey.

Endangered in North America because of small range. Breeds year-round, and 2–4 kittens are born after gestation period of 60–70 days in dens under root tangles, hollow logs, or in rock crevices. They produce a whistle-like vocalization that sounds like a bird call. Uses thick cover in mesquite or pine-oak woodlands of Arizona and Texas.

JAGUAR Panthera onca & 1.7-2.4m, 52-67cm, 79-158kg; \$ 1.6-2.2m, 43-60cm, 31-85kg

The largest cat in the New World, Jaguars are unmistakable, powerfully built, spotted cats. Coat is tawny-colored with large black rosettes. Rosettes are also visible in the rare black morph. Active any time of day. The US population was hunted to extinction in the 1800s, but recent sightings in Arizona suggest the possibility of reestablishment. They are active both day and night. Solitary hunters of large and medium-sized prey in warm forests and desert scrub, they prefer streamside and wetter habitats.





PLATE 78 **Canis**

 C_{ANIS} – All North American species in this genus are capable of interbreeding in the wild. Furthermore, their distribution is constantly changing with a dramatic series of extirpations, reintroductions, and natural expansions. This causes confusion for both identification and taxonomy. The major forms are described here, although their taxonomic status and nomenclature may change in the future. Domestic dogs may sometimes go feral, but rarely show characteristic ears and face of wild canids. Coydogs (coyote × dog hybrids) only occur with very low coyote density and are rare now that coyotes have populated most of the continent. Packs of feral domestic dogs persist, especially in the south and in some cities.



WOLF *Canis lupus* ♂ 1.0–1.3m, 35–52cm, 30–80kg; ♀ 0.9–1.2m, 35–52cm, 23–55kg

Largest wild canid. Fur usually grizzled gray but ranges from pure white to black to reddish brown. Commonly called the Gray Wolf. Bushy tail often tipped in black. Distinguished from Coyote and domestic dogs by larger

body size, large nose pad (>25mm), relatively shorter ears, and tail usually held horizontally (not down) when running. Canids between the Wolf and Coyote in size (typically 14–39kg) remain a taxonomic problem. Some taxonomists argue that all intermediates are recent hybrids between Wolves and Coyotes and therefore do not merit species' status. Others argue they are not hybrids, or that they are ancient hybrids, and that they deserve full status as one or two distinct mid-size Canis species: the Eastern Wolf (*C. lycaon*) from the north and/or the Red Wolf (*C. rufus*) from the southeast. Red Wolves now only occur in and around active reintroduction programs in coastal North Carolina. Packs usually consist of 5–10 family members. Their pack hunting is adapted to kill large prey, including moose, bison, and deer. Wolves can also survive on medium-sized mammals such as Beaver and muskrat, and will also hunt mice. When hunting large prey, pack members take turns pursuing the target, chasing it until its too tired to defend itself. Howling can be heard for great distances. Common where not persecuted; lives in all habitats within its range except deserts and high mountain tops.



COYOTE Canis latrans 1.0-1.3m, 30-39cm, 7-20kg

Smaller than wolves, with a smaller nose pad (less than 25mm) but relatively larger ears. Upperparts are variable in color, but typically brownish, often with redish highlights on legs. Belly and throat are pale. Tail usually held down when running. Coyotes expanded their range in all

directions in the mid-1900s following extirpation of Wolves. To the south they have reached the Panama Canal. To the east they have now colonized all natural habitats and are increasingly common in suburban areas. Western Coyotes are typically 12–14kg while eastern coyotes average 16–18kg, and may grow up to 23kg. Eastern Coyotes are also more variable in color, with a variety of blond and reddish forms common, as well as occasional black animals. Where hunted intensively Coyotes form smaller packs, but breed at an earlier age. Coyotes feed on a wide variety of small and medium-sized prey, as well as fruit in season. Eastern Coyotes also hunt deer. Higher-pitched howling than Wolves, with more yips. Common in all natural habitats, including suburban forests.





PLATE 79 Smaller Foxes

FOXES – These diminutive canids typically hunt small and medium-sized prey such as birds, rabbits, and mice. All den in ground holes or brush piles.



SWIFT FOX *Vulpes velox* & 74–82cm, 17–33cm, 2.2–2.9kg; & 68–75cm, 23–30cm, 1.8–2.3kg

Smallest North American canid, with a long, bushy, black-tipped tail. Similar to the Kit Fox but with a shorter tail and smaller ears. Buff-gray above with brownish sides, legs and lower surface of tail. Undersides are

lighter. Shorter summer fur is more reddish gray. Large triangular ears. Often lumped with the Kit Fox into one species (*V. velox*). Nocturnal hunter of lagomorphs, rodents, and other small prey, such as birds, lizards, and insects, they are active throughout the night. During the day, they stay in the den, or sometimes sun themselves near the entrance. The gestation period is 49–55 days, and litters of 3–6 pups are produced in February–April. Extremely rare, or possibly extirpated in the northern part of its range, but reintroduced in Canada's prairie provinces. The two species also differ in habitat preference, with the Swift Fox preferring short and mixed grass prairies.



KIT FOX Vulpes macrotis 73-84cm, 26-32cm, 1.4-2.7kg

Similar to the Swift Fox but with a longer tail and larger ears. The Kit Fox is distinguished by its longer tail (62% head and body length vs. 52%), larger ears (more than 75mm) set close to the midline of the skull, a head that is broader between the eyes but narrower at the snout, and

more slitlike, less-rounded eyes. The pelage is generally gray, but mixed with rusty overtones, and the tail has a black tip. Primarily nocturnal, but occasionally active at all hours, it feeds predominantly on rodents and lagomorphs, but also takes small birds, fish, and insects. Males and females bond in the fall and breed in winter, but pairs may not persist from year to year. Litters of 3–14 cubs are born in March–April. Constructs elaborate den systems connected by tunnels, with multiple dens having many separate entrances. Prefers shrub-steppe and desert habitats.



ARCTIC FOX *Vulpes lagopus* & 83–110cm, 28–42cm, 3.2–9.4kg; \$\vee\$ 71–85cm, 26–32cm, 1.4–3.3kg

Unique northern fox well adapted for living in harsh Arctic climate with distinctive color and short legs, snout, and ears. Unique among canids in having fur color that varies geographically and seasonally. Coastal popu-

lations are typically bluish gray in winter and dark bluish gray or chocolate-brown in summer. Continental foxes are usually white in winter and grayish brown in summer. Eyes have golden irises; soles of feet are furred. Thick, luxurious pelage insulates animals down to -70° C. Often bold in the presence of humans. Nocturnal except in Arctic summer. Hunts seabirds and small mammals alone, may scavenge in pairs or small groups. Introduced on several coastal islands, where they are farmed and harvested for the valuable fur. Populations cycle in concert with expanding prey populations, such as lemmings and voles. Inhabits Arctic tundra.





PLATE 80 Larger Foxes



RED FOX *Vulpes vulpes &* 74–82cm, 27–33cm; \$ 68–75cm, 23–30cm, 3–6kg

Uniquely-colored fox with a bushy, white-tipped tail. Most animals are redcolored with black feet and black-tipped, triangular ears. Other morphs include a black phase, a silver phase (black hair tipped with silver), and

a cross phase (reddish brown with dark on shoulders). Opportunistic foragers and scavengers, they prey heavily on voles and rabbits, as well as other small mammals, birds, invertebrates, and even fruit when available. Breeding occurs from December–March and litters of 4–7 pups are born after a gestation period of 51–53 days. They dig dens, or modify badger or woodchuck burrows for rearing the young, which are weaned after a lactation period of about 2 months. The world's most widely distributed mammal, they are declining in the east due to Coyote expansion. Prefers landscapes with a mixture of both open fields and brushy or forested areas.



GRAY FOX Urocyon cinereoargenteus 80-113cm, 27-43cm, 3-7kg

A gray fox with a black-tipped tail. Back is grizzled gray; sides are cinnamon-colored; belly is tan. A dark stripe runs down center of back and onto black-tipped tail. Often climbs trees, a trait facilitated by forelegs that rotate more than those of other canids. Dens are located in dense

clumps of brush, abandoned buildings, rock outcroppings, hollow logs, or burrows. Family units consist of breeding pair and their offspring. Breeding season is January–March, and typically 4 pups are born about 2 months later. Pups begin foraging at about 4 months, and some may disperse as early as 7 months of age. Our most omnivorous canid, eats fruit and prey the size of rabbits or smaller. Active mostly at dawn and dusk, and seldom seen in daylight when they rest in dense vegetation. May range across 5km² when foraging. Uses hardwood forests and brushy riparian habitats.



ISLAND GRAY FOX *Urocyon littoralis* ♂ 62–79cm, 14–29cm, 1.6–2.5kg; ♀ 59–79cm, 11–29cm, 1.5–2.3kg

Only found on six Channel Islands off California coast. Like Gray Fox, but smaller (one half to two thirds in size). Active day and night. Remarkably docile. Feeds on fruit, insects, and small mammals. A conservation risk

because of small range; feral pigs and goats on the islands may attract avian predators (Golden Eagles) to which this isolated carnivore has no defense. Unlike their mainland relatives, island foxes are active both night and day. They forage extensively on seasonally available fruits and berries as well as deermice, birds, lizards, and insects. Breeding season is January–March, and the young are born in April or May. Unlike many other canids, they do not excavate their own dens, but use natural shelters such as brush piles, rock outcrops, bushes, or abandoned buildings. Lives in all habitats on islands at densities up to 14 per km², with each fox occupying a home range of 20–40 hectares.





PLATE 81 Bears



BLACK BEAR Ursus americanus & 1.5–2.1m, 8–14cm, 47–409kg; § 1.3–1.7m, 8–14cm, 39–236kg

Distinguished from other bears by smaller size, larger ears, pale muzzle, and a rounded back. Fur color varies geographically; most eastern animals are dark black; western populations can be brown, cinnamon, or

blond. Some coastal populations in British Columbia and Alaska are creamy white (Kermode Bears) or bluish gray (Glacier Bears). Some animals have a white chest patch. Lips are prehensile. Males are larger. Often leaves its mark on trees when stripping bark to eat sap, climbing tree with claws, or rubbing and scratching to mark territory. In most areas the Black Bear hibernates through the winter in ground or tree dens; in the far south only pregnant females hibernate. Populations are increasing across most of their range, and this is the bear most likely encountered in North America, even roaming into densely populated suburban areas. Unlike other bears, they are basically shy, and retreat quickly, sometimes after a brief bluff. Omnivorous, it is an opportunistic predator in woodlands and swamps, and is the only bear in eastern forests.



BROWN BEAR Ursus arctos 1.0-2.8m, 6-21cm, 80-600kg

Impressive, powerful, large brownish bear with a massive head with a dished facial profile and a humped shoulder. Fur color variable and may be virtually any shade of brown. Head and shoulders are typically paler than the darker sides, belly, and legs. Front claws are extremely long.

Ears are round and indistinct and tail is short. Variable in size with larger coastal and island (including Kodiak Bear) populations and smaller inland (Grizzly Bear) forms. Males are larger. Leaves marks on trees like Black Bears. Omnivore and predator. Breeding is in May–July, but implantation delayed until November, and gestation is 6–8 weeks while the female is hibernating. In January–March, 1–4 young are born growing rapidly from a birth weight of 500g to 15kg by 3 months of age. Maximum life span is 20–30 years in the wild. Threatened and declining through much of its range in North America and Europe. Seasonally abundant near salmon spawning streams. Solitary, except for females with cubs. Persists in remote forests, tundra, and open plains.



POLAR BEAR Ursus maritimus & 2.3–2.6m, 7–12cm, 400–800kg; § 1.9–2.1m, 7–12cm, 175–300kg

A very large, white bear of the Arctic. Longer neck and relatively smaller head than other bears. Fur may appear yellow in summer. Females first breed at age 5–6, and pregnant females may weigh up to 500kg. Breeding

season is April–May but delayed implantation slows gestation until fall, and cubs are born in December. Neonates are tiny (600g) but grow quickly in the den, and emerge at 10–12kg in March or April. Cubs remain with their mother for 2.5 years, learning to hunt seals on the sea ice. Only pregnant females overwinter in dens; all others remain active. Ringed seals are the prey of choice, but they also take bearded seals, and occasional harp seals, hooded seals, walruses, belugas, narwhals, and even sea ducks. They are able to fast for up to 8 months if food is unavailable. Threatened by melting ice associated with global warming and airborne pollutants that accumulate in polar regions. Home ranges may exceed 300km² in areas of receding ice. Pursues fish and seal prey in pack ice and coastal regions.





PLATE 82 Procyonids

FAMILY PROCYONIDAE – This group of medium-sized members of the order Carnivora are all omnivores or frugivores. They typically have long tails and are good climbers.



RINGTAIL Bassariscus astutus 62–81cm, 31–44cm, 870–1143g

Unique with slender build and long, bushy, striped tail. Face is gray, back is pale yellowish to tawny reddish in color and the underparts and feet are pale. Flat-edged tail has 14–16 stripes and a black tip. Males are slightly larger. Strictly nocturnal. Eats fruit, mice, and other small prey. Found from

sea level to 1400m, and occasionally up to 2900m. Can tolerate some human presence, and sometimes found in small urban nature preserves. Use a variety of habitats with rocky outcroppings, canyons, or talus slopes including montane conifer forests, riparian areas, dry tropical habitats, chaparral, and deserts.



RACCOON *Procyon lotor* & 63–95cm, 20–40cm; ² 60–91cm, 19–34cm, 4.0–15.8kg

Well known for its dark mask and ringed tail. Grizzled pelage varies from gray to blackish. In winter a yellowish or reddish tinge may develop on the nape of neck. Albino, dark brown, and cinnamon color phases are also

known. Omnivore and semiaquatic forager, using their dexterous hands to find and catch small prey. Raccoons are probably the most omnivorous mammal in the world, and will eat whatever food items are most common in an area. They have learned how to exploit human foods in many areas, including agricultural crops and urban garbage. Typically solitary, urban raccoons have learned to tolerate each other where food is abundant and they can reach densities of 50–100 animals per km². Nocturnal. Larger in north, where well-fed animals can reach 50% body fat. Common in every habitat with water sources.



WHITE-NOSED COATI Nasua narica 85-164cm, 25-38cm, 2.7-6.5kg

This tropical procyonid reaches the northern edge of its range at the US–Mexico border. Unique with a long mobile snout and a slender tail with incomplete dark rings. Males are about 20% larger than females.

The Coati is an active diurnal forager, and may spend 90% of its waking hours hunting food. Eat a variety of invertebrates and fruit that they find by using their snouts to sniff under the leaf litter. Good climbers, but obtain most food on the ground. Females and young travel together in bands of up to 40 animals while males are typically solitary. In the United States they are typically found in riparian pinyon-oak-juniper habitats, but occasionally range into deserts and savannahs.




PLATE 83 Aquatic Mustelids



AMERICAN MINK *Neovison vison* & 55–70cm, 19–22cm, 550–1250g; ⁹ 47–60cm, 15–19cm, 550–1000g

Dark, semi-aquatic weasel with a white chin patch. Back and belly rich brown; variable amount of white on chin and throat. Hind toes slightly webbed. The Sea Mink subspecies (*N. v. macrodon*) was larger and red-

der, with a strong scent. It used rocky sea shores along our North Atlantic coast until it was hunted and trapped to extinction by the 1860s; some consider it a full species. Solitary, except for females with young, and most active at dusk and dawn. Predator of aquatic birds, mammals, fish, and frogs. Breeding is in the spring and delayed implantation may extend gestation to an average of 51 days; 3–6 young are produced each year in a single litter, and weaned at 5–6 weeks. Dens are in the banks of forested or brushy streams, under tree roots, in hollow logs, or in abandoned muskrat houses. The American Mink is common, but rarely seen, near the shoreline of waterways and lakes.



NORTH AMERICAN RIVER OTTER Lontra canadensis & 1.1m, 42–47cm, 7.7–9.4kg; \$ 0.9–1.1m, 31–40cm, 4.5–13.6kg

The only river otter in North America. Back is brown; chin and throat are silvery. Tail is long, thick at the base, and gradually tapering. Mostly nocturnal, often seen at dusk or dawn. Scenting latrine areas on shore con-

sist of matted-down vegetation and scraped-up earth, with defecations around the periphery. Eats fish and other aquatic prey. Dens are reworked from other animals' burrows or natural shelters under logs, trees, rocks, thickets or along river banks. An underwater entrance leads to a nest chamber lined with plant material and hair. They mate in the water in late winter or early spring, and the active gestation period is about 2 months, but can last up to a year through delayed implantation. Lives in most types of unpolluted freshwater and coastal marine habitats, but rare or extirpated in many parts of the east and Mid-west.



SEA OTTER *Enbydra lutris* & 1.3–1.4m, 36cm, 18.0–45.0kg; ♀ 1.1–1.4m, 27cm, 11.0–33.0kg

The only fully aquatic carnivore, and one of the smallest marine mammals, with plush fur, pawlike hands, and flipper-like feet. Tail is flattened dorso-ventrally. Noses of females are often scarred from aggressive

males. Forages solitarily (females with their pups), but often rests and socializes in groups called "rafts" that are readily observable from shore. Rafts in south are small (fewer than 12) but hundreds of males may congregate in the north. Foraging dives last from a few seconds to 4 minutes, and prey items are brought to the surface to eat. Sea Otters typically float on their back and handle invertebrate prey on their belly, using rocks as tools to open hard invertebrates. Females breed at about 4 years and have a single young annually after a gestation period of about 6 months. Recovering from massive hunting at turn of century, still threatened. Lives in shallow coastal waters.





PLATE 84 Big Mustelids



AMERICAN MARTEN *Martes americana* & 560–680cm, 20–23cm, 470–1250g; \$ 50–60cm, 18–20cm, 280–850g

Identifiable with bushy tail, buff-orange throat patch, and sharp facial profile. Fur varies from light to dark brown. Legs are short and ears are small and rounded. Larger than American Mink and smaller than Fisher.

Predominantly a predator of small mammals and birds, will also eat fruits and insects. Active day and night year-round, with peaks at dawn and dusk, but secretive and rarely seen. Maximum lifespan 15 years. Sensitive to trapping pressure and logging; recent natural expansions and managed reintroductions are helping Martens reclaim some of their historic range. Arboreal and terrestrial hunter of coniferous forests.



FISHER *Martes pennanti* & 90–120cm, 37–41cm, 3.5–5.5kg; § 75–95cm, 31–36cm, 2.0–2.5kg

Large, dark-colored, stocky weasel. Bigger and darker than American Marten. Face, neck and shoulders sometimes marked with hoary gold or silver-colored guard hairs. Deep brown coat lightens over summer, dark-

ens in fall molt, and may appear reddish in spring. Throat and chest are marked with white or cream patches of varying size and shape. Females are smaller, with finer and glossier fur. Arboreal and terrestrial predator of small and medium-sized animals. Regularly preys on Porcupines with fast frontal attacks; also eats fruits and nuts. Increasing in the east, declining in the west. Hunts in a variety of forest types.



WOLVERINE *Gulo gulo* ♂ 94–107cm, 22–26cm, 11.3–16.2kg; ♀ 86–93cm, 21–25cm, 6.6–14.8kg

Largest member of the weasel family, with a pair of yellowish bands running from shoulder to rump. Has a large head and a short, stout neck. Typically holds tail and head low while walking with an arched back.

Wide-ranging, solitary scavengers and predators of Caribou and smaller prey, such as ground squirrels, snowshoe hares, and ptarmigan. Mainly nocturnal, but occasionally out in the daytime. Breeding is in spring, summer, and fall, and delayed implantation results in 1–5 young born in February–April. Maximum lifespan is about 5 years in the wild. Dens are excavated in snow, under uprooted trees, or in rocky crevices. Lives at low densities in tundra and forested habitats.



AMERICAN BADGER *Taxidea taxus* & 60–87cm, 10–15cm, 3.6–11.4kg; \$ 52–79cm, 10–15cm, 3.6–11.4kg

Unique with short legs and black and white striped face. White stripe runs from nose to neck in most populations; stripe continues to base of tail in the southwestern animals. Long coarse fur is gray on the back and

may be mixed with white, brown, buff, rust, or orange color. Young are pale buff-colored. An efficient digger with very large claws, its presence can be detected by frequent diggings and den entrances. Secretive and solitary, but fiercely defensive when attacked. Sleeps through most of winter, but becomes active on warmer days. Hunts ground squirrels and other small and medium-sized prey. Lives in grasslands, deserts, and open marshy areas.





PLATE 85 **Mustela**



LEAST WEASEL *Mustela nivalis* & 180–205mm, 25–40mm, 40–55g; [§] 165–180mm, 22–30mm, 30–50g

North America's smallest carnivore; lacks a black tail tip. In summer, back varies from rusty brown to pale sandy tan; belly is white or yellowish. Northern populations have a pure white winter coat. Molting animals

may appear spotted. Rarely seen, even though active day and night year-round. Well-developed senses of sight, smell, and hearing allow them to use postural, vocal, and olfactory communication. Preys on mice day and night; must eat its body weight in food each day. Slender body plan allows them to chase mice down burrows. Prefers marshes, grasslands, and other nonforested areas.



ERMINE *Mustela erminea* 3 219–343mm, 65–90mm, 67–116g; \$ 190–292mm, 42–70mm, 25–80g

A short-tailed weasel with a dark tail tip and (typically) white on feet. Smaller than Long-tailed Weasel, with a relatively shorter tail (less than 44% head-body length). Males are 40–80% larger than females; animals

can also be sexed by genital morphology. Back is brown in summer. Winter coat is white, with a black tail tip. Primarily a nocturnal hunter of mice, young rabbits, and other small prey. Breeds in summer, but delayed implantation results in 4–9 young born in spring, in a burrow or hollow log. Young reach adult size by about 6–7 weeks, and mothers teach the young to hunt by going out in family groups. Uses most habitats in range, the widest variety of all mustelids.



LONG-TAILED WEASEL *Mustela frenata* 3 330–420mm, 132–294mm, 160–450g; 9 280–350mm, 112–245mm, 80–250g

A long-tailed weasel with a dark tail tip. Larger than the Ermine, with a relatively longer tail (more than 44% head-body length). Variable amount of white on hind legs and feet. Northern populations molt to a white winter

coat. Some populations in Florida and the southwest have white or yellow facial markings (leading to the name Bridled Weasel). Hunts small prey, especially mice and young rabbits. Dens are in dense brush along drainages. Breeding is in July–August and implantation is delayed until spring. Found in most habitats through large range, especially near water.

BLACK-FOOTED FERRET *Mustela nigripes* & 490–600mm, 107–140mm, 915–1125g; \$\varphi\$ 479–518mm, 120–141mm, 645–850g

This masked weasel survives only in captivity and in a few recently reintroduced wild populations in western states. Unique with a sandy-colored body and dark feet, tail tip, and facial mask. Difficult to see, they are nocturnal and terrestrial, and may remain in prairie dog burrows for extended periods in winter. Presence is indicated by tracks in snow, and in digging for prey they often leave a distinctive pile of soil on the surface measuring about 100×40×10cm. Breeding is in March–April, gestation is 42–45 days, and litter size is 3 or 4. Reclaiming prairie dog towns and surrounding areas in western grasslands, now reintroduced in parts of their historic range in Wyoming, South Dakota, Montana, and Arizona.





PLATE 86 Spotted and Hog-nosed Skunks

SPOTTED SKUNKS – Unique with their glossy, jet-black fur and white spots beginning near the ears and forming a pair of dashed lines down the back. Although some consider them to be one species, these two small skunks were recently split into an Eastern and Western species based on genetic and reproductive evidence: the Western Spotted Skunk has delayed implantation but the Eastern does not. Externally the Western Spotted Skunk has more extensive white markings than its Eastern cousin. They typically warn potential predators with their trademark handstand before spraying. These two quickest and most agile skunks are also the most carnivorous, catching mice, insects, and other small prey in their nocturnal hunts.



WESTERN SPOTTED SKUNK Spilogale gracilis & 35–58cm, 10–21cm, 500–900g; \$ 32–47cm, 200–600g

A small spotted skunk with large white spots on the face, back, and tail. Faster, more agile, and weasel-like than most skunks, and highly carnivorous. Diet includes small mammals, birds, lizards, insects, and carrion.

Pungent anal scent glands provide a defensive spray, which is accompanied by a curious handstand and tail display. Breeding is in the fall, and delayed implantation results in 2–6 young born in spring. Uses rocky and brushy areas in woodlands, grasslands, farmlands, and deserts.



EASTERN SPOTTED SKUNK *Spilogale putorius* & 31–61cm, 8–28cm, 276–885g; \$ 27–54cm, 9–21cm, 207–475g

Small skunk with thin white spots and a small white tip to a mostly black tail. Larger than Western Spotted Skunk in area of overlap. Primarily nocturnal, secretive, and rarely seen. Feed heavily on mice, birds, bird eggs,

and insects, as well as occasional fruits and vegetables if available. Cracks eggs by hiking them back between the hind legs like a football center. Breeding is in spring, with short delayed implantation, unlike *S. gracilis*. Avoids open areas, preferring habitats with extensive cover, especially riparian woodlands.



AMERICAN HOG-NOSED SKUNK *Conepatus leuconotus* 40–92cm, 13–41cm, 1.1–4.5kg

Named for its unique long, naked nose pad, this skunk has coarse, long black fur marked with a white stripe down the back. Claws are well developed for digging up insect prey. Previously recognized as two separate

species, the two forms are now viewed as subspecies. The smaller eastern subspecies from southern Texas and Mexico has a white dorsal stripe that is narrow, especially on the rump, with a tail that is black on the underside near the base (caution when looking for this character on live animals!). The larger western subspecies (*C. I. mesoleucus*) has a broader stripe and no black on the underside of its tail. Males are larger than females. Infrequent recent sightings raise concern over conservation status in some areas. Recorded from brush and semiopen grassland in southern Texas, and rocky terrain including stream beds in desert-scrub and mesquite grasslands further west.





PLATE 87 **Mephitis**



STRIPED SKUNK Mephitis mephitis 57-80cm, 18-39cm, 1.2-6.3kg

Unmistakeable and well known due to unique color pattern, and distinctive odor. Dorsal stripes converge to a V at the nape. A pair of dorsal stripes typically mark the back, but these may be so variable in size and shape that skunks look all white, all black, or spotted. The amount of

white in the tail is similarly variable. Fur is coarse. Females are 15% smaller than males. Typically raises tail and stomps front feet before spraying. They can shoot the spray accurately to 4m several times in quick succession. The noxious odor is reflected in the scientific name "*Mephitis*," which means bad odor. Holding the animal off the ground by the tail to prevent it spraying is an old wives tale, disproven by generations of daring young naturalists. Summer dens are in rock piles or hollow logs, and winter dens are more substantial underground burrows, often originally excavated by woodchucks or badgers. Winter dens may be occupied by multiple animals. Breeding season is Februrary–March, typically resulting in a seasonal peak of activity that can be seen and smelled by people. Litters of 1–10 are born 59–77 days later. Young can emit musk as young as 8 days. They are weaned at 2 months, and overwinter mortality of yearlings is high. Nocturnal hunter of insects, rabbits, birds and eggs, carrion, fruit, and small vertebrates in all habitat types except most arid, and favors woodlands, fields, agricultural areas, and human neighborhoods.



HOODED SKUNK *Mephitis macroura* ♂ 56–79cm, 27–43cm, 800–900g; ♀ 65cm, 37cm, 400–700g

Has soft fur, with a hood of long white hair on the nape. Head has one thin white stripe; back has either one wide white stripe, or two separated thin white stripes. Fur is much longer and softer than in other skunks.

Tail is longer than that of the Striped Skunk. More secretive than most skunks, rarely dens in man-made structures. Diet consists primarily of insects, small vertebrates, bird eggs, and fruit if available. They break chicken eggs by throwing them between their hind legs, football style. Small vertebrates are taken opportunistically as they make their nightly rounds. Forages among leaves and litter, pouncing on beetles and other insects as they scatter. Active year-round, but almost completely nocturnal and spends daylight hours sleeping in the den. Anal glands provide powerful defense mechanism, and they can spray many times in succession in a short period of time. Pre-spray behavior similar to that of *M. mephitis*, with foot stomping preceding full-scale spraying. Nightly foraging begins after dusk with routes following rock walls, streambeds, and other protected areas. Solitary except when females are with young, but several may come together at carrion sites. Unlike Striped Skunks, females normally do not den communally during the winter. Breeding season is February–March, and litter size ranges from 3 to 8. Lactation lasts through August. Prefers arid lowlands below 2500m, but also occurs in deciduous and coniferous forests, forest edges, pastures, rocky canyons, and riparian habitats.





PLATE 88 Otariid Seals

OTARIIDS - THE EARED SEALS - These Pacific seals have small, but distinct ears. Their hind flippers can rotate under their body, increasing their mobility on land.



CALIFORNIA SEA LION Zalophus californianus & 2.0–2.5m, 350–400kg; \$ 1.6–1.8m, 90–120kg

Unique with doglike face and brown color. Males are larger, darker, and have a thick neck and an enlarged, pale forehead. Pups are born dark, but quickly molt into a lighter blond pelage like females. First toe on hind

flipper is largest. This is the most familiar and commonly kept pinneped in zoos and aquaria, as well as circuses. Males wander north in the winter as far as Vancouver. Often unwary near cities. Feeds on small fish and squid at sea; returns to shore for pupping and mating, where annual aggregations on rocky or sandy beaches are full of noise and activity.



NORTHERN FUR SEAL *Callorhinus ursinus* & 1.9–2.1m, 175–275kg; ² 1.2–1.5m, 30–50kg

Head is short and nose is very sharply pointed. Also distinguished from Guadalupe Fur Seal by having fur that forms a straight line at the base of the foreflipper, rather than extending to a point. Females are brown;

males grow darker as they age, some appear black, especially when wet. Pups are born black, molt to a silvery color in late summer, and become golden brown over winter. Toes on hind flippers are all similar in size. Congregate on the shores of the Pribilof, Aleutian, and Channel Islands to breed and pup, then scatter to feed at sea. Seals tagged as pups do not return to their natal rookery to breed, unlike sea lions.



GUADALUPE FUR SEAL Arctocephalus townsendi \circ 1.9–2.4m, 150–220kg; 2 1.4–1.9m, 40–55kg

Males have a large head with a long pointed snout. Females are like Northern Fur Seals, but have larger flippers, with fur on the foreflipper. Toes on hind flippers are all similar in size. Males do not have enlarged head crest

found in other fur seals. Dry fur is brown or dusky black and has a thick, grizzled appearance compared with coarser hair of sea lions. Now breeds and pups only at Guadalupe and Islas San Benito in Baja California, Mexico. A threatened species, rookeries on Southern California islands were hunted to local extinction at the turn of the nineteenth century. Uses precipitous rocky coasts and caves. Hunts fish and squid in the open sea.



STELLER'S SEA LION *Eumetopias jubatus* & 2.7–3.2m, 500–1120kg; ^o 1.9–2.9m, 263–365kg

Bearlike head with a short straight snout. Larger and paler than California Sea Lion. Males have long, coarse hair on massive chest, neck and shoulders. Pups are born with a dark brown fur that molts to a lighter

color after three months. First toe on hind flipper is largest. Skull unique with conspicuous space between upper fourth and fifth post-canine teeth. An endangered species that is declining in numbers. Hauls out all along our west coast for pupping and breeding in traditional rookeries, most common in Alaska. These are easily detected by the cacophony produced by the seals' vocalizations. Swims far from shore to fish.





PLATE 89 Phocid Seals

 $P_{\rm HOCID}\ seals$ – These earless seals are awkward on land and cannot stand on their hind flippers. They are exceptional swimmers, very specialized for deep and lengthy underwater dives.



HARP SEAL Pagophilus groenlandica 1.7-1.9m, 115-140kg

A white seal with a black lyre-shaped marking on back. Face is black. Males are slightly larger. Pups are white and turn silver-gray with black blotches as juveniles. Some females retain silver coat for up to 8 years. Some males develop a dark "sooty" coat. Swim in large herds throughout

the North Atlantic. Thousands haul out together on the pack ice to pup and nurse young. Hunting of these seal pups for fur has recently sparked controversy. After pupping, animals make an annual migration that covers some 5000km of their Arctic territory.



RINGED SEAL Pusa hispida 1.0-1.5m, 45-107kg

A dark gray-colored seal with light rings on the body. Males are slightly larger. Pups are white; juveniles are silvery in color without rings. Much smaller than the Harbor Seal, with almost no neck and a short face. Strong nails on front flipper used to carve ice lair under snow drifts where

they hide from predators and the weather. Females give birth in these lairs; males maintain their own lairs. Some populations are vulnerable to overhunting, but these seals are generally abundant on and around pack and fast ice, and are the most common seals in the Arctic.



RIBBON SEAL Histriophoca fasciata 1.5-1.6m, 70-80kg

A brown seal with whitish ribbons around their head and flippers. Male is dark brown; female is lighter. The pup's white coat is shed at 5 weeks for a gray coat that is bluish above and silvery below. More slender than other seals, with a long neck and flippers. Mates, pups, and molts on

heavy pack ice in late winter and spring, and moves to the open sea in late spring and summer when the northern seas become ice-free. They are almost never seen on land. Most common in the Bering Sea, but occasionally seen in Chukchi and Beaufort seas.



HOODED SEAL *Cystophora cristata* & 2.3–2.8m, 200–435kg; § 2.0–2.3m, 150–350kg

Silvery-gray seals with black splotches and conspicuous ornaments in the males. Female is distinguished from splotchy Gray Seal by having a shorter snout. Male is larger, and has a dark hood on the top of its head that

can be inflated. Additionally, it can inflate its nasal septum like a red balloon. Both tricks probably attract females and intimidate rival males. Pups are silvery blue above and white below. Has the shortest lactation period of any mammal at 4 days, during which the pups gain an average of 7kg per day on extremely fat-rich milk produced by the females. Comes to pack ice around Labrador and Davis Strait to give birth later in spring than most seals, then migrates to areas around Greenland.





PLATE 90 Grayish Seals



SPOTTED SEAL Phoca largha 1.4-1.7m, 81-109kg

A grayish seal with dark splotches, typically found on ice around Alaska. Overlaps little with the very similar Harbor Seal. Distinguished from Harbor Seal by range, having white (not dark) pups and a smaller, more delicate skull. Breeds in isolated pairs on pack ice in winter and spring and

hauls out on ice to give birth to a single pup. One of the few seals that is seasonally monogamous, and family units of male, female, and young can be seen together during the breeding season. Gestation period is 10.5 months, including delayed implantation, and lactation lasts 3–4 weeks, during which time the young more than doubles its birth weight. Eats fish, shrimp, cephalopods, and crustaceans along coastal waters.



HARBOR SEAL Phoca vitulina \circlearrowright 1.4–1.9m, 75–150kg; \updownarrow 1.2–1.7m, 60–110kg

A wide-ranging grayish seal usually found hauled out on rocks. Color pattern may be dark with irregular pale rings or pale with dark splotches. Pups typically molt *in utero* and are born with a dark pelage. Often has banana-

shaped profile when on rocks. Typically shy when hauled out, but sometimes habituate to humans. Most populations are recovering with recent protection from hunting. Although capable of traveling long distances, most do not migrate, and are year-round residents. Capable of diving to 450m and staying underwater for 30 minutes. Feeds on wide variety of fish, cephalopods, and crustaceans. Common on undisturbed beaches, ledges, and rocks.



GRAY SEAL Halichoerus grypus & 2.0–2.7m, 240–320kg; \$ 1.6–2.2m, 150–260kg

A large gray seal with an exaggerated snout. Larger than the Harbor Seal, with a less doglike face. When viewed head-on the nostrils are curved resembling the letter W (not heart shaped like in the Harbor Seal). The

color of males varies from black to gray-green, and can be solid or mottled. Females are typically silvery with dark patches, rarely solid black or cream-colored. Males are larger, with longer, broader snouts and more massive necks that are often scarred from fighting. Pups are born with white fur that molts to adult color at two to four weeks. Largest breeding area is on Sable Island, off the coast of Nova Scotia, where 15,000 young are born each year. Breeds and molts on land or ice, feeds on fish in the open sea.

CARIBBEAN MONK SEAL Monachus tropicalis 2.1-2.4m, 70-140kg

An extinct brownish seal from the Caribbean. Adults were pale brown on the back and lighter on the belly. This was the only seal from the Gulf of Mexico, and was recorded off the Florida and Texas coast. It preferred to haul out on sandy beaches, where they had little fear of humans, who hunted them to extinction. The last confirmed sighting was 1952. Its two sister species, the Hawaiian and Mediterranean Monk Seals, are both seriously Endangered. Juvenile Hooded Seals sometimes wander south into the Caribbean, and can be distinguished by having a much shorter face and by being smaller.





PLATE 91 Big Seals and Manatee



WEST INDIAN MANATEE *Trichechus manatus* 2.7–3.5m, 500–1650kg

Unmistakable slow-moving mammal with a blunt nose and a broad spatulate tail. Gray skin is often green from algae growing on back. Young nurse from a nipple under the flipper. Endangered and vulnerable to collisions

with speed boats. Manatees are the only mammalian marine herbivores, and feed on marine plants in shallow Florida waters. Become tame in protected areas, and accept human contact from divers. Occasionally wander as far north as the Chesapeake Bay in summer, and aggregate at warm water sources in winter. Favored habitats include large rivers, lagoons, and estuaries in coastal areas.



WALRUS *Odobenus rosmarus* & 2.5–3.5m, 590–1656kg; & 2.3–3.1m, 400–1250kg

A large pinkish seal with tusks, which are greatly enlarged canine teeth. Broad snout is covered with short whiskers. The color of an individual can vary from white to pink to reddish brown as blood flow to the skin changes

for temperature control. Atlantic Walrus is smaller, with smoother skin and more rounded snouts than Pacific Walrus. Male is larger, with larger tusks and thick skin on the neck and shoulders. Tusks are used in displays to intimidate other males, and often break in fights between males. A clumsy walker on ice and rocks, it is an adept diver to forage on prey dwelling on the ocean bottom, including crabs, anemones, sea cucumbers, shrimp, clams, worms, snails, octopuses, tunicates, fish, and occasionally other seals.



NORTHERN ELEPHANT SEAL Mirounga angustirostris & 3.6-4.2m, 1500-2300kg; \$ 2.2-3.0m, 400-800kg

Third largest of all seals, with a uniform brownish back and yellowish belly. Male is unmistakable with its enormous size, elephantine nose, and thickened neck. Canines of males are often exposed, and used to

scar the necks of their male competitors. Newborns are black, and molt to a silvery color after weaning. Populations are recovering from historic overhunting. Males compete for females with visual and vocal displays, and occasionally violent physical combat. They may fast for up to 3 months while ashore competing for access to females. Hauls out on beaches to breed and molt from December–February, then migrates into the open ocean to feed on fish and squid.



BEARDED SEAL Erignathus barbatus 2.0-2.6m, 225-360kg

A large seal with a small head and prominent whiskers. Foreflippers are square-shaped. Whiskers are straight when wet and curved when dry. Female may be slightly longer than male. Adults are gray or brownish in color, sometimes with red on the face or flippers. Newborns are dark-col-

ored with white patches on head and back. Juveniles often have irregular splotches of color on their heads and bodies. Feeds on crustaceans, mollusks, and fish caught at the sea bottom. Females begin breeding at 5–6 years of age, and produce a single young annually thereafter. Lives alone or in small groups at low densities on moving ice and in open water.





PLATE 92 Antelopes and Pigs



PRONGHORN *Antilocapra americana* & 1.3–1.4m, 10–15cm, 42–59kg; \$ 1.3–1.5m, 10–13cm, 41–50kg

North America's only native antelope has unique coloration and horns. Has a stocky build on long legs, and short black horns. Cinnamon-colored body, with a white rump, belly, and facial markings. Male horns have a for-

ward pointing "prong," while female horns are smaller, usually lacking prongs. The horn sheaths are shed in November and quickly regrown each year. Some females do not grow the sheaths. Male is larger and has a black line on the lower jaw. Hairs on the rump and back of the neck can be erected. Speeds of up to 72km per hour have been recorded. Eyes are large and project sideways, yielding excellent peripheral vision in their open habitats. Heavy eyelashes serve as sun shades. Feeds on a variety of plants, especially forbs and shrubs, and grasses during spring greenup. Relies on good vision and speed to escape predators in open, grassland habitats from sea level to over 3000m, but most common between 1200 and 1800m.

BLACKBUCK Antilope cervicapra 1.2–2.1m, 10–17 cm, & 20–57kg; § 20–33kg

An exotic, bicolored antelope introduced in Texas. Adult males have long, V-shaped, spiraling horns and are black above. Females and young males are tan above and usually do not have horns. Males lighten in color after the spring molt. Coloration is accentuated by white eye rings, chin patch, chest, belly, and inner legs. Native to India and Pakistan. Does not survive long periods of freezing temperatures. Grazes on short to mid-length grasses and some brush. Introduced widely in Texas, with more than 7000 animals counted in 51 counties in 1974, mostly on the Edward Plateau.



COLLARED PECCARY Pecari tajacu 85-102cm, 3-5cm, 15-25kg

A native piglike animal with grizzled dark coat and a whitish collar. The hairs on the head and back can be erected into a mane. Small, inconspicuous tail. This neotropical animal is restricted in the north by cold. Nocturnal in summer, but diurnal in winter. Produces a variety of grunts,

snorts, and clicks, which serve to communicate with other herd members. They also mark and rub with facial glands, which probably helps to identify herd members. Groups are territorial, and dominance heirarchies dictate reproductive success of males. Territories are marked with dung piles, and with secretions from rump glands. Breeding season is November–January, and females produce a single young or twins. Diet includes fruits, seeds, roots, and tubers, as well as large amounts of cacti. Herds of 15–20 animals root and browse in grasslands, desert scrub, and arid woodlands.

WILD BOAR Sus scrofa 1.3-1.8m, 15-30 cm, 35-200kg

Basically a domestic pig gone wild, typically covered with thin, coarse grizzled black and gray hair. Hybrids may be variable in color, including spotted, black and tan. A mane of long bristles may develop down the back. The upper teeth (tusks) curve upward and are often conspicuous. Old World pig species widely introduced in North America. Feral populations are known from at least 18 states, especially in the humid south. Prolonged winter frost appears to restrict its winter foraging and, therefore, prevent its spread northward. Its rooting can be quite damaging to native vegetation. Shy and intelligent, difficult to see in their forest haunts.







MOUNTAIN GOAT *Oreannos americanus* & 1.2–1.8m, 8–20cm, 46–136kg; \$ 1.3–1.5m, 8–14cm, 45–83kg

A white goat with small, slightly curved black horns. White coat is long and shaggy in the winter and shorter in the summer. Males are larger, with longer horns. Similar to female Dall's Sheep, but with black, not brown

horns. Hooves are specialized for gripping rock. Males display and fight among themselves for access to females, and dominance hierarchies are established on the outcome. Breeding season is November–January, and one or two 2–3km young are born in May–June, usually on a steep cliff. The precocial young follow the mother immediately. Lactation lasts until fall, but young remain with mothers until the next birth. Juvenile mortality is high, but adult mortality low. Females first breed at age 3, and males somewhat later. Maximum longevity is 20 years in the wild. Typically migrates down slope in the winter with the first snowfall and uphill in the summer. Uses open country above the timberline, with meadows for foraging and steep rocky cliffs or talus slopes for refuge from predators.



BIGHORN SHEEP *Ovis canadensis* & 1.6–1.9m, 8–12cm, 75–135kg; § 1.5–1.7m, 7–12cm, 48–85kg

A brown sheep with a white rump patch and large curved horns that symbolizes mountain wilderness in North America. Large male horns are used in combat to establish dominance. Female horns are smaller. Easily dis-

tinguished from Dall's Sheep by color and geographic range. In spring molt, cream-colored females are distinguished from Mountain Goats by coat and horn color. Heaviest in October, lightest in May. Measurements given are for *O. c. canadensis* from the central and northern Rockies, the largest subspecies. Often seen at saltlicks. Typically in groups of 5–80 animals. Many populations are migratory, moving between summer and winter ranges. Limited by water availability in desert habitats, where many isolated populations are declining and the subspecies *O. c. californiana* from California is Endangered. Prefers treeless areas with nearby cliffs or rocky areas to escape from predators.



DALL'S SHEEP *Ovis dalli* & 1.3–1.8m, 7–12cm, 73–110kg; ^o 1.3–1.6m, 7–9cm, 46–50kg

A northern sheep with large horns that grow continuously through life. Coat color is usually uniform white; the subspecies *O. d. stonei* from Yukon and British Columbia is silvery gray with a white muzzle, leg trimmings, and

rump patch. Male is larger than female, with larger horns. Horns are a bit smaller than in the Bighorn Sheep, and more widely flaring. Winter coat is much thicker. Gregarious, but males and females come together only during the rut. Males fight for access to females using the huge horns to ram each other. Breeding season is November and December, and a single lamb is born in May after 171-day gestation period, on high, precipitous cliffs. Lambs weigh 3–4kg at birth, are precocial, and follow their mother the first day. They are weaned at 3–5 months, and weigh 30kg by 9 months. Feeds on grasses and low shrubs. Typically migrates between summer and winter ranges in its rugged mountain habitat.





PLATE 94 Bison and Nilgai



AMERICAN BISON *Bison bison* & 3.0–3.8m, 43–90cm, 460–907kg; \$\vee\$ 2.1–3.2m, 43–90cm, 360–544kg

North America's largest land mammal. Has a distinctive humped profile with larger forequarters and smaller hindquarters; these traits are more pronounced in males. The brown wooly pelage is thickest around the neck,

extending onto the shoulders and back in males. Males also have larger horns, which are stouter and more curled; female horns are more slender with upward pointing tips. Calves are reddish. Hair is longer in the winter. The Endangered Wood Bison (B. b. athabascae) from western Canada is slightly taller, darker, and woolier, with a larger hump than the Plains Bison (B, b, bison), Wallows 2-3m wide are used by all ages and sexes. Prairie rock rubs worn smooth by 10,000 years of use usually rest at the bottom of a slight depression formed by countless hoofs circling the stone as the bison rubbed against it. Tens of millions of bison were nearly hunted to extinction (probably fewer than 1000 animals left) at the end of the nineteenth century, the species had recovered to ca. 150,000 animals by 1995, with 90% privately owned. Typically grazes in herds of 4–20, these groups sometimes merge into much larger congregations. Herds provide protection from predators, and stampedes are a predator-avoidance behavior. Breeding season is July-August, gestation length is 285 days, and females have only a single calf with birth coinciding with spring greenup. Females leave the herd and lie down to give birth. The female fiercely defends the newborn calf. Sexual maturity is reached at age 2. Males have a repertoire of threat displays, both visual and vocal, to establish dominance relationships, but rarely resort to all-out battles. When they do occur, these battles are epic, the large bulls slamming into each other, shearing out gouts of hair with their horns, and on rare occasions, dving from a horn that penetrates the ribcage. Most breeding happens in a 2-week period, and the one-third of the males that are dominant breed with two-thirds of the females. This means that the large male bison are heavily selected for fighting specialists, while the much smaller females reproductive success depends more on competition for food. When a cow comes into estrus, she is guickly tended by a bull, who may then be replaced by a more dominant bull. Reaching their highest density in mixed and short-grass prairies, these gregarious grazers can survive in a variety of open habitats.

NILGAI Boselaphus tragocamelus 2.2–2.4m, 40–45cm, & 109–306kg; \$ 109–213kg

A very large, brownish exotic antelope introduced and running wild in Texas, especially south in Kennedy and Willacy counties. This large animal stands up to 1.5m at its enlarged shoulders; its profile then slopes to the smaller rump. Generally brownish, the bull is slightly gray while the female and young are orangish brown. It has white on the face, chin, and throat. Below this white bib hangs a beard of hair, which is larger in males. Female is smaller and generally lacks horns. Typically herds in groups of 10. Intolerant of cold temperatures. Grazes and browses in relatively dry areas of flat to rolling country with a moderate cover of thin forest or scrub. Avoids heavy woods.





PLATE 95 Arctic Ungulates



CARIBOU *Rangifer tarandus* ♂ 1.6–2.1m, 11–22cm, 81–153kg; ♀ 1.4–1.9m, 10–20cm, 63–94kg

A stocky deer of the far north. Both sexes have antlers; male antlers are larger and semi-palmated, especially the single, flat brow tine that extends down almost, but not quite, past the nose; female antlers are much small-

er and less palmate. Female tends to have more white hairs than bulls. Old antlers are whitish, new ones are black from their velvet covering. Coloration and antler size vary across subspecies. The Woodland Caribou from boreal forests and alpine tundra is the largest caribou, and is brown in the summer and gravish in the winter. It has creamy white hair on the neck, mane, underbelly, rump, and on a patch above each hoof. Barren Ground Caribou uses taiga forests and tundra and is medium in size: the coat is chocolate brown in summer. lighter brown in winter. Pearly Caribou from high Arctic islands is smaller with shorter legs, face, and ears, and a lighter coloration. Caribou eat grasses and shrubbery leaves in the summer, lichens in the winter, a food not used by other members of the deer family. Large migratory herds calve on the tundra in the spring, then wander the tundra and forest searching for food. Females can more easily detect predators on the open tundra, but in the winter forested regions offer the best forage in the form of lichens, which they reach by digging in the snow. Forest and mountain Caribou migrate less. The Woodland Caribou subspecies (R. t. caribou) is Endangered. Domesticated and European Caribou are known as Reindeer. Depending on the subspecies and time of year, the Caribou uses a variety of boreal forest and treeless tundra and mountain habitats, which are among the harshest and least productive of those used by any member of the deer family.



MUSKOX *Ovibos moschatus* & 2.1–2.6m, 7–12cm, 186–410kg; § 1.9–2.4m, 6–12cm, 160–191kg

A stocky, shaggy bovid of the Arctic. The long, brown winter hairs extend nearly to the ground, covering fine, cashmere-like underhairs. Stockings and saddle are creamy white. Male is larger (some reach 650kg in cap-

tivity) and has larger horns that merge into a massive boss on the forehead. Female horns are shorter, more slender, and more curved. Feeds on sedges, grasses, and willows, and distribution is limited by snow depth. Typically lives in mixed-sex groups, although some males are solitary in summer. Sedentary groups move little, but adult males move more than females. When confronted by would-be predators, adults circle around calves, confronting the enemy with a ring of pointy horns. Herds may also stampede when disturbed. Nearly extinct at the end of the nineteenth century, now protected, reestablished in Alaska, and recovering in Canada, where most of the population lives on Arctic islands. Males defend harems during the August–September breeding season through a variety of displays, vocalizations, and scent-marking. The culmination is an all-out charge with males running together at 50km per hour and banging heads with the huge horn bosses taking the brunt of the blow. Females give birth to a single calf (rarely twins) in April–May after a 34-week gestation period. Uses Arctic tundra, preferring grassy areas with low precipitation in the short, cool summer and windswept areas with exposed vegetation in the long, cold winter.





PLATE 96 Elk and Moose



ELK *Cervus elaphus* & 2.1–2.6m, 11–17cm, 178–479kg; \$ 2.0–2.5m, 8–19cm, 171–292kg

A large, tan-colored ungulate with a darker neck and white rump. In season, the male has a shaggy neck mane and enormous antlers consisting of one main beam and, typically, six points. Antlers are usually shed in Feb-

ruary and regrow over the summer. Summer coat is sleek and tawny brown; winter coat is gravish brown, Fawns are spotted. Tule Elk (C. e. nannodes) from parts of California are lighter overall in color and smaller. The Elk is smaller and paler than the Moose, without palmate antlers; larger than deer, with unique dark neck/white rump coloration. During the fall rut in September-October, males repeatedly give a high-pitched "bugle" vocalization. Yearlings of both sexes can breed, and the gestation period is 240 days, with a single calf (rarely twins) born in June. Newborns weigh about 15kg. Lives in herds sometimes exceeding 200 in open habitats, smaller groups in forested areas. Maximum life expectancy is 20 years. Hunted to extinction throughout eastern states by the mid 1800s; recent reintroductions of small populations into Michigan, Kentucky, Tennessee, and Pennsylvania are encouraging. Overall population size is now approaching a million animals. The smaller C. elaphus subspecies from Europe is called the Red Deer and typically has rougher antlers that grow up and inward rather than up, out and backward. Browses and grazes on a variety of plant species, preferring open or brushy habitats to mature forest. Most populations in the US are found on federally protected lands such as national parks, forests, and wildlife refuges.



MOOSE Alces americanus ♂ 2.4–3.1m, 8–12cm, 360–600kg; ♀ 2.3–3.0m, 8–12cm, 270–400kg

Largest deer, and one of the largest land mammals in North America. Elongated head with pendulous snout, unique hanging dewlap, and huge rotatable ears that provide an excellent sense of hearing. Upper lip marked by

small rectangular bare spot. Long legs gray at bottom. Heavy body with humped shoulders and a small tail. Light brown to black body color from guard hairs over gray undercoat that provide ample protection from cold, snowy winters. Male is larger than the female and bears enormous palmate antlers (largest in the world) that are grown in summer and shed in winter. Most females have white hair around vulva. Juvenile pelage is reddish. Recently recognized as a distinct species from the Eurasian A. alces. Large size and a total population size of around a million means considerable ecological impact, both as browser and as prey. Mostly solitary; herbivorous; active any time, especially dusk and dawn, and most of its activity is dedicated to foraging for the 65kg of plant food that its stomach can hold. Keen sense of smell allows them to locate food beneath the snow, but vision is not as acute. Vocalizations in the early fall rut include deep grunts and moos. Mud wallows marked by large tracks; most antler rubs on vegetation are higher (100–200cm) than deer (less than 115cm). Recently reintroduced in Colorado and northern Michigan. Can be seen cooling themselves in ponds and lakes, or standing in the shade, where they are often unwary but can be dangerous up-close; abundant in northern boreal forests, especially wet areas, and limited to cool regions where temperatures do not exceed 27°C.





PLATE 97 NATIVE DEER

DEER – These two deer species are among our most familiar animals. They are distinguished by differences in the ears, facial coloration, tail, and antlers. Hybrids are rare, and typically sterile. In areas of overlap, the Mule Deer inhabits drier habitats. The White-tailed Deer sticks to moister habitats, and is expanding its range westward. Both leave their sign on the landscape in similar ways. Antlers are rubbed on the stems of saplings, scraping away the bark. Bark scraped off with their incisors leaves a different, chewed pattern on small trees. Chewed branch ends are cut off roughly, leaving a frayed end, typically around human knee- or hip-height. Matted grass beds mark their resting sites. Finally, males mark their areas with dirt scrapes dug by their hooves and flagged with broken branches above and urine scent in the mud.



MULE DEER *Odocoileus hemionus* & 1.3–1.7m, 13–22cm, 40–120kg; ♀ 1.2–1.6m, 12–21cm, 30–80kg

Ears are larger and tail is smaller than that of the White-tailed Deer. Males have dichotomously branching antlers that are usually shed in January and regrow over the summer. The tail is large and black in coastal subspecies,

smaller with a black tip in interior subspecies. Interior animals are pale brown or tan in the winter with a large white rump patch, while coastal animals are darker and grayer with a smaller white rump patch. All races are rusty red in new summer coat. Fawns are reddish with white spots. There is a V-shaped dark mark from the point between the eyes, upward and laterally, especially in males. When alarmed they bound away in a "stot," with four feet hitting the ground together at each bound (the White-tailed Deer springs from hind to front feet). Populations in northern mountains migrate up to higher elevations in the summer and down to the foothills in the winter. Prefers mixed habitat with both open areas for feeding and forest or brushy areas for protection. Common in western mountain forests, deserts, and brushlands.



WHITE-TAILED DEER *Odocoileus virginianus* 0.8–2.4m, 10–37cm, ở 22–137kg; \$ 30–90kg

Ears are smaller and tail is larger and whiter than in the Mule Deer. Males have antlers consisting of smaller vertical tines branching off the single main beam. Year-old male fawns have small "buttons" of antlers. Antlers

are shed in December and January and regrown over the summer. Long tail is brown above, white below, and fringed in white on the sides. Coat is reddish brown to bright tan in the summer, duller and grayer in the winter. Fawns are reddish and spotted with white. Males average 20% larger than females and northern populations are larger; the Endangered Dwarf Key Deer (*O. v. clavium*) from the Florida Keys stands 60cm at the shoulder and weighs ca. 35kg. The Columbian White-tailed Deer subspecies (*O. v. leucurus*) from coastal Oregon and Washington is also Endangered. Once thought to number 40 million, populations were reduced to about a half million by the end of the nineteenth century. Subsequent management resulted in rebounding populations that now number 15 million in the US alone, with an annual hunter harvest of 2 million. Prefers forest edges and open woodlands near brushlands, especially old fields and agricultural areas. Uses a variety of forested habitats from temperate to tropical, semiarid to rain forest, making it one of our most widespread species.







PLATE 98 Exotic Ungulates

These non-native species have been introduced for hunting purposes and occasionally form feral, reproducing populations in isolated areas.

FALLOW DEER Dama dama 1.4-2.0m, 15-23cm, 3 79-102kg; 9 36-41kg

An exotic spotted deer with palmate antlers. Originally from the Mediterranean, escapes and releases from game farms have started free-ranging populations in at least seven states and provinces (California, Georgia, Texas, Alabama, Kentucky, New Mexico, and New Brunswick) and islands off British Columbia; many less successful introductions have also occurred. Most animals are rust or tan-colored, with white rump patch and belly; winter pelage is darker and the spots are often indiscernible. The white spots on the back merge into a white line near the rump and there is a black or tan line on the back. Melanistic, very dark, and very light morphs are also known, and may predominate in domesticated herds. Prefers mixed habitats with open areas for feeding and covered areas for winter food and shelter.

CHITAL Axis axis 1.0-1.75m, 12-38cm, & 30-75 kg; 9 25-45kg

A spotted exotic deer with three tines on each antler. This brownish deer has many delicate white spots, and a white abdomen, rump, throat, insides of legs and ears, and underside of tail. A dark stripe runs down the center of the back. Originally from India, Nepal, and Sri Lanka; they are now the most abundant exotic ungulate in Texas. Many have escaped from game farms in other states and probably also survive in the wild in California and Florida. Prefers secondary forests mixed with grassy areas.

SIKA DEER Cervus nippon 1.0-1.5m, 7-13cm, & 68-109kg; \$ 45-50kg

A small deer from east Asia with introduced feral populations surviving in Texas and Maryland. This compact deer has a distinctive wedge-shaped head. Dark brown with a variable amount of white spotting that is absent in some animals. Texas populations are especially variable due to extensive hybridization. There is a white rump patch that is most visible when the animal is alerted. The male's antlers have three or four points branching off each main beam; the female has a corresponding pair of black bumps on the forehead. Browses and grazes in a variety of woodlands.

SAMBAR Rusa unicolor 1.9-2.8m, 25-30cm, 109-260kg

A large dark brown ungulate with stout antlers and a white rump and undertail. Has a bald, rounded glandular area on the middle of the throat. Large antlers are stout and rugose, with three prominent tines. In season, males have a mane of hair on the neck and forequarters. Crepuscular and nocturnal. Native to India and Southeast Asia, now established in small numbers in Texas, California (Obispo County), Florida (St. Vincent Island), and perhaps other areas. Prefers wooded areas.

BARBARY SHEEP Ammotragus lervia 1.4-1.8m, 14-25 cm, & 100-145kg; & 45-65kg

A large exotic sheep with long, curved horns and long hair on the throat, chest, and front of the legs. Native to the Sahara Desert of North Africa, introduced into California, New Mexico, and Texas (mostly Panhandle region). Tail is long and tufted. Upperparts are rufous or grayish brown with a blackish mid-dorsal line. Flanks, inner surface of legs and belly are whitish; chest is colored like the sides. Yellowish horns darken with age. Inhabits dry, rough, barren, and waterless habitat, where it likely competes with native Bighorn Sheep.





PLATE 99 Large Whales without Dorsal Fins



GRAY WHALE *Eschrichtius robustus* & 11.1–14.3m; \$ 11.7–15.0m, 15,700–33,800kg

Unique with mottled gray color and low rounded hump in place of dorsal fin. Narrow triangular head is covered with barnacles and whale lice. Mouthline is straight or slightly arched. Small flippers and large flukes are

frequently marked with white from lice and scars. Top of tail stock is covered with bumpy knuckles. Active in water, often swims in shallows. Stirs up mud when feeding from sea floor. Strains food with baleen. Low heart- or V-shaped blow. Migrates along west coast between Arctic summer waters and Baja winter waters.



BOWHEAD *Balaena mysticetus* & 14–17m; 9 16–18m, 75,000–100,000kg

Large, smooth-skinned, black whale with no dorsal fin. Indentation behind blowhole divides profile of triangular head from rotund body. Head and back produce two humps above water in profile. Chin is white with variable

black spotting; some also have white around tail stock. Large fluke and paddle-shaped flippers are black and unmarked; fluke is shaped like that of the North Atlantic Right Whale. A record of 3m-long Bowhead baleen is largest of any whale. Blow is high and V-shaped. Feeds alone or in groups. Can break ice to breathe. A rare and Endangered species. Closely tied to pack ice in Arctic waters.



NORTH ATLANTIC RIGHT WHALE *Eubalaena glacialis* 11–18m, 60,000–100,000kg

Large black whale with large callosities and no dorsal fin. Smooth slope of back is different from Bowhead's double-hump profile. Flukes and wedge-shaped flippers are black with limited mottling. Body is black

except for variable amounts of white on belly. Blow is V-shaped. This slow, inquisitive whale was the "right" whale to hunt and was nearly driven to extinction. Modern recovery is slowed by mortality from fishing gear entanglement and collisions with ships. Still highly endangered, only about 300 animals survive (red area on map).

NORTH PACIFIC RIGHT WHALE Eubalaena japonica 11-18m, 22,000-107,000kg

Like the North Atlantic Right Whale in appearance, but recently recognized as a distinct species based on genetic differences. Occasionally reported from Alaska to Baja, more common in North and West Pacific parts of its range. Calving grounds unknown. Critically Endangered with as few as 100 animals left in the eastern Pacific (yellow area on map of North Atlantic Right Whale).



SPERM WHALE *Physeter catodon* & 11–18.3m, 11,000– 57,000kg; \$ 8.3–12.5m, 6800–24,000kg.

Unique large whale with square head, undersized lower jaw, and wrinkled skin. Body color varies from dark gray to light brown, rarely white like Moby Dick. Skin around mouth usually white. Male is larger, with a protruding spermaceti

organ projecting beyond the skull. Angular hump is followed by a keeled tail stock topped by bumpy knuckles. Has stubby flippers and a large triangular fluke. Single blowhole at front of head sends a bushy blow forward and to the left. Typically dives to 300m in search of squid and octopi, may reach 3000m. Usually dives to avoid boats. An endangered species. Swims in groups of ca. 20 animals in deep waters; moves north in summer and south in winter.

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PLATE 100 Enormous Whales with Dorsal Fins



HUMPBACK WHALE *Megaptera novaeangliae* 14–17m, 25,000–45,000kg

Dark whale with remarkably long, knobby flippers. Top of flippers are dark in the Pacific race and white in the Atlantic race. Head is knobbed with tubercles; projection under chin may grow with age. Dorsal fin varies from

low and stubby to high and curved. Pattern of white on flukes and shape, size, and scarring of dorsal fin allows identification of individual whales; end of tail is serrated. Widely spaced throat grooves help distend mouth for filter feeding. Blow is low and bushy. Most active and acrobatic of the large whales. Unique feeding technique involves the release of columns of bubbles that encircle schools of fish and contain them so the whales can lunge into the center of the bubble net and engulf large numbers at once. Mating and calving occur in tropical and subtropical waters in winter. They feed extensively in summer in productive cold high-latitude waters, and do not eat during the winter breeding season. This Endangered species migrates along both coasts between summer Arctic waters and winter southern waters, where it is among the most familiar of the great whales.



BLUE WHALE Balaenoptera musculus 22-28m, 64,000-195,000kg

The world's largest animal, and the largest animal ever to exist, they are mottled blue with a U-shaped head and tiny dorsal fin. Larger than Fin Whale, with a blue mottled back (not smooth gray), a more rounded head, and a less prominent dorsal fin. Shape of dorsal fin varies from round to

pointed. Belly may be light blue, white, or yellow. Long slender flippers tipped in white. Thick, smooth tail stock. Females are larger than males, and may weigh as much as 30–40 African elephants. Animals are larger in the southern hemisphere. High, slender blow. Mating and calving must occur well offshore. Calves are 6–7m at birth in fall and winter, and they nurse for 7–8 months to reach 16m. The nursing young put on 90kg per day. Sexual maturity is reached at about 5 years, when the animals are about 20m long. A rare and Endangered species. Migrates along both coasts between summer Arctic waters and winter southern waters.



FIN WHALE *Balaenoptera physalus* & 17.7–22m; 9 18.3–24m, 45,000–70,000kg

The world's second largest animal is a large whale with smooth gray skin and a V-shaped head. Undersides of belly, flippers, and fluke are white. Rarely shows fluke. Shape of pointed dorsal fin is variable. Top of tail stock

is ridged. Asymmetric lower jaw and baleen are dark on left and white on right. This head color, and the unique chevron pattern behind the head allow individual identification. Blow is high and cone-shaped. Migrate from summer feeding grounds in cold, productive waters at high latitudes to warmer wintering grounds in tropical and subtropical areas, where they mate and calve. One of the fastest swimming whales, it can reach speeds of 25 knots. Tagged individuals have travelled 1700km in 9 days. A rare and Endangered species now, it was probably one of the most abundant large whales before commercial whaling. Typically swims in deeper waters along both coasts.




PLATE 101 Large Whales with Dorsal Fins



BRYDE'S WHALE *Balaenoptera edeni* & 11.9–14.8m; \$ 12.2–15.6m, 11,300–16,200kg

Similar to Sei Whale, but smaller and only whale with three ridges on head and a prominent dorsal fin. Dark-backed with white on chin that grades into a light gray or purple-gray belly. Prominent dorsal fin is typically

hooked, and intermediate in size and shape between those of Sei and Fin whales. Slender flippers, broad fluke. Skin may be mottled with scars. Baleen is black with a pale gray, coarse fringe. Feeds on a wide variety of fish, crustaceans, and krill. Blow is moderately high and thin, and dives last 1–11 minutes. Spectacular breaches often repeated two or three times. Breeding is in winter, with young born a year later, and weaned 6 months later in summer. Uses warm waters, typically south of Chesapeake Bay in the east and south of Baja in the west.



SEI WHALE Balaenoptera borealis 14–18.6m, 10,000–25,000kg

Large whale with one central ridge on head and a prominent dorsal fin. Dorsal fin is less hooked than that of Bryde's Whale, and baleen is white and silky. Has thin, pointy flippers and a triangular fluke. Back is blueish gray, belly and chin are white. Skin may be mottled with scars. Females

are slightly larger than males, and both sexes reach sexual maturity at 8–10 years, by which time they are 13m long. Mating occurs from September–March, and a single 4.5m, 65kg calf is born a year later. The lactation period is 6–9 months and females produce young every 2–3 years. Blow is low and forked. A rare and Endangered species. Rarely breaches, and feeds both by gulping and skimming krill, squid, and small fish. Seems to follow typical great whale pattern of migrating to higher latitudes for summer feeding and to tropical and subtropical waters for mating and calving in winter. Found on both coasts, far from shore.



COMMON MINKE WHALE Balaenoptera acutorostrata & 7.6–9.8m; ° 7.3–10.7m, 5000–9,000kg

Unique with white band on flippers and a sharply pointed snout. Flippers are rarely all dark. Hooked dorsal fin is largest, in relative size, of all baleen whales. Dark gray back. White on belly and chin extends dorsally in cen-

ter of back. Baleen is yellowish white. Rarely has visible blow. Common, especially in cooler waters, where they are solitary or in small groups of 2 or 3, although larger aggregations may occur on exceptionally productive feeding grounds. They are attracted to boats, perhaps by the noise of the motor. Breeding occurs year-round, but more commonly from October–March, with young born 10 months later. Young are 2.5m long at birth and nurse for about 4–5 months. Animals grow steadily until they are about 30 years old. Often seen near coast while migrating north in spring and summer and farther offshore when returning south in autumn and winter.





PLATE 102 Small White and Gray Whales

SMALL SPERM WHALES – These are two of the smallest whales. Both have blunt, squarish heads and a conspicuous white crescent behind the eye forming a false gill. Their lower jaw is small and underslung. They are sharklike in appearance, with a dark bluish-gray back blending into a light gray or pink belly. The two species are distinguished by body size, position and size of the dorsal fin, and tooth number. Shy, sometimes leave a reddish-brown cloud of fecal "ink" if startled. They live in deep waters and are difficult to see as they typically surface and dive quietly.



DWARF SPERM WHALE Kogia sima 2.1-2.7m, 136-272kg

Has a prominent dorsal fin in center of back. Smaller than the Pygmy Sperm Whale, with fewer teeth (7–12 pairs). Feeds mainly on squid, but also takes fish and crustaceans, taken at depths of up to 300m. Seen off southeast coast along the continental shelf, rare strandings along west coast.



PYGMY SPERM WHALE Kogia breviceps 2.7-3.4m, 318-408kg

Small dorsal fin is positioned one third of the way to the tail. Larger than Dwarf Sperm Whale, with more teeth (12–16 pairs). Sometimes has pale circular mark in front of eye. Occurs along both coasts singly or in small groups of 2–6, most often seen off the southeastern coast.



RISSO'S DOLPHIN Grampus griseus 2.8-3.8m, 400-600kg

Unique with very large dorsal fin and rounded head. Blunt melon is creased down the middle when viewed head-on. Body is typically gray and scarred, but may be dark gray to white. Young are an unscarred brownish gray. Scars accumulate with age, and body color lightens. Typically in primals in offshore waters along both coasts

groups of 3–50 animals in offshore waters along both coasts.



NARWHAL Monodon monoceros \ref{scalar} (without tusk) 4.8m, 1580kg; $\hfill 4.1m, 960kg$

Only whale with a tusk; mottled gray color and rounded head also unique. Typically, only males have a tusk, which is a hollow, spiraling, modified tooth. Rarely two tusks are present. Older animals are almost white in col-

oration, and have a more convex trailing edge of their fluke. Tusks often break in fights over females, and scar the heads of males. Only found in high Arctic seas near pack ice.



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BELUGA Delphinapterus leucas & 3.5–4.9m, 800–1500kg; $ 3.3–4.0m, 540–790kg
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White color and rounded head unmistakable. No dorsal fin, small broad flippers. Young are born slate gray to pinkish brown and mature into blueishgray subadults. Skin turns white after sexual maturity, and may look yellow

in some light. Males are larger, with a more pronounced melon. Chirps and whistles may be heard above the surface. Lives in groups of 5–20 along northern shorelines and estuaries.





PLATE 103 Black Dolphins

PILOT WHALES – These two bulbous-headed dolphins are jet black with a variable blaze of gray or white behind the eye, and light-colored patches on the belly and throat. They may also have a saddle of paler color behind the dorsal fin. The forward-sitting dorsal fin is bulbous and hooked in males, more upright in females. Their flukes have conspicuously pointed tips. Strong blow often visible. In addition to range, they are distinguished by the size of their flippers and their teeth—both of which are difficult to measure at sea.



LONG-FINNED PILOT WHALE *Globicephala melas* & 6.2m, 2320kg; \$\varphi\$ 5.12m, 1320kg

Has long flippers with a sharp elbow-like bend. 8–12 pairs of teeth. Swims in groups of 10–50 in northern and temperate waters off the east coast. Follow feeding squid inshore in summer and fall, then offshore in winter

and spring. Also feed on mackerel.



SHORT-FINNED PILOT WHALE *Globicephala macrorhynchus* & 5.5–7.0m; § 4.25–5.0m, 900–3000kg

Short flippers have a gently curved edge. Seven to nine pairs of teeth. Nomadic groups of 10-30 in deep waters along the west, southeastern, and Caribbean coasts.



PYGMY KILLER WHALE Feresa attenuata 2.0–2.6m, 110–170kg

Small, black dolphin with rounded flipper tips and white "lips." Snout is more rounded than Melon-headed Whale. May have a subtle dark brown cape on back that does not dip into flanks. 8–13 pairs of teeth. Typically avoids ships. Found off southeastern coast and Caribbean.



MELON-HEADED WHALE Peponocephala electra 2.1-2.7m, 160kg

Small, black dolphin with pointed flipper tips and white or pink "lips." Snout is slightly more pointed than in the Pygmy Killer Whale. Back is dark, belly is lighter. May have a dark mask on face and a dark cape that dips toward belly on flanks. 20–25 pairs of teeth. Swims in groups of a few

hundred far off the southeastern coast and Caribbean.



KILLER WHALE Orcinus orca 6.0-10.0m, 3500-7000kg

Large, black dolphin with high dorsal fin and white eyespot. Male is larger and has an erect dorsal fin, female has a smaller curved dorsal fin. Large paddle-shaped flippers grow with age. Belly, chin, and underfluke are white. Has variable white and gray swirls on sides. An acrobatic swimmer

in all oceans including deep and shallow waters.



FALSE KILLER WHALE *Pseudorca crassidens* & 3.7–6.0m; 9 3.3–5.1m, 1000–1360kg

Large, dark gray to black dolphin with sickle-shaped flippers. Short flippers have a hump at the center and slightly concave tip. Chest may be gray, and head paler. Dorsal fin may be pointed or round. Rare but widespread and

approachable along both coasts, mostly in the south.

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PLATE 104 Unstriped, Beaked Dolphins



ROUGH-TOOTHED DOLPHIN Steno bredanensis & 2.0-2.6m; \$ 2.0-2.5m, 90-155kg

Uniquely cone-shaped head lacks a groove separating forehead from beak. Lips and tip of beak are white. Eyes are large and slightly protruding. Dark gray or purplish back with darker cape and white belly. Some yel-

lowish or white spots on flank. Deep divers with little interest in bow-riding. Maximum lifespan 32 years. Groups of 10–20 use deep warmer waters along both coasts.



BOTTLENOSE DOLPHIN Tursiops truncatus 2.6–3.4m, 150–300kg

Large, plain gray dolphin with short, wide beak, wide head and body, and long flippers. Tall dorsal fin mid-body and sickle-shaped. Flukes mediumsized with deep notch. Variable in size and color, some populations may have a few spots. Body is darkest on back, grading to white on belly. Feeds

on fish and squid. Acrobatic and fond of bow-riding. Common in groups of 1-25, and up to several hundred along coastlines and far offshore.



ATLANTIC SPOTTED DOLPHIN Stenella frontalis 1.7–2.3m, 100–143kg

Spotted dolphin with a gray band between eye and flipper. Dark dorsally with pale spots and white underside with dark spots. Dark and light color grade together on tail stock. Lips may be white. Calves born unspotted

and about 1m long. Southern races are more heavily spotted than northern pelagic forms. Feed on fish, squid, and ocean floor invertebrates. Groups of 5–15 mainly in warm Atlantic waters within 300km of the coast.



PANTROPICAL SPOTTED DOLPHIN Stenella attenuata d 1.6–2.6m; ° 1.7–2.4m, 90–119kg

Spotted dolphin with prominent dark dorsal cape. Has dark gray band between jaw and flipper and a clear division of dark and light color on tail stock. Lips are white. Calves get first spots on belly. Dorsal fin shape is

variable. Groups may reach thousands. Females bear a single young after gestation period of almost a year. Frequently associates with large schools of tuna, making them susceptible to purse seines. Found in tropical waters and most of the Atlantic coast, where it is typically offshore.



NORTHERN RIGHT WHALE DOLPHIN Lissodelphis borealis & 2–3.1m; \circ 2–2.6mm, 60–113kg

Our only slender, beaked dolphin without a dorsal fin. All other dark dolphins have blunt faces and obvious dorsal fins. Dark color is broken up by white on lower jaw, chest, belly, and under the fluke. Calves are grayish

brown or cream-colored. Jumps with low-angle leaps. Dive up to 200m in search of fish and squid, and capable of speeds up to 34km per hour. Widely distributed and relatively abundant in deep waters of the Pacific, where they form herds of hundreds or even thousands of individuals.





PLATE 105 Striped, Beaked Dolphins



SPINNER DOLPHIN Stenella longirostris 1.3-2.4m, 22-75kg

Characterized by spinning leaps, this species has a long, thin beak. The only other spinning dolphin, Clymene, has a shorter beak. Color may be dark "battleship" gray, or tricolored with a darker back and white belly. Some gray animals have white patches on belly. Stripe between eye and

flipper is parallel (not triangular). Dorsal fin becomes more erect with age. Males have a large post-anal hump. Single 0.75m calf born after gestation of 10.5 months. Lactation lasts 1–2 years. Association with schools of tuna leaves them vulnerable to suffocation in tuna nets. Swims in groups of up to 200, sometimes with other species, in warmer Atlantic waters and south of Baja California in the Pacific.



CLYMENE DOLPHIN Stenella clymene 1.8-2.0m, 50-85kg

A tricolored spinning dolphin with a relatively short beak. Stripe between eye and flipper is triangular (not parallel). Often has white "moustache" on upper mandible. Tail stock of males is usually keeled. Smallish, curved dorsal fin is sometimes marked with pale coloration. Groups of up to 50,

often mixed with other dolphin species, feed on fish and squid. Found in warm Atlantic and Caribbean waters, where it is rarely seen.



STRIPED DOLPHIN Stenella coeruleoalba 8-2.5m, 110-156kg

Unique with dark eye-to-anus stripe and a pale marking below dorsal fin. Typically grayish, but may include blue or brown tones. Belly is white or pink. Specific stripe pattern is variable, but most originate from the eye. Feeds on fish, shrimp, and squid. Known for "roto-tailing," rapidly rotating

the tail while leaping out of the water. Groups of 10–500 use deep water along both coasts.



SHORT-BEAKED COMMON DOLPHIN Delphinus delphis ở 1.7–2.2m; 9 1.6–2.2m, 70–110kg

A short-beaked dolphin with yellow and gray hourglass coloration. The fourpart hourglass color scheme includes dark back, white belly, yellowish flanks, and a gray tail stock. Yellow may appear pale gray at sea. The vari-

able flipper stripe typically originates with a zigzag near the middle of the lower mandible. Has a more rounded head and more contrasting colors than Long-beaked Common Dolphin, including a dark eye patch. There is considerable variability in the pattern of the colors and stripes. Common along both coasts in schools of from 10 to several thousands.



LONG-BEAKED COMMON DOLPHIN Delphinus capensis d 2–2.5m; 9 1.9–2.2m, 70–135kg

A long-beaked dolphin with hourglass coloration. Flipper stripe typically originates near the corner of the mouth. Has a more sloping head profile than *D. delphis*, and more muted colors. Feeds on fish, but likely also takes

deep-water squid. Young born in spring and summer. Groups of 10–500 found off southwestern coast.





PLATE 106 Striped, Blunt-Nosed Dolphins and Porpoises



PACIFIC WHITE-SIDED DOLPHIN Lagenorhynchus obliquidens 1.7–2.5m, 75–200kg

Blunt-nosed dolphin with three-part color pattern and black beak. Back is dark gray, sides are streaked light and dark gray, belly and chin are white. Dorsal fin and flippers also colored with light and dark gray. Not shy of

boats. Gregarious, active swimmer in offshore waters of the Pacific, sometimes associates with other dolphins or seals.



FRASER'S DOLPHIN *Lagenodelphis hosei* ♂ 2.3–2.7m; ♀ 2.1–2.6mm, 164–209kg

Short-beaked dolphin with a pair of broad, straight stripes running from eye to tail stock. Back is gray, belly is creamy white or pink. Thin, dark flipper stripe connects to beak. Dorsal fin and flippers are small. Sometimes

associated with other dolphins. Rarely sighted off Caribbean coast.



ATLANTIC WHITE-SIDED DOLPHIN Lagenorhynchus acutus & 2.3–2.8m; \$ 1.9–2.4mm, 180–230kg

Unique with short beak and yellow patch on tail stock. Back is black, belly white, and flanks are gray with white and yellow patches. Thin black flipper-stripe starts from corner of mouth. Lower mandible is all white. Swims D in the North Atlantic

in groups of 5–50 in the North Atlantic.



WHITE-BEAKED DOLPHIN Lagenorhynchus albirostris d 2.5–3.1m; ° 1.8–2.4m, 180–354kg

Dark, robust-bodied dolphin with a white blaze on flanks and pale patch on tail stock. Head is dark gray, short beak and throat are white. Beak may be marked with brown or gray. Found in groups of up to 30 in North Atlantic, adda of continental sholf.

especially along edge of continental shelf.

 $\mathbf{PORPOISES}$ – A group of small, blunt-nosed dolphins. Two species are known from our waters, mostly near the coast.



HARBOR PORPOISE Phocoena phocoena 1.5-1.9m, 45-90kg

Small gray porpoise with no beak. Lips and back are dark, throat and belly are white. Flippers are small and rounded. Wispy, dark flipper stripes. Shy and hard to watch. Swims in small groups of two to five near shore along western and northeastern coasts.



DALL'S PORPOISE Phocoenoides dalli 1.8-2.3m, 84-114kg

Unique blunt-faced porpoise boldly patterned with black and white. Fluke and dorsal fin also colored with black and white. Male is slightly larger and has a hump behind dorsal fin. Female has a black trident pattern in genital area. Active and unpredictable swimmer, frequently creates "rooster

tail" splashes. Common in the Pacific.



PLATES 107 AND 108 Bow-riding Dolphins and Whales

HARBOR PORPOISE

SHORT-BEAKED COMMON DOLPHIN

ROUGH-TOOTHED DOLPHIN

LONG-BEAKED COMMON DOLPHIN

> PACIFIC WHITE-SIDED DOLPHIN

DALL'S PORPOISE

STRIPED DOLPHIN

KILLER WHALE, female

FALSE KILLER WHALE







PLATE 109 Beaked Whales

BEAKED WHALES – A diverse group of whales that are recognizable by their spindle-shaped bodies and small, posteriorly positioned dorsal fins. These shy inhabitants of deep waters are poorly known and difficult to identify at sea. Some are known only from rare strandings. Body color of live animals is often variable and/or unknown. The male's remarkable tooth morphology is often the key to identification, as well as the cause of their extensive scarring.



TRUE'S BEAKED WHALE Mesoplodon mirus 5.0-5.3m, ca.1400kg

Male has two small teeth erupting from the front of beak (see page 232). Has straight mouthline. Medium-gray back, pale underside, scarring throughout. Flippers can be tucked away in "pocket" on underside. Known to feed on squid. Some 16 records known off Atlantic coast.



STEJNEGER'S BEAKED WHALE Mesoplodon stejnegeri 5.2m, ca.1100kg

Large tooth erupts from peak of the curved lower mandible in male (see page 232). Females have a less curved mouthline. Gray to black in color, often with light patches on beak, head, and neck. Scarring throughout.

Stomachs of stranded individuals contained only squid. Some 41 records in deep Pacific waters, mostly off Alaska. Groups of 5–15 individuals have been recorded.



NORTHERN BOTTLENOSE WHALE Hyperoodon ampullatus § 9.0–9.5m, 10,000kg; § 8.0–8.5m, ca.7500kg

Large whale with a relatively small beak protruding from bulbous head. Dorsal fin is two-thirds of the way down the body. Dark gray to brownish body color. Forehead is most bulbous in the males, with two teeth pro-

truding from tip of lower jaw. Older males are pale gray or white on head and neck. Light crescent sometimes present on neck. No center notch in fluke. Small groups (up to 10) found in North Atlantic.



BAIRD'S BEAKED WHALE *Berardius bairdii* 10.7–12.8m, 6800–14,200kg

Large beaked whale with long narrow rostrum and a bulging forehead. Longer beak and smaller forehead than in the Bottlenose Whale. Males have a more bulbous head and teeth erupting from tip of lower jaw. Gray

body marked with white spots on underside and scars throughout. Small dorsal fin located far back on tail stock. Center fluke notch is small or absent. Capable of diving to 1000m and staying down for 2 hours. Groups of 3–30 in Pacific Ocean.



CUVIER'S BEAKED WHALE Ziphius cavirostris 5.1-6.9m, ca.2500kg

Robust, cigar-shaped whale with a short, poorly defined beak marked with two small teeth at the tip in males. Teeth sometimes covered in barnacles. Mouthline is short and upturned. Color varies from rust brown to slate gray, belly is usually lighter. Has scarring throughout. The head of

males grows whiter with age. No medial notch in fluke. Small dorsal fin about two-thirds of the way back from snout. Common and widespread in both oceans, but rarely seen.





PLATE 110 Heads of Male Mesoplodon

HEADS OF MALE *MESOPLODON* – All these whales have similar body shape (see page 230) and are distinguished mainly by the jaw and tooth morphology of males. Body coloration is variable in most species.



SOWERBY'S BEAKED WHALE *Mesoplodon bidens* 4.5–5.5m, *ca*.1000kg

Tooth erupts from middle of a long strait beak. Large hump in front of blowhole. Body is darker above, lighter below, with limited scarring. Swims alone or in pairs in North Atlantic.

STEJNEGER'S BEAKED WHALE Mesoplodon stejnegeri

Broad tooth erupts from peak of the curved lower mandible. Gently sloping head often marked in white (see more on page 230).

TRUE'S BEAKED WHALE Mesoplodon mirus

Small tooth erupts from the front of beak. Dark patch around eye (see more on page 230).



GINKGO-TOOTHED BEAKED WHALE Mesoplodon ginkgodens 4.7–4.9m, ca.1500kg

Broad tooth erupts from middle of arched lower jaw. Dark body with little scarring. White spots on belly. Known from a handful of strandings in Pacific.



GERVAIS' BEAKED WHALE *Mesoplodon europaeus* 4.5–5.2m, *ca*.1200kg

Triangular tooth erupts about 10cm from tip of a relatively straight lower jaw. Scarred body is dark above and white below. Rare in Atlantic and Caribbean.



BLAINVILLE'S BEAKED WHALE *Mesoplodon densirostris* 4.7m, *ca*.1000kg

Large teeth tilt forward as they emerge from a hump on the lower mandible. Teeth may be covered with barnacles. Has the most curved mouthline of the genus. Dark body is covered with white splotches.



HECTOR'S BEAKED WHALE Mesoplodon perrini 4.3m, ca.1500kg

Triangular teeth located 2cm from tip of straight lower jaw. Gray body darker on back and lighter on belly. Typically found in the southern hemisphere, five strandings have been recorded off southern California.



HUBBS' BEAKED WHALE Mesoplodon carlhubbsi 5.3m, ca.1400kg

Male has a white cap around blowhole and a massive tooth extending from middle of a flat lower mandible. Strongly arched mouthline caused by raised gum tissue around tooth. Beak usually white. Body of male is dark gray; female is lighter. Found along our western coast.

PYGMY BEAKED WHALE Mesoplodon peruvianus 3.4-3.7m, weight unknown

Small, dark-colored whale with a tiny tooth that does not protrude above mouthline. This tropical species is known from only one specimen in North America, although there have been recent sightings off California.

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PLATES 111 AND 112 WHALE AND DOLPHIN DIVE SEQUENCES (not to scale) BELUGA NARWHAL LONG-FINNED PILOT WHALE COMMON MINKE WHALE SEI WHALE BRYDE'S WHALE GRAY WHALE BAIRD'S BEAKED WHALE SPERM WHALE NORTHERN BOTTLENOSE WHALE





PLATE 113 Carnivore Scats



WOLF one-quarter size

COYOTE one-quarter size



-SOL

BOBCAT one-quarter size



RED AND GRAY FOX three-quarters size





PLATE 114 Vegetarian Scats

AMERICAN BISON one-quarter size



MOOSE half size





ELK one-quarter size



CARIBOU one-quarter size





MOUNTAIN GOAT half size

WHITE-TAILED DEER three-quarters size

AMERICAN BEAVER three-quarters size



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PIKA actual size



GROUND SQUIRREL three-quarters size



CHIPMUNK actual size



TREE SQUIRREL actual size



MOUSE, VOLE AND SHREW actual size



WOODRAT half size



NORTH AMERICAN PORCUPINE three-quarters size



BAT half size

and the second

GLOSSARY

Annulation	A ringlike structure or segment.
Antitragus	A flap on the lower posterior portion of the ear, opposite the tragus.
Baculum	Os penis or penis bone.
Baubelum	Os clitoris or clitoral bone.
Calcar	A spur or spurlike projection from the ankle of a bat.
Crepuscular	Active at dusk and dawn.
Cusp	A pointed or rounded projection on the chewing surface of a tooth.
Dichotomous	Dividing into two parts or classifications.
Distal	Anatomically located farthest from the middle.
Dorsal	On, in, or near the back or upper surface.
Dorsum	The back.
Ecotone	Transitional zone between two ecological communities.
Facial vibrissae	Whiskers, or stiff hairs on the snout or brow of most mammals.
Fluke	Either of the two horizontally flattened halves of the tail of a whale.
Foramina	Openings or orifices, in a bone (singular: foramen).
Forbs	Broad-leaved herbs other than grasses.
Fulvous	Tawny; dull yellow, with a mixture of gray and brown.
Fuscous	Dark brownish gray in color.
Guard hairs	Longer, stiffer hairs that extend beyond the fur.
Hibernacula	The shelters of hibernating animals (singular: hibernaculum).
Humic	Of, relating to, or derived from humus.
Interfemoral membrane	Uropatagium, or tail membrane of a bat.
Lagomorph	Member of the order Lagomorpha, including rab- bits, hares, and pikas.
Malar	Relating to the zygomatic bone or the cheek.
Mammae	Milk-producing organ of female mammals; mammary glands.
Melanistic	Darker coloration of the skin, hair, or fur.

Nose leaf	A thin, broad, membranous fold of skin on the nose of many species of bats.
Papilla(e)	A small protuberance on the skin, base of a tooth, or on the top of the tongue.
Pelage	The coat of a mammal, consisting of hair, fur, or wool.
Pelagic	Living in open oceans or seas.
Pinna(e)	The largely cartilaginous projecting portion of the ear.
Plantar tubercles	Knoblike bumps on the soles of the feet.
Post-mandibular	Behind the main bone of the mandibles.
Post-orbital process	Projection on skull, just behind the eye sockets.
Premolars	Teeth between the canines and molars.
Procumbent	To protrude, bend, or lean forward.
Proximate	Anatomically located closest to the middle.
Riparian	Relating to the banks of a natural course of water.
Rostrum	Snout; the long, projecting nose of a mammal.
Rugose	Having many wrinkles or creases; ridged or wrinkled.
Sagittal crest	Raised surface in midline of skull where parietal bones meet.
Semi-palmated	Having the distal portion broad, flat, and lobed.
Septum	A wall separating two cavities as, the nasal septum.
Sphagnum	Mosses of the genus <i>Sphagnum</i> whose decomposed remains form peat.
Sphenoidal fissure	Long narrow opening in the bone situated at the base of the skull.
Suture	The line of junction between two bones, especially of the skull.
Tail stock	Base of the tail of a whale or dolphin.
Tine	A branch of a deer's antlers.
Tragus	The prominence in front of the external opening of the ear.
Venter	The belly, or underside of the body between the thorax and the pelvis.
Ventral	On or near the belly.
Unicuspid	A tooth having only one cusp.
Zygoma	The jugal, malar, or cheek bone.
Zygomatic arch	Arch formed between the cheekbone and the temple bone.

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Coyote Front L 5.7-8.9 W 3.8-7.3 Hind L 5.4-8.3 W 2.9-6.0



Kit and Swift Fox Front L 4.3 W 3.8 Hind L 3.3 W 3.0



Wolf Front L 9.8–14.0 W 6.0–12.7 Hind L 7.9–11.4 W 5.7–10.8



Domestic Dog Front L 8.9 W 7.6 Hind L 10.2 W 9.5



Arctic Fox

Front L 5.7 W 5.4 Hind L 5.4 W 4.8





Grav Fox Front L 3.2–4.8 W 3.5–5.1 Hind L 2.5–4.4 W 3.2–4.4

Domestic Cat Front L 3.8 W 3.4 Hind L 2.9–4.8 W 3.4–4.8

Cougar Front L 7.6–10.8 W 8.3–12.1 Hind L 7.6–8.3 W 8.4



Ocelot Front L 4.1-5.1 W 5.1-5.9 Hind L 4.8-5.1 W 4.1-6.3

Red Fox Front L 5.4–7.3 W 4.1–5.4 Hind L 4.4–6.3 W 3.8–4.8

Jaguarundi Front L 3.6–4.1 W 3.4–3.6 Hind L 2.8–3.8 W 2.5–3.2



Canadian Lynx Front L 8.3-10.2 W 7.6-9.7 Hind L 8.3-9.5 W 7.6-10.4

Bobcat Front L 4.8-6.3 W 3.8-6.7 Hind L 4.8-6.3 W 3.8-6.7



Raccoon Front L 5.1–7.6 W 4.8–6.3 Hind L 5.9–10.2 W 5.8–6.3





Ringtail Front L 2.5 W 4.6 Hind L 2.5–2.9 W 2.5



Coati Front L 6.1 W 4.6 Hind L 7.1 W 4.6

Jaguar Front L 9.4 W 12.1 Hind L 9.7 W 7.6

Track measurements in cm L = length, and W = width



Black Bear Front L 12.7–15.9 W 9.5–14.0 Hind L 15.2–19.7 W 8.9–14.0



Wolverine Front L 9.4–19.0 W 9.7 Hind L 8.9–10.2 W 8.9



Fisher Front L 5.4–9.8 W 5.4-8.3 Hind L 5.4–7.6 W 5.1–7.6



Mink Front L 4.3 W 4.6 Hind L 4.6 W 4.8



Spotted Skunk Front L 2.3–3.4 W 2.5 Hind L 3.2 W 2.3–2.5



Brown Bear Front L 17.8–22.9 W 12.7–22.9 Hind L 24.8–40.6 W 14.0–26.7



River Otter Front L 6.3–8.3 W 4.8–7.6 Hind L 7.6–10.2 W 5.7–9.1



American Badger Front L 6.3 W 5.1 Hind L 4.4–5.1 W 4.4



Long-tailed Weasel Combined L 1.6-3.7 W 1.9-3.0

Black-footed Ferret Front L 3.0 W 3.3 Hind L 3.3 W 3.3



Least Weasel Combined L 0.8-1.6 W 1.0-1.4



Hog-nosed Skunk Front L 4.5 W 4.5 Hind L 4.9 W 2.4

Artists: Susan C. Morse and Jesse Guertin



Ermine Combined

L 1.1-1.6

W 1.1-2.2







Striped Skunk Front L 3.8–5.7 W 2.5–3.2 Hind L 4.4–5.1 W 2.5–3.6



Polar Bear Front L 30.5 W 22.9 Hind L 29.2 W 20.3



American Marten L 4.1-6.7 W 3.8-6.7



Collared Peccary Front L 4.6 W 4.1 Hind L 4.1 W 3.8



Mule Deer Front L 5.9–8.3 W 6.6–6.7 Hind L 7.9 W 6.3



White-tailed Deer Combined L 3.2–8.9 W 3.4–7.3



Elk Combined L 7.9–12.4 W 7.9–11.7



Moose Combined L 10.2-17.5 W 8.9-14.0



Caribou Combined 7.6-12.1 W 11.4-14.6



Pronghorn Combined 4.1 W 7.0



Bison Front L 8.9 W 17.1 Hind L 10.2–14.6 W 10.2–14.6



Muskox Front L 11.0 W 12.7 Hind L 10.2 W 12.7



 Mountain Goat

 Front L 7.6 W 4.8

 Hind L 6.6 W 3.8



Bighorn Sheep Combined L 4.4–8.9 W 3.8–6.3



Dall's Sheep L 4.4-8.9 W 3.8-6.3



Mountain Beaver Front L 3.0 W 4.6 Hind L 4.6 W 2.3



Coypu Front L 6.0 W 6.0 Hind L 12.0 W 7.0



American Beaver Front L 7.3–9.8 W 7.0–8.9 Hind L 12.7–17.8 W 8.3–13.3

Woodchuck/Marmot Front L 4.8-7.0 W 2.5-5.1 Hind L 4.8-7.0 W 3.4-5.1

Track measurements in cm L = length, and W = width


Ground Squirrel Front L 1.6 W 1.3 Hind L 2.5 W 1.9



Gray Squirrel Front L 4.1 W 2.5 Hind L 6.6 W 2.5-4.4



Jumping Mouse Front L 1.0 W 0.63 Hind L 2.5 W 0.63



Prairie Dog Front L 2.5 W 2.0 Hind L 2.5 W 2.3



Eastern Chipmunk Front L 2.2–2.5 W 0.95–2.1 Hind L 1.3–1.9 W 1.6–2.4



Red Squirrel Front L 3.0 W 1.9 Hind L 4.4-6.3 W 4.4-7.3



Kangaroo Rat Front L 2.5 W 2.8 Hind L 3.8 W 1.3



Deer Mouse Front L 0.63 W 0.63 Hind L 0.83 W 1.3







Snowshoe Hare Front L 4.4 W 3.8 Hind L 11.4–12.7 W 9.5–11.4



Virginia Opossum Front L 3.8–5.4 W 4.4–6.0 Hind L 4.4–6.3 W 4.4–7.3



Nine-banded Armadillo Front L-4.6 W 3.6 Hind L 5.6 W 4.1



Sorex Shrews Front L 0.63 W 0.51 Hind L 0.76 W 0.51

Artists: Susan C. Morse and Jesse Guertin



 Porcupine

 Front L
 5.7-8.4
 W
 3.2-4.8

 Hind L
 6.3-9.8
 W
 3.8-5.1