Water Vole

Microtus richardsoni

REGULATORY STATUS

USFWS: No special status
USFS R2: Sensitive
USFS R4: No special status
Wyoming BLM: No special status
State of Wyoming: Nongame Wildlife

CONSERVATION RANKS

USFWS: No special status
WGFD: NSS3 (Bb), Tier II
WYNDD: G5, S1
Wyoming Contribution: HIGH
IUCN: Least Concern

STATUS AND RANK COMMENTS

As discussed below, the Water Vole (*Microtus richardsoni*) population on the Bighorn Mountains is isolated from adjacent populations, and thus may be treated as an independent element of biological diversity for some purposes. If treated as such, the Bighorn Mountain population of Water Vole would receive a higher degree of conservation concern than the full species – specifically, a Wyoming Contribution Rank of VERY HIGH.

NATURAL HISTORY

Taxonomy:

Historically, there was confusion regarding the separation of Water Vole in North America from its European counterpart, *Arvicola terrestris* [1, 2]. Genetic and morphological evidence has since confirmed the discrete taxonomic position of *Microtus* in general and *M. richardsoni* in particular, and Water Vole is currently considered a distinct and legitimate species. Four subspecies are currently recognized: *M. r. arvicoloides*, geographically isolated to the Cascade Mountains; and *M. r. richardsoni*, *M. r. macropus*, and *M. r. myllodontus*, collectively occupying the Northern and Central Rocky Mountains. Only *M. r. macropus* is known to inhabit Wyoming, with *M. r. myllodontus* approaching (but not known to enter) the southwestern corner of the state [2, 3]. Water Voles on the Bighorn Mountains are considered geographically isolated from neighboring populations on the Absaroka and Beartooth Mountains and likely represent a Pleistocene relict. The subspeciation of other small mammals (e.g., *Lepus americanus seclusus, Tamias minimus confinis, M. montanus zygomaticus*) on the Bighorn Mountains raises the possibility of similar divergence of Water Vole on the range, but this has not been formally evaluated [3-5].

Description:

Water Vole is notably larger than all other arvicoline rodents within its range, with the exception of Common Muskrat (*Ondatra zibethicus*). In most external aspects the species appears as a very

large and densely-furred version of other *Microtus*: dorsal pelage uniformly gray-brown to reddish brown and often darkened by black-tipped hairs, ventral pelage approaching silvery-gray or even white, total length 198–274 mm, tail 66–98 mm, hind foot 25–34 mm, and mass 85–120 g. Both sexes have large flank glands that become prominent during the breeding period. Adults can be distinguished from other *Microtus* by their large size and large hind feet (> 23 mm) [2, 3]. Juveniles may be confused with adults of other *Microtus*, but hind feet > 23 mm appears to be a distinguishing characteristic even for young animals. Detailed dentition patterns can be used to identify skulls to species [2, 6]. The number of plantar tubercules on the hind foot was previously thought useful for species identification, but was subsequently found to be unreliable [3, 7].

Distribution & Range:

This species occupies two discrete subranges: one on the Cascade Mountains from southwestern British Columbia south through Oregon, and another on the Rocky Mountains from central British Columbia and Alberta south through Idaho, western Montana, and western Wyoming to central Utah. Within this overall range the fine-scale distribution of Water Vole is highly discontinuous. As with other semi-aquatic mammals, population segments occur in small patches of suitable habitat along stream networks. Overland dispersal between close drainages is possible, but large upland expanses, sharp divides, and warm and arid basins separate otherwise nearby populations. Extensive forests are also barriers, as Water Vole strongly prefers riparian meadows over forested streamsides [2, 3, 8, 9]. In Wyoming, Water Vole occupies the western mountains and the Bighorn Mountains [3, 4]. A genetic study found no significant differentiation among Water Voles on the Beartooth Mountains, but also found that those populations were genetically distinct from populations near Togwotee Pass on the Absaroka Mountains [9]. Water Voles on the Bighorn Mountains have likely been isolated for many generations, with little to no interchange with populations on neighboring mountain ranges.

Habitat:

Water Vole is specialized to riparian meadows within the alpine and sub-alpine life zones. Preferred habitat is clear, low-gradient, gravel-bottomed streams (and occasionally ponds and marshes) bordered by alpine tundra or subalpine meadow. Occupied sites have heavy and extensive herbaceous cover, occasionally with some willow (*Salix* spp.) overstory [2, 3, 5, 10, 11]. A well-developed herbaceous layer may be especially important in suspending snow and providing a large subnivean space in which Water Vole lives in winter [5]. The species is almost never observed more than 17 m from open water, but it is assumed that dispersers may occasionally traverse uplands for short distances [2, 9]. Dispersers may also travel along forested stream segments in search of riparian meadows, but long forested reaches may be movement barriers. Moreover, downstream dispersal is naturally limited by elevation (presumably as a surrogate for suitable climatic conditions) – in the Bighorn Mountains, no Water Voles were captured below 2,440 m [3, 5], and the species was only captured in mountain big sagebrush (*Artemisia tridentata vaseyana*) and subalpine meadows. Within these habitats, sites with Water Vole captures tended to have higher thallophyte cover [7]. Like other *Microtus*, individual Water Voles construct and use extensive runway systems, including surface segments and sub-surface tunnels, in herbaceous vegetation. Unlike other *Microtus*, Water Vole runway systems frequently cross streams and incorporate the streams themselves as runway segments. The species swims well and often, and likely uses water to escape predators. Underground nests and resting chambers are dug periodically along runways and used year-round. Entrances to chambers and sub-surface tunnels are often placed in streambanks near or even below water level, and streambank stability has

been cited as an important habitat feature [3]. Runway systems are used and maintained under snow, which can persist for 7–8 months in Water Vole habitat [2].

Phenology:
Water Vole is active year-round. In Alberta, first pregnancies were recorded in late May and last pregnancies in early September. It is assumed that breeding start- and end-dates are modulated by snow depth and general climatic conditions. Gestation is about 22 days, and trappable young have been recorded in the first week of July. Litter size ranges from 2–10 and averages 5. Mature females can produce 2 litters in favorable years. Some individuals may breed in their first year, but most breed after their first winter [2, 12]. Early fall may be a critical period for Water Vole survival, as frozen ground prevents maintenance of sub-surface chambers and tunnels, stream ice obstructs swimming, and persistent insulating snow has yet to develop [8].

Diet:
The leaves and stems of forbs are the primary foods of Water Vole. Grasses, sedges, and willow bark are also frequently eaten, and seeds and insects are consumed as available. Rhizomes and other subterranean plant parts may be especially important winter foods. Water Vole is not known to store food for the winter [2].

CONSERVATION CONCERNS

Abundance:
Continental: WIDESPREAD BUT DISJUNCT
Wyoming: UNCOMMON
There are no population estimates of Water Vole for Wyoming or adjacent regions. The UNCOMMON abundance at the state scale is inferred from the small portion of the state encompassed by the species' range and the sparse and discontinuous pattern of suitable habitat within that range. Populations fluctuate dramatically between seasons and years. Precipitation and population size are positively correlated, but the mechanism behind this effect is unclear [3]. As discussed above, Water Voles on the Bighorn Mountains are completely isolated from adjacent populations, and thus are of special concern. If treated as an independent element of biological diversity, the Bighorn Mountain population of Water Vole would receive a RARE or VERY RARE statewide abundance rank. Water Vole was captured on 71% of apparently-suitable stream segments in the Beartooth Mountains, but only on 33% of apparently-suitable stream segments in the Bighorn Mountains [5, 11]. More recently, Water Vole was captured at only 4 of 22 sites surveyed in the Bighorn Mountains, and no individuals were detected below 44.6° latitude despite historic records [7]. Furthermore, sign (e.g., scat, runways, tunnels) of Water Vole was evident at occupied sites on the Beartooth Mountains, but not at occupied sites on the Bighorn Mountains, possibly because abundances on the latter range were lower [3].

Population Trends:
Historic: UNKNOWN
Recent: UNKNOWN
Historic and recent population trends of Water Vole in Wyoming are unknown.

Intrinsic Vulnerability:
HIGH VULNERABILITY
Water Vole is a habitat specialist restricted to harsh high-elevation environments known to be sensitive to disturbance, slow to recover following disturbance, and likely to change rapidly as a

result of climate change. Additionally, Water Vole populations are naturally fragmented into small local segments that are restricted to high headwater basins and connected by only infrequent inter-basin dispersal [8]. Local population segments undergo dramatic annual and seasonal fluctuations [2, 5, 12]. In one study, 89% of captured adults disappeared by the end of September each year, suggesting that local extirpations may be frequent. Also, reproductive output is lower than expected for a rodent of this size [8, 12].

Extrinsic Stressors:

MODERATELY STRESSED

On both the Beartooth and Bighorn Mountains, Water Vole was less common in sites grazed by livestock than in ungrazed sites – thus, livestock grazing is commonly cited as a threat [4, 5, 10, 11]. It is assumed that grazing by native ungulates (e.g., *Cervus elaphus*) adds to an overall grazing effect on Water Vole habitat. Other activities that compact streamside soils and break down stream banks, such as road building and motorized recreation, may also threaten some populations [3]. However, much Water Vole habitat in the state exists within federally-designated Wilderness, which receives far less livestock grazing and vehicle pressure than non-Wilderness lands. Projected effects of climate change on subalpine and alpine systems, including the upwards migration of forests, reduced snowpack, and lower late summer stream flows, are likely long-term threats to Water Vole.

KEY ACTIVITIES IN WYOMING

In 2014 the Wyoming Game and Fish Department (WGFD) began cooperating with the Bighorn National Forest to survey Water Voles there, with a main goal of measuring occupation at previously occupied sites [7]. This work will continue in 2016 as a collaboration between WGFD, Bighorn National Forest, and the Wyoming Natural Diversity Database (WYNDD). Prior to this effort, the work by Klaus represented the latest investigations of Water Vole in the state, specifically on the Bighorn [5], Beartooth, and Absaroka Mountains [10].

ECOLOGICAL INFORMATION NEEDS

Coarse-scale distribution within Wyoming is known with some confidence, as are general habitat needs. Priority information needs now include a finer-scale knowledge of distribution, perhaps with attention to southern mountain ranges (e.g., Wind River, Gros Ventre, Wyoming Ranges), and information on Water Vole responses to specific characteristics of vegetation, soil, and stream channels that are known to be affected by livestock grazing. Additionally, a better understanding of whether and to what extent beavers (*Castor canadensis*) create habitat would be beneficial to habitat management and restoration projects. A formal monitoring program, possibly based on occupancy modeling across a sample of stream segments that represent the full range of the species in the state, would inform managers of range-wide population trends. Also, a modern genetic investigation could elucidate the extent to which Bighorn Mountain Water Vole has diverged from adjacent populations.

MANAGEMENT IN WYOMING

This section authored solely by WGFD; Nichole L. Bjornlie. Recent management activities for Water Vole in Wyoming have included developing a better understanding of distribution and habitat use, especially in the isolated Bighorn Mountains. Moving forward, priorities will expand to include evaluating the impact of external stressors, especially grazing, and developing a monitoring protocol for the Bighorn Mountains in collaboration with the U.S. Forest Service and

WYNDD. During this effort, field personnel will collect genetic samples from all captured individuals, both in the Bighorn Mountains as well as other sites throughout the western mountains, that will be stored for future genetic analyses to elucidate if and to what degree individuals from the Bighorn Mountains have diverged from other, geographically connected populations.

CONTRIBUTORS

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Figure 1: Adult Water Vole photographed along a subalpine meadow stream in the Bighorn Mountains in Sheridan County, Wyoming. (Photo courtesy of Brian Zinke)

Figure 2: North American range of *Microtus richardsoni*. (Map from: Patterson, B. D., et al. (2007) Digital Distribution Maps of the Mammals of the Western Hemisphere, version 3.0, NatureServe, Arlington, Virginia.)

Figure 3: Water Vole habitat in a subalpine meadow in the Bighorn Mountains in Sheridan County, Wyoming. (Photo courtesy of Brian Zinke)

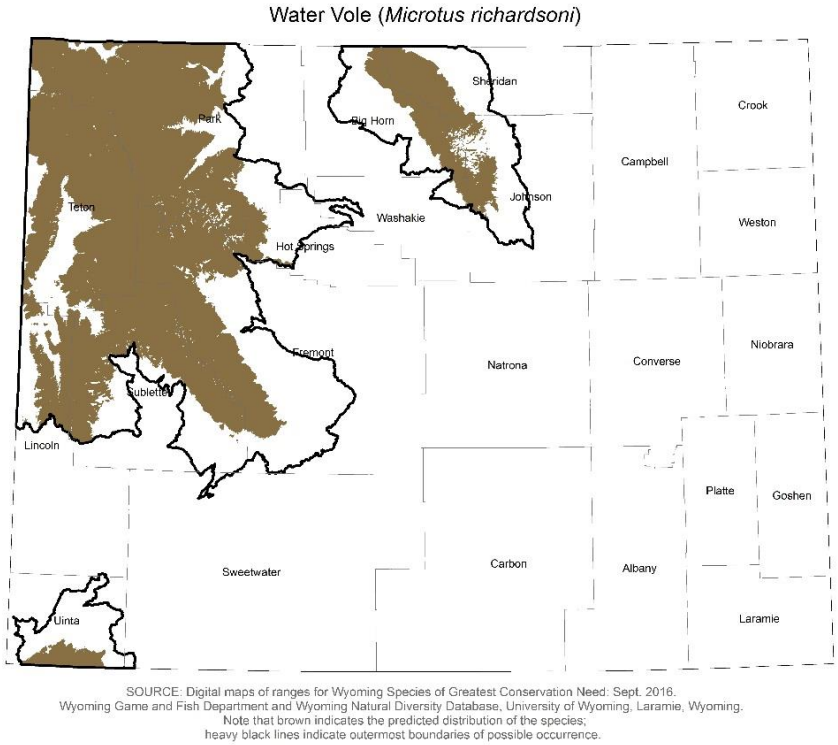

Figure 4: Range and predicted distribution of *Microtus richardsoni* in Wyoming.