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## Mass Mortality of Red-spotted Newts (*Notophthalmus viridescens viridescens* Rafinesque) on a Central Virginia Road

Joseph C. Mitchell

Department of Biology  
University of Richmond  
Richmond, Virginia 23173

Large numbers of amphibians and reptiles are killed annually on highways and roads in North America by vehicular traffic (Carpenter & Delzell, 1951; Dodd et al., 1989; Rosen & Lowe, 1994; Fahrig et al., 1995; Ashley & Robinson, 1996). Roads located near or adjacent to wetlands pose special problems for amphibians, especially those that move to and from terrestrial retreats to breeding sites on a seasonal basis (Palis, 1994). Road mortality in pond-breeding ambystomatid salamanders during their breeding migrations has been observed in several locations (Klemens, 1993; JCM, personal

observations). In the mountains of Virginia, red-spotted newts (*Notophthalmus viridescens viridescens*) arrive in breeding ponds in March in large breeding migrations and leave en masse in August for terrestrial hibernacula (Gill, 1978). Gill found that juveniles leave the ponds in late summer and early fall months but did not observe mass migrations. Mass migrations of juveniles have been documented in Massachusetts (Dunn, 1930; Stein, 1938; Healy, 1975), New York (Hulbert, 1969, 1970), North Carolina (Chadwick, 1944), and Ohio (Smith & Pflingsten, 1989), with the highest numbers occurring on

nights with rainfall. Such migrations of adults and juveniles in areas with roads increase the risk of mortality from vehicular traffic.

On 4 October 1991, I observed mass mortality of *Notophthalmus viridescens* on County Route 629 where it passes along a beaver-maintained wetland adjacent to Beaverdam Creek, 4.2 km NE Maidens, Goochland County, Virginia. I counted 182 dead and 4 live immature newts (efts) in a 0.25 km stretch of the hard surface road. Conditions of the specimens formed two categories, dry (older road kills) and moist (recent road kills), reflecting at least two periods of movement activity. These groups may have corresponded to two larval size classes like those observed in New York by Hulbert (1970). The moist group may have been killed during the rainfall of 2 October. The newts were counted but not measured due to time constraints. However, all sizes of eft were represented, ranging from very small ones to those that were showing green coloration, suggesting that they were near reproductive maturity. The stretch of road on which dead salamanders were found consisted of two sections, the part adjacent to the wetland without canopy and the part immediately to the east with partial canopy from the adjacent mixed hardwood and pine forest. Numbers of salamanders were approximately equal in both sections.

I visited the site again on several dates in 1992 and once in 1994 but did not find large numbers of dead eft. None was found on 17 April 1992, although one northern cricket frog (*Acris crepitans*) and one spring peeper (*Pseudacris crucifer*) were found dead in the wooded section of the road. I found six dead eft (mean SVL =  $33.7 \pm 3.1$  mm, 30-37) on 1 September 1992, 10 dead eft (mean SVL =  $37.4 \pm 3.5$  mm, 33-43, n = 8) on 17 September 1992, and eight (each 35 mm SVL, n = 2) on 29 November 1992. Most of the salamanders were found in the wooded section of the road. On 14 November 1994 I found 10 dead eft and one live eft on the section of the road adjacent to the beaver pond. I had originally hypothesized that mass migration in the fall should lead to mass mortality on this road. The large number found in October 1991 may have been a chance event or related to an unusually large production of cohorts that year. Road mortality impacts on this local population apparently occur at low intensities each year but high rates of mortality apparently do not appear to be a frequent event.

Road mortality was suspected by Hoffman (1992) to be the primary source of decline in frog populations in the Clifton Forge area of Alleghany County between the 1950s and early 1990s. Reptile populations in Virginia, especially snakes, suffer losses annually due to road

mortality (Mitchell, 1994 and unpublished). Roads fragment habitats and further contribute to declines in animal populations (Mader, 1984; Andrews, 1990). Because road construction and widening projects continue unabated, it is likely that vehicular traffic will continue to be a significant cause of red-spotted newt mortality and possible population decline in Virginia.

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