

## Winter predation of the viviparous lizard *Zootoca vivipara* by the Eurasian kestrel *Falco tinnunculus* in Britain

JOSH PHANGURHA

Author e-mail: [phang061094@gmail.com](mailto:phang061094@gmail.com)

The viviparous lizard *Zootoca vivipara* is one of the mostly widely distributed reptile species and one of the most northerly, having been recorded within the Arctic Circle as far as 71° N. As protection from sub-zero temperatures during the winter months these lizards brumate in a hibernaculum under debris (Costanzolo et al., 1995) or in a carefully prepared cell in the soil (Hodges & Seabrook, 2022). Lizard activity is dependent on weather conditions and in particular the amount of solar radiation available (Van Damme et al., 1987).

The Eurasian kestrel *Falco tinnunculus* is a predator of small mammals, reptiles, other birds and invertebrates (Village, 1990) and is a significant predator of *Z. vivipara* with which it shares many habitats. One of the most comprehensive studies on this predator-prey relationship found that the likelihood of a viviparous lizard being delivered to a kestrel nest by the parent birds increased towards midday and independently increased with increasing ambient temperature (Steen et al., 2011). When lizards were delivered to the nest, the average temperature was 20.2 °C but other types of prey were delivered at an average temperature of 15.7 °C. Delivery of *Z. vivipara* to the kestrel nests could be a functional response to the increasing availability of lizards with increased temperature, as well as solar height (Steen et al., 2011). Those lizards basking or actively foraging will be at risk of predation (Lima & Dill, 1990; Caro, 2005) while at other times they stay well hidden within the vegetation. For the lizards, this means there may be a trade-off reaching their optimal body temperatures for maximum physiological performance (for foraging, mating etc.) and the likelihood of being captured by kestrels (Steen et al., 2011).

In the middle of winter on 17 December 2020, I observed a female kestrel predating two viviparous lizards on the Solent coast in the Havant area of Hampshire (England) at 13:38 h, one of these is shown in Figure 1. The weather conditions at the time were unusually mild with a temperature of 11 °C, relative humidity of 85 % and wind speed of 9.3 mph (Timeanddate website, 2020). The observed temperature (11 °C) falls within the lower end of the temperature range at which lizards have been recorded to be delivered to nests by kestrels 7.1–31.4 °C (Steen et al., 2011). Due to the lack of orange ventral colouration, no distinct hemipenial bulge at the tail base and adult size, the lizard in this observation appears to be female. This is interesting to note, as males may be expected to emerge from hibernation earlier than females in readiness for



**Figure 1.** A kestrel eating a viviparous lizard on 11 December 2020, Havant, Hampshire, England

reproduction (Van Damme et al., 1987). However, due to the disfigurement of the body, it is difficult to determine the lizard's gender with certainty.

This may be the first record of predation by kestrels on viviparous lizards in December in Britain. Certainly, warmer British winters in recent times may be rendering *Z. vivipara* more vulnerable to winter predation (Davies et al., 2021).

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