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Ecology of the Namaqua Dwarf Adder, Bitis schneideri

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ABSTRACT

The loss of global biodiversity is exacerbated by the problem of trying to conserve species whose biology is not understood. The conservation of African snakes provides a striking example of this problem as many species remain entirely enigmatic. If we are to effectively manage or conserve these species, then we need to begin to describe and quantify their ecology. This project aimed to increase the body of knowledge regarding the ecology of *Bitis schneideri*, an arid-adapted African viperid, and as such, provide the basis for an informed critical assessment of the conservation status of the species. The improved understanding of the ecology of *B. schneideri* will contribute to the emerging study of African snake ecology, allowing scientists to compare and contrast the ecology of African snakes with those from northern temperate systems on which most of the global understanding of snake ecology is based.

Bitis schneideri is a species of very small-bodied viperids that grow rapidly and reach sexual maturity within the first two years. They are sexually dimorphic for several traits, and evidence suggests that fecundity selection has played an important role in shaping their morphology. Moreover, I suggest that the selective advantage of being able to bury into sandy substrates has resulted in the extreme body size displayed in the species. *Bitis schneideri* is diurnally active, a state that is probably a derived condition, as *B. caudalis* (the sister species to *B. schneideri*) is reported to be nocturnal. Additionally, *B. schneideri* shows seasonal variation in activity, with increased activity during the spring mating season. Activity during winter is reduced, but not absent, and appears to be governed by the availability of suitable environmental conditions. Activity in *B. schneideri* is limited at all temporal scales by environmental conditions. Radio-telemetry and mark-recapture analysis showed that *B. schneideri* is highly sedentary, moving between 0.8 ± 6.5 m.d^{-1} and 47.3 ± 3.9 m.d^{-1}, inhabiting small homeranges (♂: 0.85 ± 0.09 ha; ♀: 0.10 ± 0.09 ha). Moreover, juveniles show limited dispersal that, when combined with sedentary adult behaviour, could result in vulnerability to fragmentation by limiting gene-flow. Population densities are high (≈ 8 ha^{-1}) and survival is low (39% and 56% per annum) compared to viperids from other parts of the world. Additionally, juveniles have higher survival rates than adults. Small litter sizes imposed by small-bodies, and low survival, means that *B. schneideri* must reproduce frequently, probably annually, in order for populations to persist. Such frequent reproduction is atypical, even among closely related species, and in *B. schneideri*, appears to be facilitated through the capacity to feed year-round in the aseasonal habitat in which they occur. *Bitis*

schneideri is a generalist that ambushes prey in proportion to encounter frequency. Also, I show that the capacity of *B. schneideri* to capture and consume relatively large prey items provides snakes with a large energetic advantage. Abundant generalist predatory birds are likely to be more important predators of *B. schneideri* than are rare specialist predatory raptors, although snakes are also vulnerable to other predators that include small mammals, other reptiles, and large invertebrates.

Small body-size has two important implications for *B. schneideri* biology – reduced litter size, and vulnerability to a wide suite of predators. These attributes interact to result in low survival, reduced movement and dispersal, frequent reproduction, generalist foraging, and year-round feeding. *Bitis schneideri* is not at significant risk of facing extinction in the near future. The primary biological factor that ameliorates against extinction risk is large population size and high population density.