

## Recent Records and Range Expansion of *Erethizon dorsatum* (North American Porcupine) in Virginia

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**Abstract** - Although *Erethizon dorsatum* (North American Porcupine, hereafter Porcupine), occurred in Virginia during the Pleistocene and into the 1700s, this species was probably extirpated from the state by the mid-1800s. Here we document recent evidence of Porcupines in Virginia from verified photographs submitted to the Virginia Department of Game and Inland Fisheries and voucher specimens deposited into the Mammal Collection of the Virginia Museum of Natural History. These recently collected and observed Porcupines are likely dispersers from expanding Porcupine populations in western Maryland and eastern West Virginia. This report includes evidence of reproduction in Virginia populations (or nearby populations in West Virginia) and provides a foundation for future investigations into the distribution and abundance of the Porcupine in Virginia.

The extant distribution of *Erethizon dorsatum* (L.) (North American Porcupine, hereafter Porcupine) includes much of western and northern North America (Roze and Ilse 2003). During the late 1900s in the eastern United States, resident populations were reported only as far south as south-central Pennsylvania (Kirkland and Krim 1990, Merritt 1987). Porcupine remains have been found in Pleistocene and archaeological deposits in at least 7 western counties in Virginia (Augusta, Bath, Highland, Russell, Scott, Washington, and Warren; Benthall 1990, Eshelman and Grady 1986). Until AD 500, the geographic range of this species extended southward along the Appalachian Mountains as far as northwestern Alabama, eastern Tennessee, and western North Carolina (Barkalow 1961, Parmalee 1963, Parmalee and Guilday 1966, Whyte 2010). Whyte (2010) suggested that climatic events (the Medieval Warm period, AD 900–1300) and human predation might have led to the Porcupine's extirpation from much of the southern Appalachians by AD 1000.

During the past several centuries following European contact, the occurrence of the Porcupine south of Pennsylvania has been intermittent. The Porcupine occurred in West Virginia during the late 1800s (Goode 1878) and early 1900s (Kellogg 1937), although it was considered extinct in that state by the mid-1950s (Handley 1956). Similarly, the Porcupine was in Maryland during the late 1800s (Lugger 1881), and Paradiso (1969) stated that the Porcupine had been extirpated from Maryland, even though Harman and Thoeig (1968) reported 4 Porcupines killed by hunters during the 1960s in western Maryland. Feldhamer et al. (1981) reported a skull-only specimen from western Maryland (Museum Number 221 at the Appalachian Environmental Laboratory of the University of Maryland, Frostburg, MD) and stated that Porcupines in Maryland were probably transient individuals.

In Virginia, Handley and Patton (1947) described a 1739 report by John Clayton (Virginia game ... 1899) as evidence that this species possibly occurred in western Virginia during early Colonial times. Nevertheless, Handley and Patton (1947) and Handley (1980, 1991) considered the Porcupine to be extirpated in Virginia, probably by the mid-1800s (Audubon and Bachman 1846). Based on a newspaper article and photo, Handley (1991) stated that hunters killed a Porcupine in Bath County, VA, in 1978, but he maintained that the sporadic reports of Porcupines in Virginia during the last century were likely the result

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of animals wandering into the state from Pennsylvania or being accidentally transported by logging trucks. Linzey (1998) also considered the Porcupine to be extirpated in Virginia, although he mentions a museum catalog record in the Department of Fisheries and Wildlife mammal collection at Virginia Tech (Blacksburg, VA) of a skin-plus-skull specimen collected in Giles County in 1952, which was missing from the collection in 1992.

In 2015, Pagels and Moncrief reported a single museum specimen (USNM 570136) collected in Virginia and deposited (as a skin-plus-skeleton specimen) into the Mammal Collection of the National Museum of Natural History (NMNH). NMNH records indicate that this was a male Porcupine found dead on Virginia Route 55 on North Mountain in Frederick County on 4 September 2006. Pagels and Moncrief (2015) also reported that 3 other Porcupines were struck by automobiles (photographed but not collected) in Frederick and Augusta counties during 2010–2011, and they described photographs of live Porcupines from several locations in northwestern Virginia during 2008–2014, including an adult accompanied by a single juvenile, which was photographed on 13 June 2011. Here we provide detailed locality information for all of the animals reported by Pagels and Moncrief (2015) and report multiple additional verified records and specimens of Porcupines collected in Virginia, including evidence of reproduction in Virginia populations (or nearby West Virginia populations).

During 2008–2019, we documented Porcupines at 24 locations in Virginia (Table 1, Fig. 1). Our verified evidence of Porcupines during that time includes photographs of live Porcupines at 9 locations, photographs of dogs with quills in their noses and mouths at 6 locations, and photographs or carcasses (collected for preparation as museum specimens) of 9 dead Porcupines (Table 1). Unfortunately, the condition of 4 animals (1 from Loudoun, 1 from Augusta, and 2 from Frederick counties) precluded preparation as museum specimens. Three road-killed Porcupines (1 each from Augusta, Frederick, and Rockingham counties) were prepared as skin-plus-skeleton specimens and deposited into the Mammal Collection of the Virginia Museum of Natural History (VMNH 2972–2974). We consider VMNH 2973 (a female) to be a juvenile, less than 8 months old because her 3<sup>rd</sup> molars had not erupted (Sutton 1972). According to Woods (1973), female Porcupines are not sexually mature until about 18 months. We consider VMNH 2972 and VMNH 2974 to be adults because all molars of these 2 animals were fully erupted. A fourth road-killed Porcupine, a post-lactating female, was collected in Rockingham County on 2 July 2019, and a fifth road-killed animal was collected in Giles County on 5 September 2019. The latter 2 animals have not yet been prepared as VMNH specimens. Our searches for non-fossil Virginia specimens of Porcupines in electronic databases of more than 50 museum collections via the VertNet portal returned only the NMNH specimen (USNM 570136) collected in 2006 previously reported by Pagels and Moncrief (2015). This animal was a roadkill collected slightly north of our map location 9 (Fig. 1)

It is likely that most of our verified observations of Porcupines in Virginia during 2008–2019 (Table 1, Fig. 1) are evidence that animals are dispersing into Virginia from western Maryland and eastern West Virginia. The 3 possible exceptions are 2 individuals (1 live, 1 dead) photographed along Interstate 81 (I-81) in Frederick County (map locations 2 and 7 in Fig. 1, Table 1) and a live Porcupine photographed in Montgomery County (map location 24 in Fig. 1, Table 1). We suspect that the animals photographed adjacent to the interstate, one under an automobile at a rest stop along I-81 and another killed in a yard less than 100 m from I-81, were accidentally transported into Virginia on vehicles. Similarly, we suspect that the animal photographed in Montgomery County may have also been accidentally transported on a vehicle, or it may have been intentionally released, because it was photographed in an urban setting.

In a period of ~35 years, the Porcupine appears to have expanded its range at least 300 km from central Pennsylvania into western Virginia. In the mid-1980s, this species was rare in Pennsylvania south of Interstate 80, and it probably was absent from the southeastern and southwestern corners of Pennsylvania (Genoways 1986). According to game warden surveys conducted in 2016 (M. Lovallo, Bureau of Wildlife Management, Pennsylvania Game Commission, Spring Mills, PA, unpubl. data), populations of Porcupines in portions of south-central Pennsylvania were either stable or increasing. Similarly, M. Frantz (West Virginia Division of Natural Resources, Elkins, WV, pers. comm.) reported that the number of Porcupines has increased since the 2000s in northeastern West Virginia, and range expansion is occurring southward and westward. During this same time period, J. McCann (Maryland Department of Natural Resources, Frostburg, MD, unpubl. data) reported an increased number of Porcupine records (sightings, road kills, quilled dogs, veterinarian

Table 1. Verified observations of *Erethizon dorsatum* (North American Porcupine) in Virginia 2008–2019. All photographs of dogs show individuals with quills in their mouths and/or noses. Map loc. = map location as shown in Figure 1.

Map loc.	County	Date	Comments
1	Loudoun	25 November 2017	Photo of dead Porcupine
2	Frederick	11 September 2010	Photo of live Porcupine under automobile at rest stop along I-81, suspect accidental transport
3	Frederick	26 August 2019	Photo of dead Porcupine
4	Frederick	27 September 2017	Juvenile female specimen, VMNH 2973
5	Frederick	20 July 2015	Photo of live Porcupine on side of tree and on ground
6	Frederick	26 April 2008 <sup>1</sup>	Photo(s) of live Porcupine(s) on ground, including adult with single young
7	Frederick	21 July 2011	Photo of dead Porcupine in yard less than 100 m from I-81, suspect accidental transport
8	Frederick	19 September 2015	Photo of dog; Porcupine not observed directly
9	Shenandoah	25 August 2018	Photo of live Porcupine at hiker shelter in national forest
10	Shenandoah	25 March 2010	Photo of live Porcupine on ground
11	Shenandoah	17 October 2013	Photos of live Porcupine(s) on ground
12	Shenandoah	25 September 2015	Photo of dog; Porcupine not observed directly
13	Shenandoah	4 September 2015	Photos of dogs; Porcupine observed in tree
14	Shenandoah	1 November 2017	Photo of dog; Porcupine not observed directly
15	Shenandoah	27 July 2016	Photo of live Porcupine on ground in woods
16	Shenandoah	25 July 2016	Photo of live Porcupine on side of tree
17	Rockingham	7 August 2019	Photo of dog; Porcupine not observed directly
18	Rockingham	20 July 2016	Adult female specimen, VMNH 2972
19	Rockingham	2 July 2019	Carcass of adult post-lactating female Porcupine
20	Augusta	30 September 2017	Adult male specimen, VMNH 2974
21	Augusta	5 September 2010	Photo of dead Porcupine
22	Bath	14 June 2018	Photos of dogs; Porcupine not observed directly
23	Giles	5 September 2019	Carcass of Porcupine collected 11 air km from location 24, may be same animal
24	Montgomery	25 May 2019	Photo of live Porcupine in town of Blacksburg; suspect intentional release or accidental transport

<sup>1</sup>Porcupine(s) were also photographed at this location on 19 July 2008, 13 June 2011, and 18 September 2011.

reports) in the western mountain counties of Maryland. Thus, there has been a general trend of increasing numbers and southward range expansion of Porcupines in states north of Virginia. We suggest that Pennsylvania animals dispersed southward into eastern West Virginia and western Maryland during recent decades. As populations increased in those states, individuals eventually dispersed southward into Virginia along high-elevation ridgelines.

Considering this species' low reproductive capabilities (average 1 young per year) (Woods 1973) and short dispersal distances by juveniles (Sweitzer and Berger 1998), it is somewhat surprising that this southward range expansion into Virginia occurred so rapidly. Although certain factors have likely increased the possibility of detecting Porcupines during the past 35 years (e.g., increased use of trail cameras and additional road traffic), it is

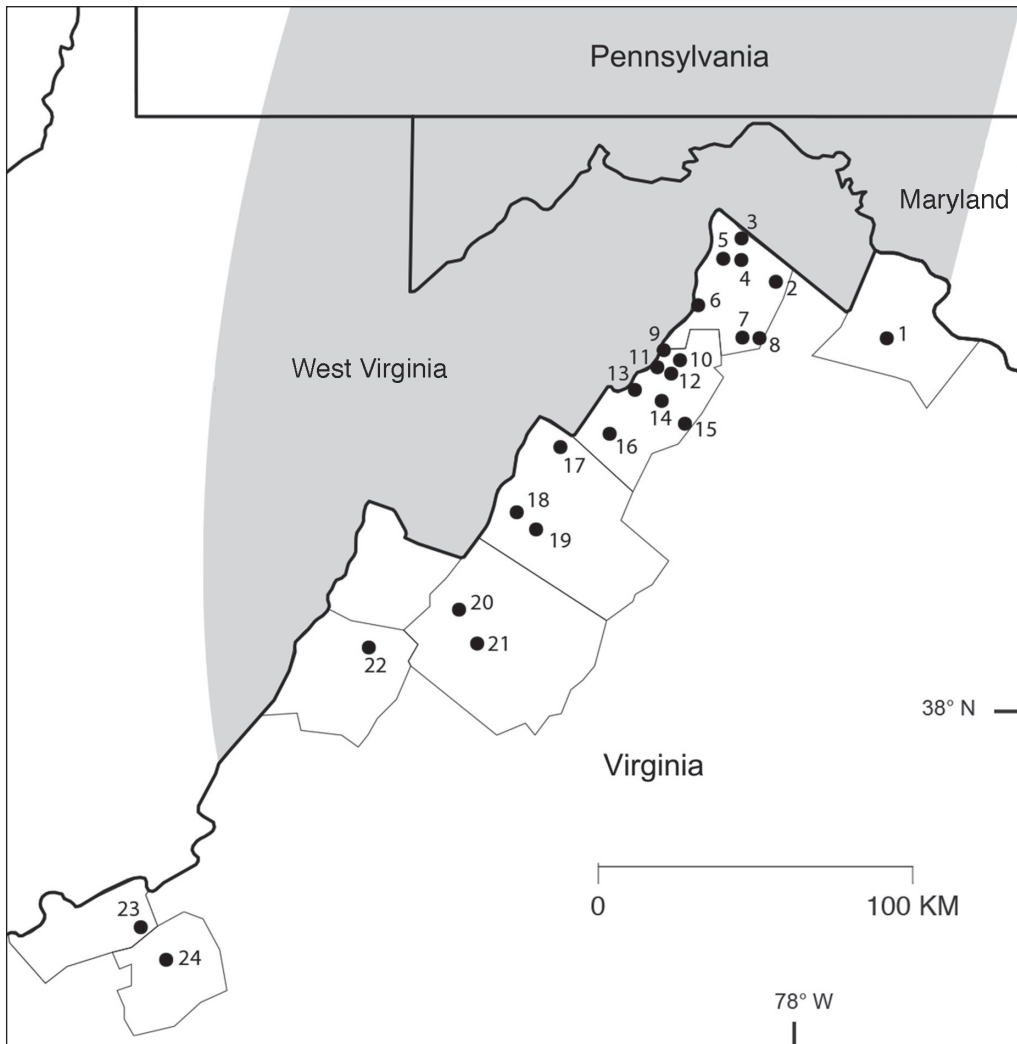


Figure 1. Current distribution (gray shading) of *Erethizon dorsatum* (North American Porcupine) in Pennsylvania, Maryland, and West Virginia (based on maps supplied by M. Lovallo; H. Spiker, Maryland Department of Natural Resources, Oakland, MD, unpubl. data; and R. Rogers, West Virginia Division of Natural Resources, Romney, WV, unpubl. data), and locations (black dots) of recently verified photographs and/or carcasses (collected for preparation as museum specimens) in Virginia. See Table 1 for details on each numbered location.

also likely that other factors (e.g., hunters using hounds that might encounter Porcupines) would have resulted in detection of many more Porcupines before 2008 if resident populations had been present all along. Thus, we suggest that the increase in verified Porcupine observations south of central Pennsylvania during recent decades more likely represents a true range expansion rather than detections of populations that previously occurred there.

We can only speculate regarding the possible factors that facilitated Porcupine range expansion into Virginia. Aside from occurrences where we suspect transport by humans (2 observations along a major interstate and 1 in an urban setting), most verified records of Porcupines in Virginia have been located in remote and mountainous forest on or near the George Washington and Jefferson National Forests. Timber harvest on National Forest lands has decreased in Virginia since the 1980s (VDGIF 2015), resulting in forest maturation that likely created habitat conditions more favorable for Porcupines. Mature trees and rocky outcrops in these areas provide potentially abundant den sites and ample food resources (Griesemer et al. 1998), and the topography of the region (mountain ridge tops with generally contiguous suitable habitat) may provide corridors for movement and dispersal of Porcupines. The remoteness of these sites also reduces the likelihood of encounters with humans and motor vehicles, which are the most important cause of mortality for Porcupines in many areas (Roze and Ilse 2003).

Although we identified possible factors that may have provided favorable conditions for Porcupines to move southward into unoccupied habitats, the actual mechanisms behind this recent range expansion event are poorly understood. In their review and synthesis of Porcupine biology and distribution, Roze and Ilse (2003:378) asked, “what limits the species’ distribution in the eastern deciduous forest? Why do they not extend through Virginia and Tennessee into the southern Appalachians?” We share their appeal for more information about the ecological requirements for establishment of Porcupine populations in peripheral regions of this species’ geographic distribution.

We agree with Handley (1991) that sporadic reports of Porcupines in Virginia during the 20<sup>th</sup> century did not represent resident populations or range extensions. However, we suggest that most of the numerous verified occurrences of Porcupines in Virginia during 2008–2019 (Table 1) are the result of natural dispersal of individuals into Virginia from expanding populations in western Maryland and eastern West Virginia. Furthermore, trail camera photographs from Frederick County on 13 June 2011 of an adult Porcupine accompanied by a juvenile, a road-killed juvenile female (VMNH 2973) collected 27 September 2017 (also in Frederick County), and a post-lactating road-killed female collected 2 July 2019 in Rockingham County, are evidence of reproduction in Virginia populations (or nearby populations in West Virginia). Regardless of the particular circumstances associated with the Porcupine’s range expansion into Virginia during 2008–2019, we have now documented verified physical evidence of this species in 8 counties and provided a foundation for future investigations into the distribution and abundance of Porcupines in this state.

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