Voles and Deermice

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Mouse, deermouse, harvest mouse, grasshopper mouse, pygmy mouse, pocket mouse, jumping mouse, rat, rice rat, cotton rat, woodrat, kangaroo rat, vole, lemming, gopher, mole, shrew. These are all accepted common names for major groups of relatively small North American mammals in the two orders Rodentia (mice through gophers) and Insectivora (moles and shrews). I suspect there is a fair amount of confusion among birders regarding proper names for the various furry creatures we see in the field. Throw in the fact that these names are improperly used, misnomers and additional slang words may be standard in local usage, and it gets worse. "Moles" are called "voles," "mice" are called "voles" and "rats." And on and on.

Identification of these small creatures is not easy. They are difficult to see well because they are often in hiding, only come out at night, move quickly, stay in plain view only briefly, and/or those that stay put tend to be altered by exposure to vehicle tires. Many look a lot alike. Dentition is a useful identification tool but how often do they open their mouths for inspection? Handling specimens is often not a good idea because of fleas, diseases, and potential bites.

While putting a correct name on these creatures might be important for mammologists, naturalists, and some birders, birds literally cut to the chase. For a wide variety of birds they are staples or at least opportunistic nourishment. Their name really does not matter to a bird.

Covering all groups mentioned above would require a mini-book. Because of their abundance in Colorado and resultant importance to predaceous birds, this installment will feature two groups, both in the family Muridae: the voles (subfamily Arvicolinae) and deermice (formerly "deer mice," New World subfamily Sigmodontinae). Note that both scientific and standardized English common names are in a state of constant flux. Those used in this article are from the Kaufman Guide *Mammals of North America* (Bowers et al. 2004), which conforms to *Common Names of Mammals of the World* (Wilson and Cole 2000).

As justification for this focus and exclusion of the others, the following very general, maybe too general, statements are offered:

- "Mice," various murid genera, are mostly associated with human dwellings and, thus, mostly inside and unavailable to wild birds.
- "Harvest mice," murid genus *Reithrodontomys*, a couple of spe-

cies common in Colorado, but probably because of identification issues, not a lot about their use by birds is published.

- "Grasshopper mice," murid genus *Onychomys*, only one widespread species in Colorado, not a lot of specifics available about bird usage.
- "Pygmy mouse," murid genus *Baiomys*, no representatives here although they occur within 160 km of southeastern Baca County.
- "Pocket mouse," murid genus *Perognathus*, four species in Colorado, mostly in burrows during the day, thus, primarily only available to owls.
- "Jumping mouse," murid genus *Zapus*, two species in Colorado, mostly nocturnal, some exhibit hibernations lasting six months.
- "Rat," members in murid Old World subfamily Murinae (i.e., introduced from Europe and Asia), mostly associated with human structures, most common in bigger cities and towns.
- "Rice rat," murid genus *Oryzomys*, not present in Colorado.
- "Cotton rat," murid genus *Sigmodon*, one species, hispid cotton rat (*S. hispidus*), common in eastern Colorado, not a lot known about use by birds, probably due to resemblance to voles. Quite common in certain years and, in truth, may be a major menu item for large hawks and owls in that area (Figure 1).
- "Woodrat," murid genus *Neotoma*, at least six species in Colorado, perhaps worthy of separate treatment in a future column due to their importance to a very rare, special Colorado bird, the Mexican subspecies of Spotted Owl.
- "Kangaroo rat," family Heteromyidae, one abundant, mostly nocturnal species in arid habitats in Colorado.
- "Lemming," various murid genera, none known to be present in Colorado, but the southern bog lemming (*Synaptomys cooperi*) has been found as near as 25 km east of our northeastern border in Dundy County, Nebraska. Other lemming species, however, are definitely connected to the occasional appearance in our state by Snowy Owl.
- "Gopher," at least five species in three genera in the family Geomyidae in Colora-

Figure 1. Hispid cotton rat (Sigmodon hispidus) in the talons of an immature Red-tailed Hawk found dead by Norma Verhoeff on their farm in Bent County just east of John Martin Reservoir, winter 2016–2017. Photo by Dave Leatherman

do, mostly subterranean activity, only rarely forsaking their careers as plant root eaters to come to the surface where they would be exposed to bird predation.

- "Mole," family Talpidae, not a rodent but due to a name confusingly similar to "vole," these sets of creatures are, well, confused by humans for each other. Only one species in the Julesburg area of extreme northeastern Colorado, mostly subterranean, not likely prey for birds.
- "Shrew," family Soricidae, voracious insectivores often confused with mice and other small rodents, mostly in leaf litter or underground, may be available to diurnal predators like birds on occasion when, in their metabolism-driven frenzy for food, they run in the open between hiding places. For example, in January 2017 I saw a shrew, species undetermined, tippy hopping over snow by the south side of John Martin Reservoir dam (Bent County). If I, possessed of fused-vertebrae wannabes, could get a plastic food container over it, certainly a shrike or kestrel could have turned a similar opportunity into an easy snack.

So, voles and deermice are our subjects here.

What is an easy way to tell them apart? Voles are chunky-bodied, have small ears, smallish eyes, and short, relatively thick tails. Deermice (this combination word is more proper than "deer mice") have big (think "church" or "Mighty" mouse) ears, big eyes, and long, thin tails (see Figures 2 and 3). If you see a rodent well enough to determine it has a mix of these characters (little ears–long tail or big ears–short tail) it probably belongs to one of the groups mentioned in passing earlier (harvest mice, for example, which have little ears and long tails).

Voles

Our eight species of Colorado voles belong to four genera: *Microtus*, *Clethrionomys*, *Phenacomys*, and *Lemmiscus*. They can be abundant and active at any time of the day or night. Some vole species maintain fairly even populations through the year, some experience one to a few cycles during a given year corresponding to brood production periods, and still others characteristically show big swings in population at multi-year intervals. One species, long-tailed vole, can achieve population densities as high as 50 individuals per acre (an acre is about equal to a football field) (Conley 1976). That is a lot of rodents, and perhaps explains the amazing numbers of red-tails and other buteos sitting on poles in winter along some of our major highways paralleling river systems (US 50 from Pueblo to Holly along the Arkansas River, for example).

Their prolific reproductive capacity can result under the right

Figure 2, above left. Vole briefly showing itself along Buffam Creek at Bobcat Ridge Natural Area near Masonville, CO, winter 2015–2016. Photo by Carl Manderbach

Figure 3, above right. Peromyscus sp., probably North American, found dead November 2009 on bike trail along Poudre River in Fort Collins, CO. Note big ears and long tail typical of this genus, and unlike that of a vole. Photo by Dave Leatherman

conditions in a new brood *every three weeks*, with the young of certain vole species being able to breed after just six weeks! If you want to engage in a sadistic math exercise, consider the following. In the meadow vole, litter size varies from 1 to 11, with 4–6 being average. See if you can figure out how many voles could directly and indirectly descend from just one adult female in a year, assuming her average brood size is 6 and half her initial litter is female. I cannot. Regardless of your aptitude with numbers, it is easy to see how these factors can result in boom cycles and how voles could be quite important in the diets of many meat-eating birds.

Figure 6. Female American Kestrel with vole. Note the stocky body and short tail that distinguishes this as a vole vs. our other small, prairie rodents. Lower Latham Reservoir (Weld County), CO, late January 2011. Photo by Tom France

Unlike deermice, voles are strictly herbivorous and prefer green vegetation. At times they cause considerable injury to trees, particularly cultivated seedlings in nurseries, by gnawing basal trunk bark under the safety of leaf litter or snow (Figure 4). They spend the great majority of their time in burrows and runways constructed at or just below the plant litter–soil interface, which may explain the reduced size of their ears and eyes. Burrows and runways, like our human abodes and road systems, can lead to predictability. Accounts of birds that eat these rodents frequently mention considerable time being spent watching hole entrances and pathways. Human strategies for reducing pest populations of these creatures often involve placement of traps and poison baits in these same locations. Not all voles make pathways. The pathways of vole species that do are often conspicuous following snow melt in spring (see Figure 5).

Figure 4 (facing page, bottom left). Evidence of fresh (brown areas) vole (probably long-tailed or montane) feeding on aspen bark above the normal snowline. Older feeding areas below the snowline (solid gray) at bottom of photo. Northwest of Dolores, CO. Photo by Dave Leatherman

Figure 5 (facing page, bottom right). Vole runway in the grass, revealed after snowmelt. Grandview Cemetery, Fort Collins, CO. Photo by Dave Leatherman

The meadow vole (*M. pennsylvanicus*) is a very important vole species when it comes to bird diets. Its three subspecies occur in various habitats from the high mountains to the plains (Fitzgerald et al. 1994). Interestingly, besides hawks, falcons, and owls, it is occasionally eaten by American Bittern (Lowther et al. 2009). In my experience, grasshoppers and crickets dominate the summer diet of American Kestrels, while voles are their favorite food in winter (Figure 6).

The southern red-backed vole (*C. gapperi*) is notable for its association with wet, conifer forests, for readily climbing trees, and for being a key element of Boreal Owl diets (Hayward et al. 1987). In Colorado on Cameron Pass, one of the late Dr. Ron Ryder's graduate students, my friend Dave Palmer, found 54% of 72 prey items were red-backed voles and 25% other *Microtus* voles (Palmer 1986). This owl catches both voles and deermice. The latter are eaten whole, the former gradually, not necessarily all in one meal, starting with the brain (Norberg 1970). Voles are sometimes cached, either at roosts or at nests, depending on the season. At nest cavities, this is done immediately prior to nesting and during nesting (rare by the third week of nesting) (Korpimaki 1987, Norberg 1987, Schwerdtfeger 1988). At roosts this usually involves laying prey on spruce or fir foliage or in branch forks, both within a few meters of a perch (Hayward and Hayward 1993). In addition to simply pouncing directly on observed prey, Boreal Owls can capture rodents under the snow surface (plunge diving) or those obscured by vegetation. Execution of these feats is attributed to the extreme asymmetry of its skull (Norberg 1987).

Heather vole (*P. intermedius*) occurs in our mountains from 7,000 feet elevation to above timberline. Being mostly nocturnal (McAllister and Hoffman 1988), it is probably more important to owls than to diurnal raptors. An Ontario study measured its importance in diets as follows (from most to least): Short-eared Owl, Snowy Owl, Northern Hawk Owl, and Rough-legged Hawk (Foster 1961). Its "unwariness" is considered a factor in its vulnerability to predation (Foster 1961, Banfield 1974).

Long-tailed vole (*M. longicaudus*) occupies the western half of the state and is particularly common in montane aspen stands. This is an atypical vole with a tail greater than one-third the total length of the head and body. It is part of the diets of several hawks and owls (Smolen and Keller 1987), including Barn Owl (Maser and Brodie 1966, Roth and Powers 1979), Great Horned Owl (Maser and Brodie 1966, Seidensticker 1968), Long-eared Owl (Maser and Brodie 1966), and Short-eared Owl (Fitzner 1975).

The range of the Mogollon (or Mexican) vole (*M. mongollonensis* [formerly *M. mexicanus*]) barely reaches northward into extreme

southern Colorado near Mesa Verde National Park and in the San Luis Valley. Little is known about its avian predators. It occurs in a variety of forest and shrub habitats.

Montane vole (*M. montanus*) is found mostly in our mountains, particularly aspen areas. Avian predators include American Kestrel, Swainson's Hawk, Red-tailed Hawk, and Great Horned Owl (Jannett 1984). An Idaho study found montane voles to constitute 28–80% of Great Horned Owl diets (Marti and Kochert 1996). In Oregon the figure for a particular research project was 38% (Brodie and Maser 1967). No doubt the true roster of its bird predators is considerably longer (Maser et al. 1971, Negus et al. 1986) (Figure 7).

Figure 7. Northern Pygmy-Owl with a vole. Summer 2015, Estes Park, CO. Photo by Scott Rashid

Meadow vole (*M. pennsylvanicus*) has been dubbed the most prolific mammal on Earth (Bowers et al. 2004). It is widespread and the subject of much research. In Colorado it occurs in a broad north–south swath down the Front Range (including a population that extends westward into the San Luis Valley) and out the Platte River drainage. Interestingly a small population of the subspecies *M. p. finitis* is found near the Republican River in Yuma County. It prefers moist habitats with lush vegetation. Within areas that are generally dry, it occupies riparian corridors. Per the math assignment handed out earlier, they can be subject to impressive population surges. They serve as important staples for many land predators including most hawks, falcons, and owls with which they share ecosystems. Even American Bittern diets can be up to 10% meadow voles (Cottam and Uhler 1945, Madison 1978, Reich 1981, Lowther et al. 2009).

Prairie vole (*M. ochrogaster*) is a flatland species occupying broad sections of the northeastern and southeastern Colorado plains (Fitzgerald et al. 1994). A summary for this species states that "nearly every predator sympatric with *M. ochrogaster* has been reported to eat this vole" (Errington 1936, Kirkpatrick and Conway 1947, Martin 1956, Stalling 1990). Included in the list are most of the large owls, Northern Harrier, and Rough-legged Hawk.

Sagebrush vole (*Lemmiscus curtatus*), as its common name implies, is mostly found in sagebrush habitats in northwestern Colorado. One reference states that "owls are particularly successful" in feeding on this species (Carroll and Genoways 1980, Fitzgerald et al. 1994). Specific documentation exists for Short-eared Owl (Moore 1943, Long 1965, Hoffman et al. 1969), Burrowing Owl (Maser et al. 1971), Great Horned Owl (Maser et al. 1970, Long-eared Owl (Maser et al. 1970), and even Northern Pygmy-Owl (Maser et al. 1974). Of note, Loggerhead Shrike is also sometimes a predator on sagebrush voles (Moore 1953).

Collectively, it seems safe to say voles are of *major* importance to our hawks, owls, and falcons virtually statewide. Other birds that regularly eat voles include waders, roadrunner, large corvids, and shrikes.

In some cases, like a study of Great Blue Heron nestling diet in Idaho, it is not just a vole here, a vole there, it is a volume of voles. Like 24–40% of the prey volume delivered to young herons (Collazo 1979, Butler 1991). We have all seen Great Blue Herons standing in fields far from water. There may be several explanations for this, but one of them might well be, to paraphrase an old nut commercial, "Sometimes you feel like a vole, sometimes …."

Black-crowned Night-Herons can have diets that are 100% small mammals, almost certainly mostly made up of voles and deermice (Hothem et al. 2010). *Microtus* is mentioned in several diet analyses of nestlings.

If you guessed that Greater Roadrunners might eat small mammals, including our subjects here, you would be correct (Hughes 2011).

This installment has not said much about accipiter hawks, given that they are mostly bird-eaters. Apparently Northern Goshawks do not commonly take small rodents. Cooper's Hawk is known to occasionally take *Peromyscus* (Rosenfield 1988) and Sharp-shinned Hawk is known to take both *Microtus* and *Peromyscus* (Duncan 1980).

Vole and deermouse predation apparently is not typical of another common raptor in Colorado, Ferruginous Hawk (Bechard and Schmutz 1995).

Flammulated Owl: Taken collectively, these observations indicate Flammulated Owls rarely eat small vertebrate prey and then primarily during periods of environmental stress. Documentation of capturing and killing vertebrate prey, rather than simply scavenging, still is lacking. These observations also leave little doubt the owl is highly adapted as an insectivore. The possibility that Flammulated Owls may overwinter in northern areas by subsisting on vertebrates,

Figure 8. Northern Pygmy-Owl entering nest cavity in an aspen with a deermouse. Summer 2015, Estes Park, CO. Photo by Scott Rashid

however, cannot be completely discounted (Linkhart and McCallum 2013).

Deermice

Six species in the genus *Peromyscus* inhabit Colorado. As mentioned, this genus of rodent has broader food habits than *Microtus*. In addition to plant material, they also consume insects (especially during warm months), other arthropods, fungi, carrion, and bone. They have multiple broods per year, can be highly variable in color, and generally have large ears and long, thin, bi-colored tails (Figure 3).

From low perches at night, perhaps the Colorado raptor putting the biggest bullseye on deermice in Colorado is North-

Figure 9. Northern Saw-whet Owl nest box showing cached deermice. Newly hatched owls in lower right. Spring 2016, Estes Park, CO. Photo by Scott Rashid

ern Saw-whet Owl (Marks and Doremus 1988, Dinsmore and Clark 1991, Priestly et al. 2005, Rasmussen et al. 2008). Screech-owls, which can have as much as an 85% overlap in prey with saw-whets, also have deermice high on their menus (Hayward and Garton 1988). Individual Northern Pygmy-Owls in local areas exploit deermice, and are known to cache them in nest cavities/boxes (Figures 8 and 9).

Perhaps worthy of emphasis here is the role Flammulated Owl plays in deermouse predation. None to virtually none. While properly portrayed as moth eaters in most accounts, the myth of mice being a regular part of their diet persists. While they may occasionally eat vertebrate prey during times of extreme stress, and may rarely scavenge such fare, documentation of these phenomena is sorely lacking (Linkhart and McCallum 2013).

Brush deermouse (*P. boylii*) is distributed over two distinct areas of Colorado, the southeast and the southwest up to Grand Junction; it is absent in mountainous areas in between. They eat a lot of vegetable matter, including Gambel oak acorns, but as is typical of the genus, also eat a considerable number of insects. Not a lot is known about their life history, including predation by birds.

Canyon deermouse (*P. crinitus*) occurs along our entire western border with Utah. Properly named, it inhabits rocky canyons and is one of the few mammals found atop arid buttes within its range. "Hawks and owls" are mentioned as predators, along with predaceous mammals and snakes but no details are known (Johnson and Armstrong 1987, Fitzgerald et al. 1994. One could surmise when the ancient dwellings of Mesa Verde National Park host Mexican Spotted Owls, canyon mice are on their menu. In fact the Birds of North America account for spotted owl lists *Peromyscus* as comprising 30% of the diet of the Mexican subspecies (Gutierrez et al. 1995). Three other members of the genus, canyon mouse, *the* deer mouse, and pinyon mouse, also occur in Montezuma County.

Although widely studied in the East, the white-footed deermouse (*P. leucopus*) in Colorado has been largely ignored (Fitzgerald et al. 1994). Its range is confined to the southeastern part of the state. No doubt this rodent is food for screech-owls, saw-whets that winter at low elevation within its range, larger owls, falcons, and hawks.

I once pulled a big sheet of bark from a cottonwood log lying in the dump area of Salida's Fairview Cemetery. Instead of the insects I sought, my gaze was met with those of a North American deermouse family (*P. maniculatus*). Of course, my camera was in the car. And, of course, they were gone after I returned with a camera. This mighty mite of many colors (their fur ranges from gray-brown to ru-

fous orange to pale buff) is found in all Colorado counties. It has been described as "surely the most common mammal in Colorado" (Fitzgerald et al. 1994). It has a broad diet and is widely utilized by hawks, owls, and probably most of the other rodentiphagous birds mentioned in this account (Figures 8 and 9).

The distribution of the northern rock deermouse (*P. nasutus*) is centered over most of New Mexico. The Colorado portion forms an "L" with the vertical portion running up the Front Range and the horizontal leg running along our southern border with New Mexico, from Trinidad east to southwestern Baca County. It is associated with cliffs and rock outcrops. I could find little regarding its use by birds, but its habitat preferences and range seem to put it squarely in contact with roadrunners in addition to cliff-frequenting hawks, falcons, and owls.

The last member of this genus is the pinyon deermouse (*P. truei*). Its distribution is very similar to that of the brush mouse (i.e., southeast and southwest). Unlike the brush mouse, along the western border its range extends about as far north as just below the Wyoming line. It is almost always found in pinyon-juniper habitat and relies a great deal on junipers for food, mostly berries and male flowers. No mention of predators, although one could assume from its habitat that owls, kestrels, and both shrikes would be likely threats. In the southeastern part of the state, roadrunners would also seem to be an occasional issue for this rodent.

Summary

Of the roughly 79 species of rodents and shrews/moles found in Colorado, the great majority of them, in terms of numbers of prey items taken by birds and other predators, come from the 14 species we call a "vole" or "deermouse" (Fitzgerald 2004). I suspect largely because of negatives generated by house mice and Norway rats living inside with us (or comments by our parents), a great majority of humans detest and/or fear all rodents and little furry creatures. This is unfortunate, as their value within natural food chains is immense. Many of our most charismatic birds eat voles and deermice on a regular basis. Hopefully this article helps with general identification, documents which birds consume them, and more importantly, generates interest in the reader to learn more. A great starting reference is *Mammals of North America* by Nora and Rick Bowers and Kenn Kaufman. As always, I welcome reports, anecdotes, and photos on the subject or birds eating voles and deermice, or anything, for that matter.

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