

Recent Records and Range Expansion of *Dasyopus novemcinctus* (Nine-banded Armadillo) in Virginia

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Abstract - The distributional range of *Dasyopus novemcinctus* (Nine-banded Armadillo, hereafter Armadillo) has been expanding into the southern and midwestern United States since the mid-1800s. Here we document recent evidence of Armadillos in southwestern Virginia from verified photographs submitted to the Virginia Department of Wildlife Resources and voucher specimens deposited into the Mammal Collection of the Virginia Museum of Natural History. These recently collected and observed Armadillos are likely dispersers from expanding populations in eastern Kentucky and eastern Tennessee. This report provides a foundation for future investigations into the distribution and abundance of the Armadillo in Virginia.

The distributional range of *Dasyopus novemcinctus* L. (Nine-banded Armadillo, hereafter Armadillo) has been expanding north and east into the southern and midwestern United States since it was first documented in southern Texas in 1849 (Audubon and Bachman 1854). This expansion is the result of natural dispersal combined with accidental and intentional introductions by humans (Taulman and Robbins 1996). By 2013, the Armadillo's breeding range had advanced to include the southern two-thirds of South Carolina, all but the northeastern corner of Georgia, all of Alabama, the western half and southeastern corner of Tennessee, and the western half of Kentucky (Eichler and Gaudin 2011, Taulman and Robbins 2014). Since 2013, Armadillos have further expanded their breeding range into western North Carolina (Olfenbuttel 2021), eastern Tennessee (R. Applegate, Tennessee Wildlife Resources Agency, Nashville, TN, pers. comm), and eastern Kentucky (J. MacGregor, Kentucky Department of Fish and Wildlife Resources, Frankfort, KY, pers. comm).

Although Taulman and Robbins (2014) suggested that the breeding range of Armadillos did not extend into Virginia at the time their paper was published, they included a map showing a pre-2003 sighting in Prince Edward County, in the south-central portion of the state. We investigated details of this reported observation and learned that this data point was based on a photograph in the Farmville Herald newspaper. Published about 1986, the photo showed a man holding a road-killed Armadillo reportedly found near Farmville (J. Bowman, Virginia Department of Wildlife Resources, Richmond, VA, pers. comm.). At the time the photo was published, this animal was believed to have been accidentally or intentionally transported to the area (J. Bowman, pers. comm.). Records maintained by the Virginia Department of Wildlife Resources (VDWR) also document 2 road-killed Armadillos found in southwestern Virginia prior to the Taulman and Robbins (2014) paper. One animal was recovered in Tazewell County prior to 2010; the other was collected in Smyth County between 2010 and 2013 (A. Boynton, Virginia Department of Wildlife Resources, Richmond, VA, pers. comm.). Both counties are situated in the far southwestern part of the state. At the time of collection, both of these roadkills were also considered to be animals intentionally or unintentionally transported by humans (A. Boynton, pers. comm.).

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Subsequent studies using trail cameras to document mammal occurrence in Tennessee, North Carolina, and Virginia have resulted in numerous photos of Armadillos in Tennessee and North Carolina, but have failed to produce any photos of this species in Virginia (W. McShea, Smithsonian Conservation Biology Institute, Front Royal, VA, pers. comm.).

Here we report the first verified records of live, free-ranging Armadillos in Virginia, all from counties in the southwestern part of the state. On 11 March 2019, a homeowner photographed a live Armadillo in her yard near Oakwood, Buchanan County (map location 1 in Table 1, Fig. 1). Based on the time that the resident first noticed damage to her lawn, the animal had likely been in the area for ~1 month prior to being photographed. Efforts to trap the animal by one of us (S.D. Thompson) were unsuccessful. The Armadillo disappeared several weeks after first being photographed and was not seen again.

About 2 months later, on 20 May 2019, a dog killed an Armadillo near Swords Creek, Russell County (map location 2 in Table 1, Fig. 1), ~18.8 km SE of the Buchanan County observation. This animal, a male, was prepared as a skeleton-plus-ossified-dermal-scutes specimen and deposited into the Mammal Collection of the Virginia Museum of Natural History (VMNH 3269). We consider this animal to be an adult, based on the complete fusion of all postcranial epiphyses and a fully erupted permanent dentition (Ciancio et al. 2012, Straehl et al. 2013). By comparing photos of the Buchanan County Armadillo with the specimen recovered from Russell County and observing differences in size and coloration, we do not believe them to be the same animal.

On 24 October 2019, a third Armadillo was found dead in a cage trap baited with cat food near Honaker, Russell County (map location 3 in Table 1, Fig. 1). This animal, another male, was also prepared as a skeleton-plus-ossified-dermal-scutes specimen and deposited into the VMNH Mammal Collection (VMNH 3270). It too was an adult, based on complete

Table 1. Verified observations of *Dasyurus novemcinctus* (Nine-banded Armadillo) in Virginia and adjacent counties in Kentucky and Tennessee during 2019 and 2020. Map loc. = map location as shown in Figure 1.

Map. loc.	State, County Coordinates	Date	Evidence
1	Virginia, Buchanan 37°11'28"N, 82°0'26"W	11 Mar 2019	Photo of live animal
2	Virginia, Russell 37°2'11"N, 81°55'1"W	20 May 2019	Adult male specimen VMNH 3269
3	Virginia, Russell 37°2'39"N, 82°1'27"W	24 Oct 2019	Adult male specimen VMNH 3270
4	Virginia, Washington 36°43'57"N, 81°44'4"W	13 Mar 2020	Photo of live animal
5	Virginia, Wythe 36°57'3"N, 80°52'42"W	17 May 2020	Photo of dead animal
6	Kentucky, Pike 37°22'9"N, 82°14'7"W	5 Feb 2019	Photo of dead animal
7	Tennessee, Sullivan 36°32'4"N, 82°34'55"W	30 Jul 2019	Photo of dead animal
8	Tennessee, Sullivan 36°35'11"N, 82°15'45"W	16 Aug 2019	Expert report (R. Applegate)

epiphyseal fusion and permanent dental eruption. The trap location for this Armadillo was ~9.6 km W of the previous Russell County record and 16.4 km S of the Buchanan County observation. The condition of this animal’s carcass prevented meaningful comparisons with photos of the Buchanan County Armadillo.

During the spring of 2020, two additional Armadillos were photographed in southwestern Virginia near Interstate-81 (I-81). The first animal, photographed alive on 13 March 2020, was moving across an open field near Glade Spring, Washington County (map location 4 in Table 1, Fig. 1). This animal was reported to VDWR by several observers over a period of 2 days, and then it disappeared. Approximately 2 months later, on 17 May 2020,

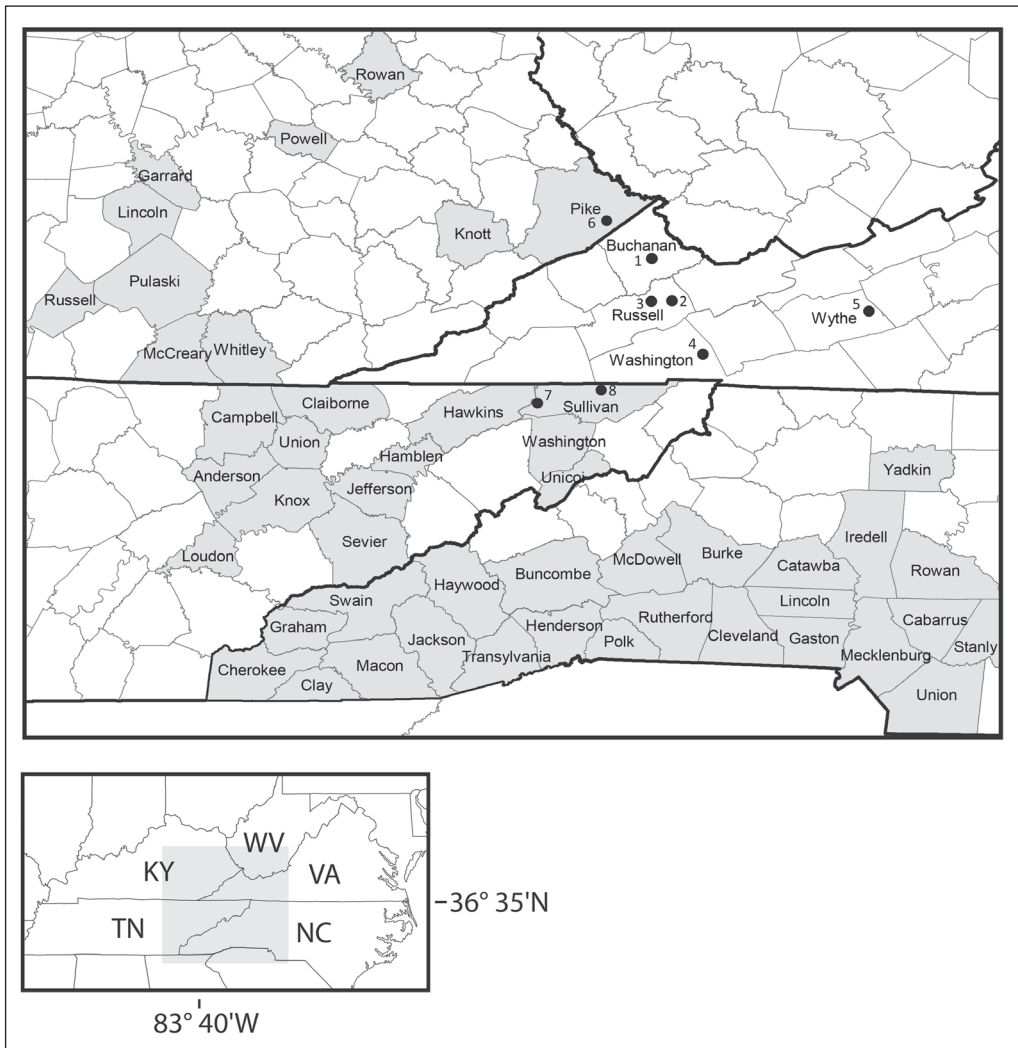


Figure 1. Verified observations (black dots) of *Dasyurus novemcinctus* (Nine-banded Armadillo) in Virginia and adjacent counties in Kentucky and Tennessee during 2019 and 2020. Gray shading indicates counties with reports of this species in portions of North Carolina, Kentucky, and Tennessee since 2013 (based on Olfenbuttel 2021 and data supplied by K. Wethington, Kentucky Department of Fish and Wildlife Resources, Frankfort, KY, pers. comm.; R. Applegate, pers. comm.; and T. Gaudin, pers. comm.). See Table 1 for details on each numbered location.

another Armadillo was photographed near Fort Chiswell, Wythe County (map location 5 in Table 1, Fig. 1). This animal had been killed by a vehicle and was photographed along the edge of the road on an exit ramp of I-81. The carcass disappeared before VDWR biologists could retrieve it the following day.

Although it is possible that some or all of these animals were accidentally or intentionally transported into Virginia, we believe that it is highly unlikely that all were transported to locations in such close geographic proximity over a 1-year time span at intervals of 2–5 months. Rather, we suggest that most of these individuals were likely transient natural dispersers that moved long distances from adjacent states. Possible exceptions may be the 2 animals photographed near I-81 in Washington and Wythe counties. The proximity of these Armadillos to a major interstate highway would seem to increase the likelihood that they were accidentally transported into Virginia on a vehicle (e.g., an open bed truck).

In the years since Taulman and Robbins (2014) gathered evidence for their study, the Armadillo has expanded its range into North Carolina, eastern Kentucky, and eastern Tennessee. In North Carolina, most observations that are characterized as “confirmed” occur in the extreme southwestern corner of the state (adjacent to Tennessee, South Carolina, and Georgia), and those considered to be “credible” are distributed farther east, including areas that border southeastern Virginia along the Atlantic Coast (Olfenbuttel 2021). Recent confirmed records from eastern Kentucky and eastern Tennessee include counties in those states on or near their borders with southwestern Virginia. For example, a road-killed Armadillo was recorded in Pike County, KY, on 5 February 2019 (J. MacGregor, pers. comm.), only 1.7 km from the Virginia state line (map location 6 in Table 1, Fig. 1).

In Tennessee, a road-killed Armadillo was photographed on 30 Jul 2019 in Sullivan County near Kingsport (map location 7 in Table 1, Fig. 1), and an additional road-killed animal was observed 16 August 2019 in Sullivan County near Bristol (map location 8 in Table 1; Fig. 1). In addition, there are multiple “citizen science” reports of Armadillos from other counties in extreme northeastern Tennessee (Campbell, Claiborne, and Union counties), from a time period covering summer 2017 through the end of 2019 (T. Gaudin, University of Tennessee at Chattanooga, Chattanooga, TN, pers. comm.). The closest of these reports in Tennessee (the road-killed animal in Sullivan County near Bristol; map location 8 in Table 1, Fig. 1) is ~2 km from the Virginia border.

Studies of Armadillo movements indicate that individuals are capable of moving considerable distances over relatively short time periods. Layne and Glover (1977) reported movements of up to 488 m within an animal’s home range during a 24-hour period. Gammons et al. (2009) translocated animals and used radiotelemetry to follow their movements. Three animals moved notable distances: one animal moved 1.7 km within 3 hours of release, traveling at a rate of 0.56 km/hour; a second animal moved 1.6 km in 5 days; and a third individual traveled 1.2 km in 8 days, including crossing a creek that was 20–40 m wide and more than 2 m deep. These animals were clearly motivated to return to their original home ranges and, as a result, they may have traveled longer distances in a shorter time than usual. Nevertheless, data for the Armadillos in Gammons et al.’s (2009) study demonstrate that this species is theoretically capable of natural dispersal over relatively long distances.

We can only speculate regarding the source populations for the Armadillos we have observed in southwestern Virginia. Although this species is considered to be well-established in 3 states that border Virginia (North Carolina, Kentucky, and Tennessee), the closest confirmed records are from Kentucky and Tennessee. Considering further the relative number and proximity of recent reports from Tennessee and Kentucky and the differences in

topography along Virginia's border with these 2 states, we suggest that most of the recent observations of Armadillos in Virginia are likely natural dispersers from Tennessee. We also propose that rivers in this region are the likely dispersal routes, given the number of studies that have identified riparian habitat, particularly bottomland hardwoods, as preferred habitat for Armadillos (Loughry and McDonough 2013). Animals from Buchanan and Russell counties (map locations 1–3 in Table 1, Fig. 2) could have traversed into Virginia through the Upper Clinch River watershed. If we assume the Washington County animal (map location 4 in Table 1, Fig. 2) was not transported by a vehicle on I-81, it may have entered Virginia through the Holston River watershed.

We have no evidence of reproduction by Armadillos in Virginia and consider at least 3 of the 5 animals we report here to be pioneering individuals, as defined by Humphrey (1974). Their appearance in Virginia was not surprising, given the increasing number of individual sightings in eastern Kentucky and eastern Tennessee during the past 40 years (R. Applegate, pers. comm.; Eichler and Gaudin 2011; J. MacGregor, pers. comm.; Taulman and Robbins 2014). Additionally, in light of Feng and Papes' (2015) modeling results that suggest most of Virginia is climatically suitable for this species, and the close proximity of established populations of Armadillos in Kentucky, Tennessee, and North Carolina, we predict additional individuals will move into southwestern Virginia (from Kentucky and Tennessee) and into the Piedmont and Coastal Plain of Virginia (from North Carolina) in the coming years.

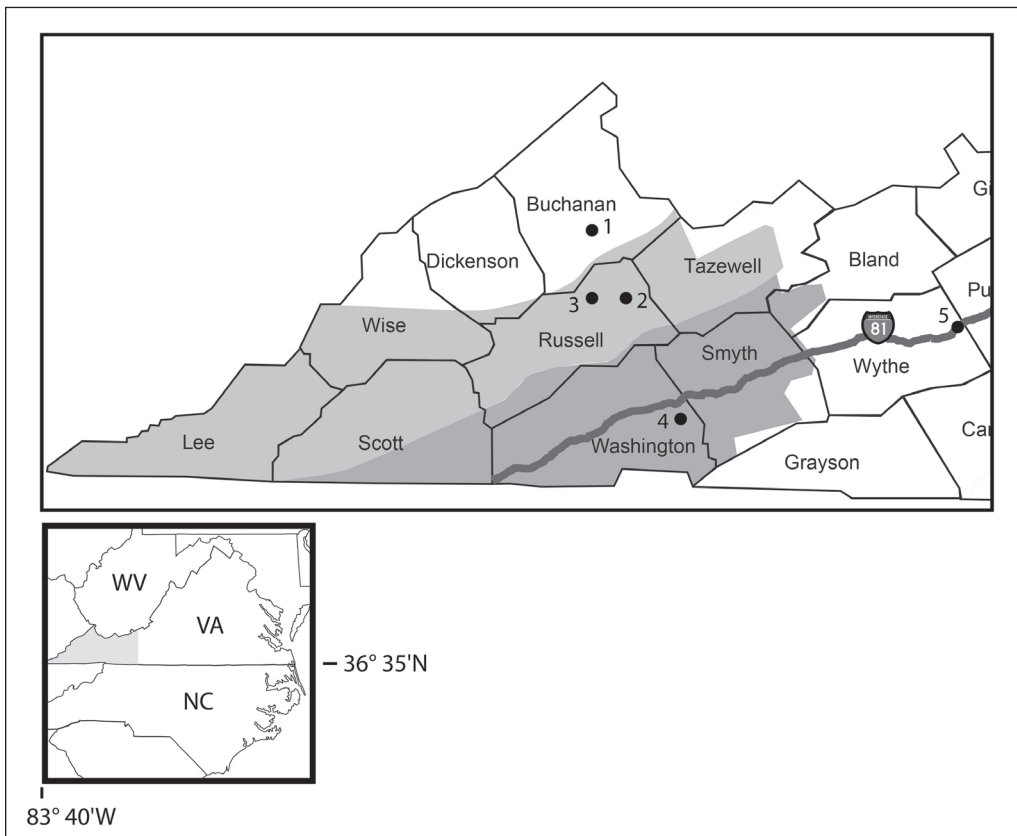


Figure 2. Locations (black dots) of verified observations of *Dasyurus novemcinctus* (Nine-banded Armadillo) in Virginia during 2019 and 2020. The Upper Clinch River watershed is shown in lighter gray, and the Holston River watershed is shown in darker gray.

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