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Lethal grip for an endangered endemic frog: The freshwater crab *Potamon karpathos* (Decapoda, Potamidae) preys on Karpathos water frog *Pelophylax cerigensis* (Anura, Ranidae)

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Abstract

Invertebrate predation on amphibians is widespread, although unreported in Europe. Here, we present documented predation of the Karpathos water frog (*Pelophylax cerigensis*) by the crab *Potamon karpathos*. *Pelophylax cerigensis* is an endangered, endemic species exclusively found on the Rhodes and Karpathos Islands in the South Aegean Sea, Greece. The Karpathos population is at risk due to limited suitable habitats and a scarcity of freshwater bodies on the island. From April to October, when there is no rain on the island, frogs and crabs cohabitate, sharing the same shallow ditches. Incidents of frog predation by crabs are common, indicated by numerous individuals with amputated limbs and scars, representing an additional threat to the endangered frog. Further research on the interactions between the two species is urgently required, as it has direct conservation implications.

Key Words

Aegean Sea, amphibians, crustaceans, interspecific interactions, predation

Invertebrate predation on amphibians has been recorded numerous times worldwide, with insects and arachnids being the most common predators (e.g., Toledo 2005; Baracho et al. 2014; Maffei et al. 2014; Jablonski 2015; Christopoulos et al. 2022). Brachyura, both marine (Pyke et al. 2013; Pérez-Sorribes and Gil-Climent 2021) and freshwater species (Sichieri et al. 2021; Abraham and Hutter 2022), are also known to prey on anurans.

In this study, we present the first documented case of predation of the Karpathos frog by a freshwater crab. Reports of crab predation on frogs have been published in the past (Affonso and Signorelli 2011; Warrington and Cossel 2012; Hedrick and Cossel 2014). To the best of our knowledge, this is the first documented case of amphibian predation by a crustacean in Europe.

The freshwater crab genus *Potamon* Savigny, 1816 (Decapoda: Potamidae) includes 22 species distributed in Asia, Southern Europe, and Northern Africa (Cumberlidge and Ng 2009; Ghanavi et al. 2023). The Aegean Islands host seven species of the genus, and *Potamon karpathos* Giavarini, 1934, is the species living on Karpathos Island in the South Aegean Sea, Greece (Jesse et

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al. 2011). The feeding ecology of the species is largely understudied and remains elusive. Nonetheless, the literature on the diet of other *Potamon* crabs supports an opportunistic pattern based on omnivory, with a higher preference for plants (Bahuguna et al. 2016; Fadlaoui and Melhaoui 2022), which may also include extreme cases of animal consumption such as ophiophagy (Groen et al. 2023).

Until recently, the Karpathos frog (*Pelophylax cerigensis* Beerli et al., 1994) (Anura: Ranidae) was considered endemic to Karpathos and was classified as critically endangered (CR) (IUCN 2022). A recent phylogenetic study revealed that the populations of Rhodes Island also belong to the same species (Toli et al. 2018, 2023). Consequently, *P. cerigensis* is now categorized as endangered (EN) according to the newest assessment (NECCA 2024). However, the risk category of the species may change again in the future: the Karpathos populations are sparse, water bodies on the island are few and in bad condition, and wildfires that occurred on Rhodes in July 2023 may have had a negative impact on the frog populations. The ongoing implementation of the national action plan (NAP) for the conservation of the Karpathos frog (Pafilis et al. 2020) will shed light on these issues after its completion in December 2025.

The snout-vent length (SVL) of adult Karpathos frogs usually ranges from 5–7 cm (Valakos et al. 2008). The species is diurnal throughout the year, and its diet follows an opportunistic pattern, with coleoptera, Araneae, Isopoda, and Hymenoptera being the main prey groups (Pafilis et al. 2019).

The first unconfirmed reports of frog predation by crabs come from the guards of the local management unit of the Dodecanese. During the annual fieldwork of the Action Plan implementation, we recorded a number of incidents that confirmed the initial reports. First, we noticed many individuals with amputated limbs or digits (Fig. 1A) or body scars (Fig. 1B), indicating that a predator with a sharp instrument attempted to capture them. Following this, we observed two clear cases of predation in the field.

On 30 June 2021 (3:20 pm), along the Argoni Stream (35.7004°N, 27.1501°E; 142 m a.s.l.), we noticed a frog (SVL = 51 mm) that was immobilized by the chelae of an adult crab (carapace width (CW) = 75 mm) grasping the frog's hind limbs. Subsequently, although the crab was captured to release the frog, it continued to hold the frog very tightly (Fig. 2).

On 3 December 2023 (11:47 am), again in Argoni Stream (35.6917°N, 27.1554°E; 185 m a.s.l.), we observed an adult frog (SVL ≈ 52 mm) jump into the water. A crab (CW ≈ 70 mm) immediately emerged from under a stone and grabbed the frog with its chelae (Fig. 3A). The frog was trying to escape, but the crab was persistently holding it underwater using a firm grip on the frog's hind part of the trunk (Fig. 3B). The crab immobilized the frog, grasping its hind limb with one chela, while trying to grab the frog by the body with the other chela (Fig. 3C). When the crab squeezed the frog's neck for some seconds, the frog stopped reacting. After a few minutes, during which the frog passed out, the crab began to consume its prey from the outer side of the thigh base (Fig. 3D).

Our numerous observations suggest that crabs regularly prey on Karpathos frogs. *Pelophylax cerigensis* and *P. karpathos* have been sharing the same biotope for a long time. However, their main habitat, small river puddles, is becoming increasingly scarce due to prolonged drought, particularly during the long Aegean summer. Thus, the two species have to coexist in quite restricted ponds that do not exceed 30 cm^2 in width and 3 cm in depth. In such limited microhabitats, encounters are inevitable and, app arently, end up in predation attempts by the crab. These new observations should be taken into account to design and adapt appropriate mitigation measures that will ensure the viability of the frog population. At this stage, we cannot propose such measures due to the complexity of the problem: water scarcity forcing the two species to live in the same microhabitats, while it is not possible to eradicate the crab's because it is a native species and part of the ecosystem. Further future investigations should look at this in more detail.

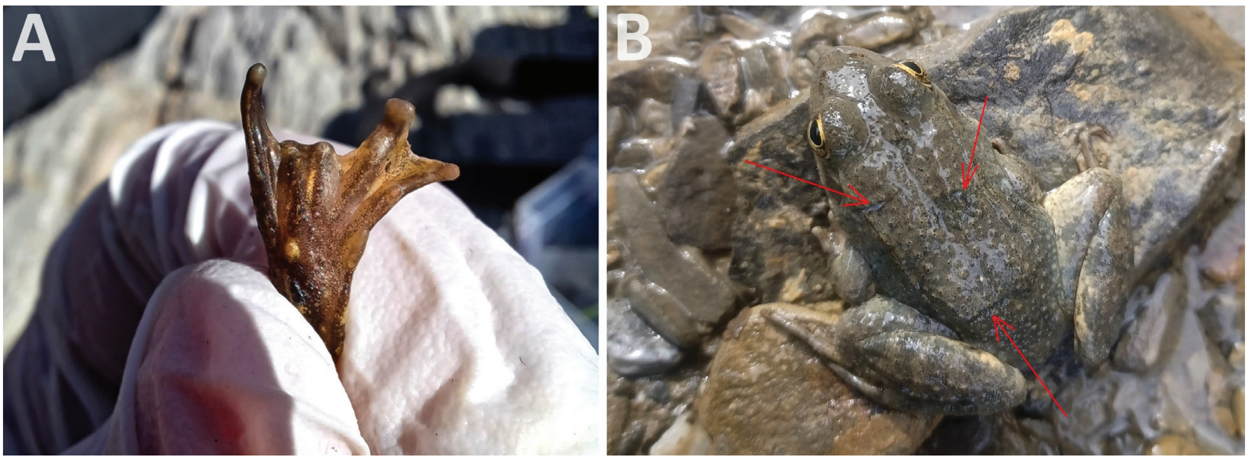

Figure 1. A. Amputated digits of the right hind limb of an adult *Pelophylax cerigensis*; **B.** Scars on the trunk of an adult frog marked with red arrows.

Figure 2. The first documented incidence of predation on *Pelophylax cerigensis* by *Potamon karpathos* on Argoni Stream, Karpathos Island, Dodecanese, Greece. Photos by Apostolos Christopoulos.

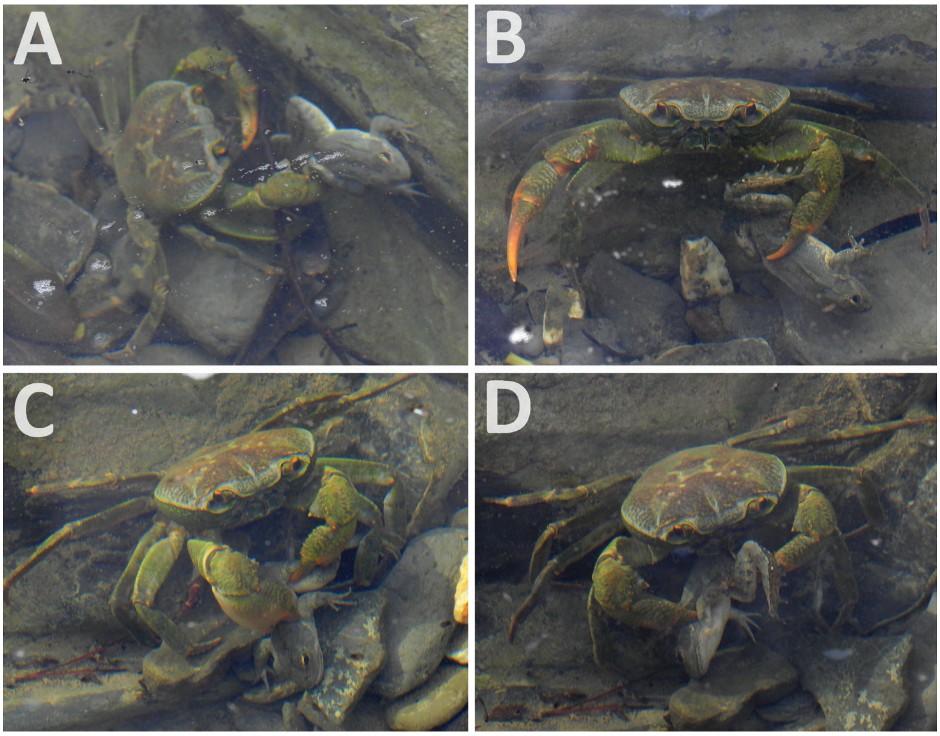

Figure 3. The second documented incidence of predation on *Pelophylax cerigensis* by *Potamon karpathos* in Argoni Stream, Karpathos Island, Dodecanese, Greece. **A.** The crab tries to grab the frog by its hind limbs; **B.** The crab holds the frog underwater with a firm grip; **C.** The crab keeps the frog immobilized while trying to strangle it between the trunk and head; **D.** The frog stops reacting and the crab starts to consume it. Photos by Apostolos Christopoulos.

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