

Attempted predation by *Coronella austriaca* on grass snakes *Natrix natrix* and an adult northern viper *Vipera berus* in Norway

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The smooth snake *Coronella austriaca*, grass snake *Natrix natrix* and northern viper *Vipera berus* are sympatric in Norway, the smooth snake being the only reptile species on the national red list categorised as Near Threatened (NT). All three snake species are widely distributed in Europe (Speybroeck et al., 2016). In Norway specifically, the grass snake and the smooth snake have similar ranges along the coast surrounding the outer Oslo fjord, from the border with Sweden in the south-east to Stavanger in the south-west, extending northwards to 60° latitude, while the more cold-tolerant northern viper is found from the coast to 1000 m above sea level in the mountains and to almost 72° N. All three snake species are found together in the same locations along the southern coast in Norway, though the northern vipers tend to avoid the microhabitats that are used intensively by smooth snakes (author's observations). This negative correlation in habitat use has also been noted in England (Phelps, 1978). Smooth snakes and grass snakes, however, often bask and shed in exactly the same locations in the author's long term study area of Kristiansand, southern Norway.

There are well known examples of snakes with a specialised dietary preference for other snakes (ophiophagy), such as King cobras *Ophiophagus hannah*, whose generic name derives from its dietary habits, kraits (*Bungarus* spp) and file snakes (*Mehyla* spp). In Europe, there are no snake species that specialise in ophiophagy but the smooth snake is a well-known reptile predator feeding mainly on lizard species and small mammals across its European range (Beebee & Griffiths, 2000) but has on occasion been recorded eating snakes. The NCC-Report (1983) referenced in Beebee and Griffiths (2000) refers to 6% of the smooth snake diet in England being made up of immature and juvenile northern vipers, 4% being immature and juvenile smooth snakes and 2% adult grass snakes as determined by analysis of regurgitates and faecal material. The current article describes direct observations of three adult smooth snakes attempting to eat grass snakes and a northern viper.

As part of an ongoing long term smooth snake monitoring and research project, an old military area from the second world war is visited regularly (Møvik, Kristiansand, 58° 5'33.26829" N, 7° 58'10.47294" E). On 28 September 2023 at 15:17 h the author discovered a smooth snake that was constricting a very small snake that was identified as a hatchling grass snake (Fig. 1). This was released when the smooth snake became aware of the observer. At first sight



Figure 1. Adult smooth snake *Coronella austriaca* constricting a neonate grass snake *Natrix natrix* on 28 September 2023 in Kristiansand, southern Norway



Figure 2. Hatchling grass snake *Natrix natrix* having been constricted by an adult smooth snake *Coronella austriaca*. The individual is in the last stage of sloughing, 28 September 2023 in Kristiansand, southern Norway

it appeared that the hatchling was dead, and blood was visible around its mouth. Both individuals were weighed and measured. The smooth snake was a known female that had bred the previous year and was non-breeding that year in preparation for breeding the following year, which is typical of the species in Norway. She weighed 96 g with a snout vent length (SVL) of 59.5 cm and total length of 70 cm. She had last been recorded feeding on a slow-worm *Anguis fragilis* on 20 July 2023. The grass snake weighed 3 g with an SVL



Figure 3. An adult female smooth snake consuming a grass snake in Kristiansand, southern Norway in May 2024

of 16.7 cm and a total length of 20.5 cm and was sloughing (Fig. 2). Despite signs of injury the grass snake appeared to make a full recovery and it was released where it was found.

A second, but more successful, predation attempt on a grass snake by a smooth snake was observed on 3 May 2024 at 10:00 h in Kristiansand. The smooth snake was of adult size with typical female colouration, lacking orange pigment on the sides of the head. When the smooth snake was first observed, most of the grass snake was already eaten (Fig. 3). The observation was made in a south facing location by a lake with lots of sunshine early in the day; the site is frequented by shedding grass snakes and smooth snakes and by gravid smooth snakes.

A third and rather different example was of a smooth snake on 19 May 2023 in the forest of Mykland in the Agder county in southern Norway (58° 36'16.75836" N, 8° 16'47.87438" E). A forest walker observed two entwined snakes fully exposed on a sandy track in sunny conditions with an air temperature of between 18–20 °C. Upon inspection the snakes were found to be an adult smooth snake and an adult melanistic northern viper. The latter was in the early stages of being eaten by the smooth snake when found (Fig. 4). Regrettably the walker left the snakes and continued with his walk and upon his return both snakes had gone. It is not known therefore whether the smooth snake completed its predation on the viper nor indeed whether the viper had been killed by the snake or was already dead when it was found by the smooth snake.



Figure 4. Adult smooth snake *Coronella austriaca* has started to ingest an adult northern viper *Vipera berus* in Mykland, inland Agder county, southern Norway on 19 May 2023

In the first example of grass snake predation described above, three further hatching grass snakes were found within two metres suggesting that the smooth snake could have enjoyed a substantial meal prior to hibernation. It is possible that smooth snakes deliberately target grass snake egg laying sites, as in Poland two juvenile *N. natrix* were found in the stomach of a dead adult female smooth snake (Najbar, 2001); and it was suggested that adult smooth snakes actively seek out egg-laying locations of grass snakes, and subsequently eat the neonate snakes on emergence. However, in the case described here the egg laying site was known to be within this smooth snake's home range and also that of four or five other smooth snakes. The constriction of such a small prey item was probably unnecessary but such behaviour was likely to have been instinctive. Pål Sørensen reports from smooth snakes in terraria during the 1970's that one adult female ingested another slightly smaller female, and a juvenile swallowed a sibling with the result that both siblings died. Also, a juvenile smooth snake swallowed a juvenile American corn snake *Pantherophis guttatus*. Interestingly all three victims were sloughing, as was the constricted neonate grass snake reported here. Also, Kolanek & Bury (2020) observed that a juvenile smooth snake attempted cannibalism of a sibling just after their first shed and suggested that the shed may have triggered this behaviour. A Norwegian Lundehund (small dog) trained for finding smooth snakes in eastern Norway finds clutches of newborn smooth snakes during their first slough that are not visible to us and detect sloughs that are hidden under vegetation (Rune Botnermyr, pers comm). It is highly likely that this dog detects these neonates and sloughs by olfaction. Larger smooth snakes that are not sloughing are not detected by the dog unless they move, leading to visual detection. Andrén (1986) makes it clear that male adders only respond to each other in springtime once they have moulted (sloughed) and in the presence of a reproductive female. Incidentally, various studies note that some bird species, for example black-capped donacobius (*Donacobius atricapilla*), use sloughs to deter mammal predators from their nests (Almeida et al., 2014).

It would be of interest to undertake further research into Norway's rarest snake to determine the proportion of snakes in its diet, whether it may reduce northern viper populations

in its strongholds, and if it seeks out grass snake egg-laying sites to prey on hatchlings. Finally, investigation of whether the odour released from a sloughing snake is a behavioural cue in ophiophagy would be help to explain our observations.

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