

Predation of Ocellated Skink, *Chalcides ocellatus* (Forskål, 1775), by the Common Kestrel, *Falco tinnunculus*, in a Sardinian dunal ecosystem, Italy

Alessandro Prezzi^{1*}, Elena Chiesa¹, Massimo Delfino², and Miguel Angel Carretero^{3,4}

The Ocellated Skink, *Chalcides ocellatus*, is a robust viviparous lizard widely distributed across the southern Mediterranean, Asia Minor, the Levant, and the Arabian Peninsula. Across its range, several evolutionary lineages have been identified (Kornilios et al., 2010), including a long history of human-mediated colonisations to the islands of Sardinia, Sicily, Malta, Crete, Rhodes, Karpathos, Chios (Kornilios et al., 2010), and more recently to the Iberian Peninsula (Bisbal-Chiniesta et al., 2020). In Sardinia, the species is now widespread, occupying shrublands, sandy areas, rocky terrain, but also orchards such as olive tree groves, almond groves, and citrus groves (Corti et al., 2010, 2022; Di Nicola and Mezzadri, 2018; Kapsalas et al., 2018). Due to its shy behaviour, semi-fossorial habits, and partially crepuscular activity, these lizards may be difficult to observe, but they frequently bask on dry stone walls and dry vegetation in the early morning and late afternoon.

With the support of photographic evidence, we here report a direct observation of predation of *C. ocellatus* by a female Common Kestrel, *Falco tinnunculus*, that took place on 5 May 2023 in coastal Mediterranean shrub

along a sandy beach with low dunes called Is Arutas on the Sinis Peninsula, western Sardinia, Italy (approximate coordinates 39.9528°N, 8.4028°E). We noticed the kestrel's hunting behaviour (i.e., hovering and flying low) as soon as we approached the beach. Shortly after our arrival, we observed that the falcon caught a skink, which we were able to identify as *C. ocellatus*, which is easily differentiated from *C. chalcides* (Linnaeus, 1758) by its thicker and shorter cylindrical body and longer limbs. The kestrel then proceeded to use a public shower as a perch, giving us the opportunity to take photographs (Fig. 1A, B). It remained still for just a couple of minutes, not consuming the meal, before taking flight again and returning to where it originally came from (Fig. 1C, D), suggesting the presence of a nesting site. The predation event was observed in the late afternoon, at 17:30 h, during sunny weather. To our knowledge, this type of predation has never been directly reported and documented with photographic evidence, although it has been mentioned for Sardinia (Di Nicola and Mezzadri, 2018), Sicily (based on direct examination of kestrel pellets; Corti et al., 2010), and North Africa (Schleich et al., 1996) without supporting information.

The diet of birds of prey, including the Common Kestrel, can vary greatly in composition based on prey availability, season, and other environmental variation within a bird's home range (Žmihorski and Rejt, 2007; Romanowski and Žmihorski, 2008; Tulis et al., 2017; Hobart et al., 2019; Montoya et al., 2021). The diet of the Common Kestrel, a ground predator that detects prey in flight but captures it on the ground (Casagrande et al., 2008; Garrat et al., 2011), is mainly composed of small mammals, especially the Common Vole, *Microtus arvalis* (e.g., Aschwanden et al., 2007; Casagrande et al., 2008; Tulis et al., 2017; Montoya et al., 2021; Kovinka et al., 2023), but it can also include insects, birds, and reptiles (Martin and Lopez, 1990). Quantitative data on kestrel diet from previous studies (Guarino et al., 2013; Kovinka et al., 2023) indicate that reptiles constitute

¹ Dipartimento di Scienze della Vita e Biologia dei Sistemi, Università di Torino, Via Accademia Albertina 13, 10123 Torino, Italy.

² Dipartimento di Scienze della Terra, Università di Torino, Via T. Valperga Caluso 35, 10125 Torino, Italy; and Institut Català de Paleontologia Miquel Crusafont, Edifici ICTA-ICP, Universitat Autònoma de Barcelona, Carrer de les Columnes s/n, Campus de la UAB, 08193 Cerdanyola del Vallès, Barcelona, Spain.

³ Centro de Investigação em Biodiversidade e Recursos Genéticos, Universidade do Porto, 4485-661 Vairão, Portugal.

⁴ Departamento de Biologia, Faculdade de Ciências da Universidade do Porto, Rua do Campo Alegre, 4169-007 Porto, Portugal.

* Corresponding author. E-mail: alessandroprezzi20@gmail.com

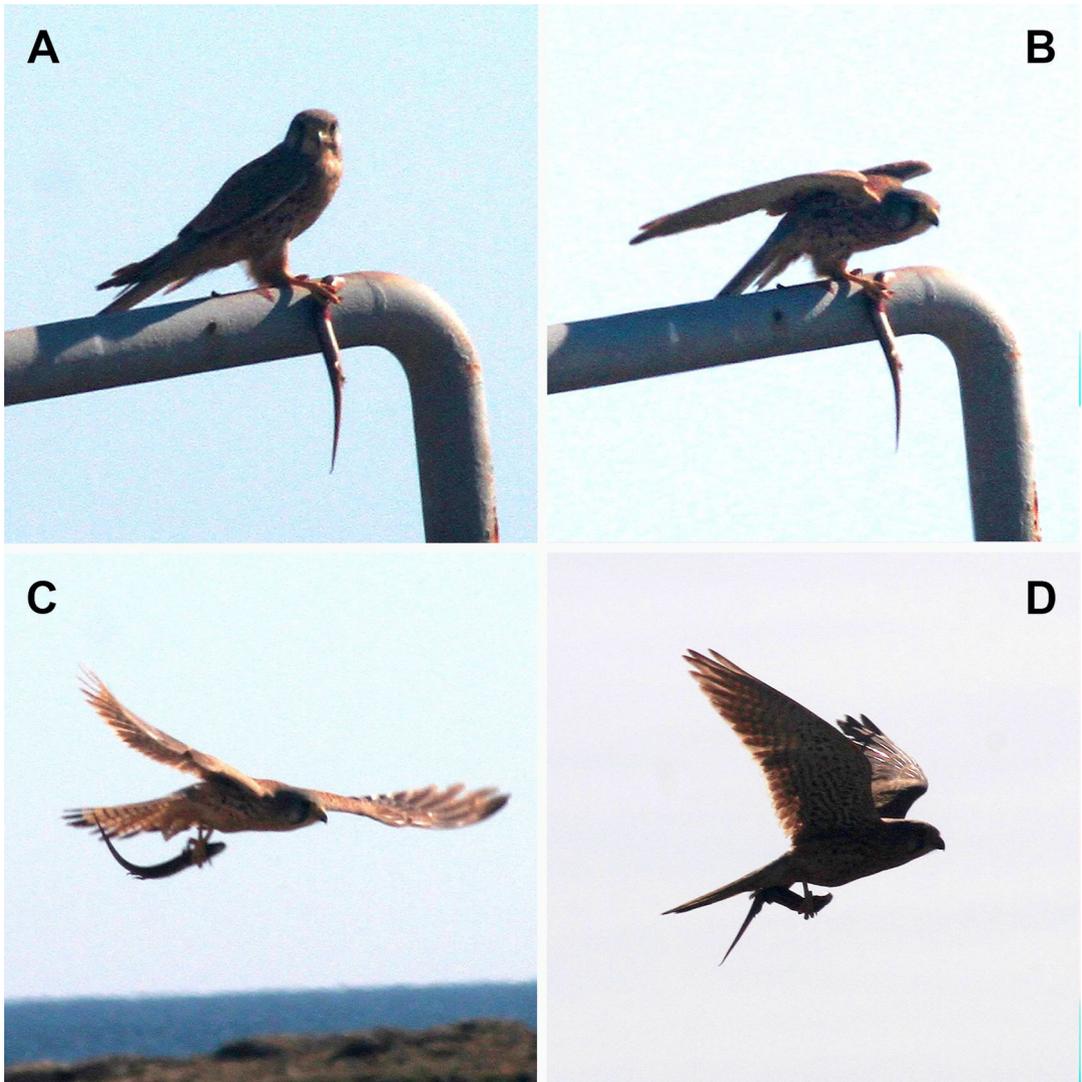


Figure 1. Photographic record of a common kestrel (*Falco tinnunculus*) preying on an ocellated skink (*Chalcides ocellatus*). The photos are presented in chronological order from A to D. Photos by Elena Chiesa.

a minor part of its prey, with the major part being small mammals and invertebrates, followed by birds. However, where reptiles (e.g., lizards) are abundant, such as in insular environments, they may constitute the main prey item of kestrels (Carrillo et al., 2017). Furthermore, during the warmer months in southern Europe, reptiles are more frequent prey than in the colder months in more northern latitudes (Andrews, 1990; Grano and Cattaneo, 2017), when they may be less available or not available at all.

To underline the variability of kestrel diet, it is worth mentioning that two cases of cannibalism have

been reported in Israel (Haddad and Yosef, 2022), showcasing this raptor's very opportunistic hunting behaviour. Therefore, predation of a skink should not be surprising. However, in the sandy area where the event occurred, the most common lizard species was more likely the Italian wall lizard, *Podarcis siculus* (Rafinesque-Schmaltz, 1810), a less elusive and more abundant species that would make an easier prey for kestrels and therefore likely present a more regular meal. We actively searched for other *C. ocellatus* in the area for 1 h and observed five more individuals, three under rocks and two moving through the shrubs.

In addition, we found two *C. chalcides*. We also observed an adult male western whipsnake, *Hierophis viridiflavus* (Lacépède, 1789), which may also prey on lizards and skinks on the beach. We believe it is unlikely that kestrel predation constitutes a threat for local skink populations due to the bird's generalist diet, which makes it a non-selective predation of skinks that will include other, more common lizard species in its diet.

Acknowledgements. We thank everyone involved in the trip of the herpetology course from the University of Turin, and especially Arianna Bedocchi for her contribution to taking the photos. We also thank Luis Felipe Rojas Muñoz for an English revision and Edoardo Razzetti for preparing the pre-peer review of the manuscript.

References

- Andrews, P. (1990): Owls, Caves and Fossils: Predation, Preservation and Accumulation of Small Mammal Bones in Caves, with an Analysis of the Pleistocene Cave Faunas from Westbury-sub-Mendip, Somerset, UK. Chicago, Illinois, USA, University of Chicago Press.
- Ashwanden, J., Holzgang, O., Jenni, L. (2007): Importance of ecological compensation areas for small mammals in intensively farmed areas. *Wildlife Biology* **13**: 150–158.
- Bisbal-Chinesta, J.F., Tamar, K., Gálvez, A., Albero, L., Vicent-Castelló, P., Martín-Burgos, L., et al. (2020): Trade and stowaways: molecular evidence for human-mediated translocation of eastern skinks into the western Mediterranean. *Amphibia-Reptilia* **41**: 49–62.
- Carrillo, J., González-Dávila, E., Ruiz, X. (2017): Breeding diet of Eurasian kestrels *Falco tinnunculus* on the oceanic island of Tenerife. *Ardea* **105**: 99–111.
- Casagrande, S., Nieder, L., Di Minin, E., La Fata, I., Csermely, D. (2008): Habitat utilization and prey selection of the kestrel *Falco tinnunculus* in relation to small mammal abundance. *Italian Journal of Zoology* **75**: 401–409.
- Corti, C., Capula, M., Luiselli, L., Razzetti, E., Sindaco, R. (2010): Fauna d'Italia. Reptilia. Bologna, Italy, Edizioni Calderini.
- Corti, C., Biaggini, M., Nulchis, V., Cogoni, R., Cossu, I.M., Frau, S., et al. (2022): Species diversity and distribution of amphibians and reptiles in Sardinia, Italy. *Acta Herpetologica* **17**: 125–133.
- Di Nicola, M.R., Mezzadri, S. (2018): Anfibi e Rettili di Sardegna: Guida Fotografica. Milan, Italy, Libreria della Natura.
- Garratt, C.M., Hughes, M., Eagle, G., Fowler, T., Grice, P.V., Whittingham, M.J. (2011): Foraging habitat selection by breeding common kestrels *Falco tinnunculus* on lowland farmland in England. *Bird Study* **58**: 90–98.
- Grano, M., Cattaneo, C. (2017): *Stellagama stellio daani* (Beutler and Frör, 1980) as a prey of *Falco tinnunculus* Linnaeus, 1758 on Tilos Island (Dodecanese, Aegean Sea). *Parnassiana Archives* **5**: 45–50.
- Guarino, F.M., Di Già, I., Sindaco, R. (2010): Age and growth of the sand lizards (*Lacerta agilis*) from a high alpine population of north-western Italy. *Acta Herpetologica* **5**: 23–29.
- Haddad, E., Yosef, R. (2022): Cannibalism in common kestrel (*Falco tinnunculus*). *Acta Ethologica* **25**: 195–197.
- Hobart, B.K., Jones, G.M., Roberts, K.N., Dotters, B.P., Whitmore, S.A., Berigan, W.J., et al. (2019): Trophic interactions mediate the response of predator populations to habitat change. *Biological Conservation* **238**: 108217.
- Kapsalas, G., Deimezis-Tsikoutas, A., Georgakopoulos, T., Gkourtsouli-Antoniadou, I., Papadaki, K., Vassaki, K., Pafilis, P. (2018): How effectively do European skinks thermoregulate? Evidence from *Chalcides ocellatus*, a common but overlooked Mediterranean lizard. *Acta Herpetologica* **13**: 75–82.
- Kornilios, P., Kyriazi, P., Poulakakis, N., Kumlutas, Y., Ilgaz, Ç., Mylonas, M., Lymberakis, P. (2010): Phylogeography of the ocellated skink *Chalcides ocellatus* (Squamata, Scincidae), with the use of mtDNA sequences: a hitch-hiker guide to the Mediterranean. *Molecular Phylogenetics and Evolution* **54**: 445–456.
- Kovinka, T., Sharikov, A., Massalskaya, T., Volkov, S. (2023): Structure and heterogeneity of habitat determine diet of predators despite prey abundance: similar response in Long-eared, Short-eared Owls and Common Kestrels. *Avian Research* **14**: 100072.
- Martin, J., Lopez, P. (1990): Amphibians and reptiles as prey of birds in southwestern Europe. *Smithsonian Herpetological Information Service* **82**: 1–43.
- Montoya, A., Cabodevilla, X., Fargallo, J. A., Biescas, E., Mentaberre, G., Villanúa, D. (2021): Vertebrate diet of the common kestrel (*Falco tinnunculus*) and barn owl (*Tyto alba*) in rain-fed crops: implications to the pest control programs. *European Journal of Wildlife Research* **67**: 79.
- Romanowski, J., Zmihorski, M. (2008): Effect of season, weather and habitat on diet variation of a feeding-specialist: a case study of the long-eared owl, *Asio otus* in Central Poland. *Folia Zoologica* **57**: 411–419.
- Schleich, H.H., Kästle, W., Kabisch, K. (1996): Amphibians and Reptiles of North Africa. Königstein im Taunus, Germany, Koeltz Scientific Books.
- Tulis, F., Slobodník, R., Langraf, V., Noga, M., Krumpálová, Z., Šustek, Z., Křištín, A. (2017): Diet composition of syntopically breeding falcon species in south-western Slovakia. *Slovak Raptor Journal* **11**: 15–30.
- Žmihorski, M., Rejt, Ł. (2007): Weather-dependent variation in the cold-season diet of urban kestrels *Falco tinnunculus*. *Acta Ornithologica* **42**: 107–113.