Information on the winter ecology of amphibians is important for understanding their biology, management and conservation, particularly in temperate climates where amphibians may spend several months overwintering (Irwin, 2005). However, few data are available on winter ecology of many amphibians, especially salamanders (Irwin, 2005; Lannoo, 2005).

_Pseudotriton ruber_ are medium-sized, semi-aquatic salamanders occurring generally from New York State to Louisiana and westward to Indiana in the eastern United States (Petranka, 1998; Hunsinger, 2005). Typically, adult _P. ruber_ move from terrestrial to aquatic habitats (e.g., streams, springs) during late fall, and presumably overwinter at these sites (Bishop, 1941; Bruce, 1978; Petranka, 1998). While abundant in these aquatic habitats during the fall and subsequent spring, _P. ruber_ have been noted to be difficult to locate during winter (Bruce, 1978; Pfingston, 1989; Hunsinger, 2005) and typically disappear from the surface cover of streams and springs, leading to the suggestion they may occupy inaccessible, subterranean retreats within streams and springs during the winter months (Pfingston, 1989; Hunsinger, 2005).

During winter 2016-2017, two instances of adult _P. ruber_ congregated underneath a single rock within two separate springs were observed in the South Branch Roaring Creek watershed, Northumberland County, Pennsylvania, USA (40.831°N, 76.502°W, WGS 84 grid). On 27 December 2016 at 14:00 h (United States Eastern Standard Time) at an air temperature of 4 °C, eight adult _P. ruber_ were congregated underneath a small (~20 x 15 cm diameter) rock within an unnamed spring. On 16 January 2017 at 13:45 h (United States Eastern Standard Time) at an air temperature of 0 °C, 22 adult _P. ruber_ were found congregated underneath a medium-sized (~40 x 30 cm in diameter) rock within an unnamed spring (Fig. 1). During each observation, the salamanders were active and began dispersing from their aggregation immediately upon removal of cover (Fig. 1). In each case, the rocks were carefully returned to their original position and the salamanders gently coaxed back underneath the retreats.

Few reports have appeared in the literature regarding aggregations of adult _P. ruber_. Niemiller et al. (2006) found nest attending _P. ruber_ in their cave aggregation; suggesting these individuals aggregated for reproduction. However, no nests were associated with the aggregating _P. ruber_ in Pennsylvania. Additionally, because breeding in _P. ruber_ occurs outside of the coldest winter months (i.e., breeding season of this species varies geographically but is thought to occur outside of the cold winter months, Petranka, 1998), this aggregation appears to be unrelated to mating. Climate records for Northumberland Co., Pennsylvania show that temperatures during winter 2016-2017, including the months of December and January during which the present observations took place, were warmer on average than previous years (https://www.usclimatedata.com/climate/elysburg/pennsylvania). Thus, it is possible that above-average temperatures might have stimulated mating later in the season. Walker (1931, in Pfingston, 1989) suggested that the aggregation of _P. ruber_ he observed was related to hibernation. Because the observations reported occurred during winter and (e.g., woody debris) at each spring were gently lifted but no more adult _P. ruber_ were found. However, adult and larval salamanders of _Desmognathus fuscus_ and _Eurycea bislineata_ were found underneath other cover objects within each spring. Thus, it is unclear why a number of adult _P. ruber_ aggregated underneath a single cover rock when other (presumably) suitable cover was present within each spring. Niemiller et al. (2006) found nest attending _P. ruber_ in their cave aggregation; suggesting these individuals aggregated for reproduction. However, no nests were associated with the aggregating _P. ruber_ in Pennsylvania. Additionally, because breeding in _P. ruber_ occurs outside of the coldest winter months (i.e., breeding season of this species varies geographically but is thought to occur outside of the cold winter months, Petranka, 1998), this aggregation appears to be unrelated to mating. Climate records for Northumberland Co., Pennsylvania show that temperatures during winter 2016-2017, including the months of December and January during which the present observations took place, were warmer on average than previous years (https://www.usclimatedata.com/climate/elysburg/pennsylvania). Thus, it is possible that above-average temperatures might have stimulated mating later in the season. Walker (1931, in Pfingston, 1989) suggested that the aggregation of _P. ruber_ he observed was related to hibernation. Because the observations reported occurred during winter and
presumably outside of the known breeding season for \textit{P. ruber}, it seems more likely that these aggregations were due to overwintering, although mating might also have been involved. Perhaps some unknown physical factor made these particular rocks more suitable for overwintering than other cover available within each spring. These observations of adult \textit{P. ruber} aggregating underneath rocks at the surface of springs, while limited, contribute an important observation regarding the winter ecology of this species.

**ACKNOWLEDGEMENTS**

I thank Andrea Swartz for assistance in acquiring literature references and thank Suzanne M Coombes, Roger Meek and an anonymous reviewer for comments on the manuscript. Observations reported herein were conducted incidentally while collecting data as a volunteer for the Pennsylvania Amphibian and Reptile Survey (PARS). The salamanders were released unharmed and the author complied with all Pennsylvania regulations.

**REFERENCES**


---

Winter aggregations of adult red salamanders

\[\text{Accepted: 21 November 2017}\]