

Consumption of a Rough Earthsnake, *Virginia striatula* (Linnaeus, 1766), by a Green Sunfish, *Lepomis cyanellus*, in Brazos County, Texas, USA

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Snakes represent a diverse group of limbless vertebrates, with more than 4229 recognised species (Uetz et al., 2026). They occupy a wide geographic distribution, with diverse adaptive radiations in tropical and subtropical regions, where they inhabit arboreal, terrestrial, and both freshwater and marine habitats (Savage, 2002). Snakes play multiple ecological roles, being primary or secondary predators and prey to many predatory species, mainly mammals, birds, lizards, and other snakes (Pianka and Vitt, 2003). In numerous ecosystems, small-bodied size species of herpetofauna, like lizards, frogs, and snakes, are mainly preyed on by avian species (Nordberg and Schwarzkopf, 2019). However, the available natural history information for some secretive or uncommon snake species is still minimal (e.g., Todd et al., 2008).

With over 10 known aquatic, or semi-aquatic snake species in North America, predator-prey interactions between snakes and fishes occur commonly in this part of the world. However, most of the published records about ecological interactions between these vertebrate groups typically show snakes as the predators and fish as prey (Su et al., 2005; Olamendi-Portugal et al., 2008; Schalk and Cove, 2018). For example, McKnight et al. (2014) reported the consumption of Green Sunfish (*Lepomis cyanellus*) by Western Cottonmouth (*Agkistrodon piscivorus leucostoma*), Plain-bellied Watersnake (*Nerodia erythrogaster*), and Diamond-

backed Watersnake (*Nerodia rhombifer*).

To date, there is limited information about fish predation on snakes (Tavares-Pinheiro et al., 2020), and the number of publications identifying predators and prey species is minimal and frequently includes generalist predatory fish species that present opportunistic feeding behaviours. Additionally, we consider it important to include the species' natural history when analysing the interspecific predation of snakes by fishes. Life history traits influencing a higher use of aquatic environments and their resources by semi-aquatic snakes make these species more prone to predation by predatory fishes than other fully terrestrial species because the development of their life cycle away from the water reduces the probabilities of interacting with such aquatic predators.

The Redeye Piranha (*Serrasalmus rhombeus*) has been reported to consume Amazon Watersnakes (*Hydrops martii*) in South America (Tavares-Pinheiro et al., 2020), while the Largemouth Bass (*Micropterus salmoides*) has been reported to feed on a wide variety of invertebrate and vertebrate prey that includes mammals, fishes, frogs, birds, and several reptiles, including the Mexican Gartersnake (*Thamnophis eques*), Plains Gartersnake (*T. radix*), Eastern Gartersnake (*T. sauritus*), Redbelly Snake (*Storeria occipitomaculata*), and even the Painted Turtle (*Chrysemys picta*) (Hodgson and Kinsella, 1995; Hodgson and Hansen, 2005; Lundgren et al., 2012; Saylor et al., 2012).

Information on the interspecific role of snakes as fish prey is critical for ecological research in temperate freshwater systems of North America, as understanding the full scope of aquatic food webs can help guide species conservation planning. Here we present a novel record of consumption of the Rough Earthsnake (*Virginia striatula*) by a Green Sunfish (*Lepomis cyanellus*) in an urban stream in the town of College Station, Texas, USA.

The colubrid *Virginia striatula*, whose range is restricted to the American South East, is one of the

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Figure 1. Green Sunfish (*Lepomis cyanellus*) caught by electrofishing while consuming a Rough Earth Snake (*Virginia striatula*) in College Station, Texas, USA. Photos by Rose Blanchard.

smallest snakes in Texas with adults reaching a total length of ca. 32 cm (Werler and Dixon, 2000). It is also among the most common terrestrial, fossorial, nonvenomous, viviparous snake species in the eastern half of the state, where it inhabits grasslands and swamp edges, hardwood forests, pine woods, wooded rocky hillsides, and even highly urbanised areas, where it can be found around the yards and the bases of houses and buildings (Dixon et al., 2020).

The species can be differentiated from similar small-sized snakes by having a cone-shaped head with a single internasals scale, one postocular scale, five supralabial scales on each side, and 17 rows of dorsal scales at midbody. The upper body colour can be dark grey, olive brown, reddish brown, or almost black. The belly can be pale yellow, creamy, dirty white, pinkish, or grass green, and the anal plate is almost always divided (Dixon et al., 2020).

The Green Sunfish is a freshwater fish in the family Centrarchidae native to east-central North America (Sosa et al., 2009). The species has a statewide distribution in Texas, inhabiting lotic and lentic systems (Thomas et al., 2007). It is an opportunistic feeder and the most piscivorous species in the genus *Lepomis* (Werner, 1977), reaching a total length of up to 25 cm and a weight of 0.54 kg (Thomas et al., 2007). Furthermore, Green Sunfish have been introduced globally, making it an invasive species well-adapted to even urban streams (Babbington et al., 2023). Within its introduced range, it has reduced or even eliminated populations of native frogs and fishes due to its predatory and competitive interactions (Dudley and Matter, 2000; Rogosch and Olden, 2020).

The dorsal and lateral body regions of *L. cyanellus* are brown to bluish green with dark, mottled vertical bars. The sides of the head are green or iridescent blue

with a dark mottling pattern, while the ventral region can be yellow or yellow orange. It can be distinguished from other congener species by having yellow-orange margins in the dorsal, anal, and pelvic fins. Additionally, it has a large mouth in which the lower jaw extends to approximately the middle of the eye, non-flexible dark coloured opercle flaps bordered by white or yellow orange, 41–52 scales in the lateral line, 9–11 spines in the dorsal fin, three anal fin spines, 8–11 anal soft fin rays, 9–12 dorsal soft fin rays, and 13–15 pectoral soft fin rays (Thomas et al., 2007).

While performing backpack electrofishing sampling using an Infinity XStream backpack electrofisher (Midwest Lakes Electrofishing Systems) in an urban stream in College Station, Texas, USA (30.6259°N, 96.3463°W, elevation 96 m) on 21 February 2023, we caught an adult *L. cyanellus* of approximately 160 mm total length. Upon capture, we noticed the fish had a deceased *V. striatula* of approximately 250 mm total length in its mouth (Fig. 1A). By the time we found the fish, it had already ingested approximately the lower half of the snake's total length, leaving its upper half, including the head, out of its mouth (Fig. 1B). After taking photographs, the live fish was released back to the water as it was found, with the snake still in its mouth.

Given that the interaction was documented following electrofishing, we were unable to determine if the fish had intentionally preyed on the live snake or if the snake was dead when the fish started to consume it. However, we consider it important to note that the snake's skin looked fresh, and it had no signs of putrefaction and decolouration that would suggest it had been dead for a considerable amount of time before the Green Sunfish started to consume it.

This report provides new insights into the natural history of both species. It represents the first record of snake consumption by *L. cyanellus*. At the same time, it adds one more species to the list of animals that include *V. striatula* in their diet, highlighting the importance of this snake species as a food item, and supporting the ecological importance of small-bodied snakes because they can influence different trophic levels as both prey and predators (Taylor and Cox, 2019).

Furthermore, our observation increases the evidence of the generalist and opportunistic feeding behaviour of *L. cyanellus*, which inspires the development of new research to understand in a more detailed way its trophic ecology, and the effects its presence may have on biological communities in both native and introduced

ranges. This is especially important in cases when *L. cyanellus* has caused negative effects on other vertebrate groups, such as amphibians and fishes, because the *in situ* effectiveness of management plans for controlling it as an invasive species may have been developed without considering the full extent of its feeding habits inducing an underestimation of its ecosystemic impacts.

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