



Short Note

Pine marten *Martes martes* and black stork *Ciconia nigra* encounters at black stork nests

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Abstract

This study reports five cases where pine martens, *Martes martes*, tried to enter nests occupied by black storks, *Ciconia nigra*, in central Poland, Lodz Province. In four cases, when adult black storks or nestlings guarded the nest, the pine marten immediately retreated, and no brood losses occurred. Thus, the pine marten's role as a predator of black stork nests might be smaller than previously thought.

Nest predation is one of the most important mortality factors for many bird species (Ibáñez-Álamo et al., 2015; Ricklefs, 1969). Among birds, goshawk (*Accipiter gentilis*), white-tailed eagle (*Haliaeetus albicilla*), and raven (*Corvus corax*) are listed as predators of black stork (*Ciconia nigra*) nests (Dmitrenok and Pakul, 2018; Janic et al., 2018; Strazds and Oze, 2018; Strazds, 2011; Czuchnowski and Profus, 2008; Horban and Bumar, 2006; Janssen et al., 2004; Keller and Profus, 1992).

Among mammals, Eurasian lynx (*Lynx lynx*) is reported to prey on black storks occasionally (Strazds, 2011; Horban and Bumar, 2006), while there are many reports of pine marten (*Martes martes*) preying on black stork eggs or nestlings (Kamiński et al., 2018b; Ornithomedia, 2011; Strazds, 2011; Czuchnowski and Profus, 2008; Horban and Bumar, 2006; Janssen et al., 2004; Pugaciewicz, 1994; Hancock et al., 1992; Keller and Profus, 1992; Cramp, 1966).

However, records of pine marten predation are based mainly on remains of black stork nestlings and pine marten scats found under, or in, black stork nests. In such cases identification of the direct cause of nestling death is not 100% certain, as nestlings in the nest could have died of hunger or disease, could have fallen out of the nest by accident, been thrown out by an adult stork, or dropped by a bird predator and found later by the pine marten. Thus, the role of pine martens as the main predator of black stork nests is not well supported by direct observation. In fact, as far as we know, there is only one published note from

Belgium (Ornithomedia, 2011), adequately documenting the case of pine marten devouring black stork eggs. More observations documenting the outcome of pine marten and black stork interactions are needed to better understand the role of pine marten as a predator of black stork nests. The aim of this paper is to describe the consequences of several instances of direct encounters between pine martens and black storks at the site of stork nests that were recorded using camera traps and a network camera.

Pine martens occur throughout North and Central Europe and the Mediterranean region, but are absent from large parts of Spain, Portugal, and Greece (Proulx et al., 2005). The pine marten inhabits various habitats but reaches higher densities in mature or old coniferous, deciduous, or mixed forest (Proulx et al., 2005). Pine martens occur primarily in forest habitats, but in some areas, particularly in southern and western Europe, the species is less forest-dependent and occurs in cultivated land with fragmented woodland (Kubasiewicz et al., 2017; Balestrieri et al., 2010). In Poland, pine martens occupy forests and avoid developed areas (Wereszczuk and Zalewski, 2015; Pucek, 1981). The pine marten is primarily nocturnal, although, particularly in spring, it is frequently active during the day (Wereszczuk and Zalewski, 2015). Male and female pine martens are territorial, and male home ranges are larger than those of females. Both sexes show high fidelity to their home ranges. The density of pine marten in the lowland Białowieża Forest (E Poland) was 5.4 individuals per 10 km² (Zalewski and Jędrzejewski, 2006). Pine martens weigh around 1.36 kg for males and 0.96 kg for females (Zalewski, 2007).

The pine marten preys mainly on small mammals, although throughout Europe, its opportunistic diet varies greatly according to local and

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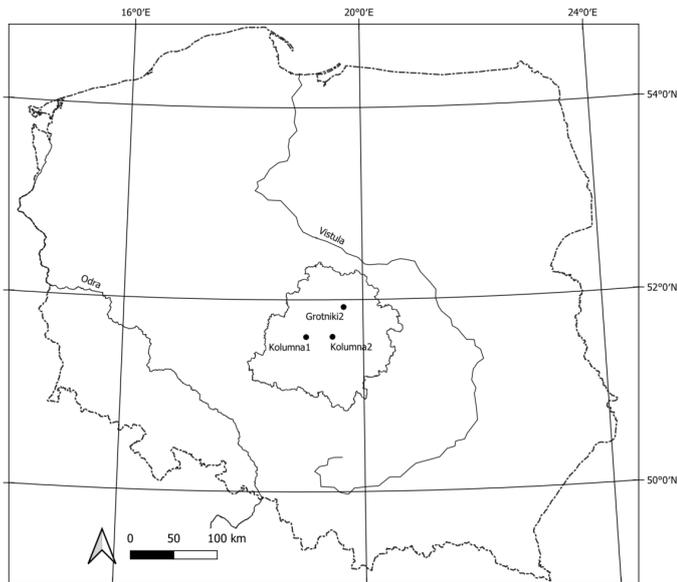


Figure 1 – Location of three studied black stork nests in central Poland, Lodz Province.

seasonal food availability (De Marinis and Masseti, 1995). In Poland, bank vole (*Myodes glareolus*), yellow-necked mouse (*Apodemus flavicollis*), and three other species of vole (*Microtus* spp.) constitute 50% of the biomass consumed by pine martens in June (Jędrzejewski et al., 1993). Pine marten are also known to feed on birds (mainly thrushes and woodpeckers), ungulate carcasses, fruit, and mushrooms (Zalewski, 2007; Postuszny et al., 2007; Zalewski et al., 1995; Jędrzejewski et al., 1993).

The black stork is a widespread but rare species inhabiting Palearctic old-growth forests in Europe and Asia. Isolated populations are scattered from Malawi and Namibia to South Africa (Elliott et al., 2018). Black storks breed as single pairs and build nests in large trees, preferably in undisturbed forests (Elliott et al., 2018). In some parts of their range, black storks are cliff-nesters (Elliott et al., 2018). They usually lay clutches of 3–4 (2–6) eggs and raise one brood in the breeding season. Incubation generally lasts 32–38 days and the fledging period is 63–71 days (Elliott et al., 2018). Black storks feed mainly on small fish and amphibians (Kamiński et al., 2018a). The studied black stork population density in central Poland was 1.96 pairs/100 km² of forested area, and the mean distance between occupied nests was 8.9 km (Zieliński et al., 2017).

Forests in central Poland (Lodz Province) are highly fragmented. They cover 21.5% of the province area and are dominated by Scots pine *Pinus sylvestris* (Raport, 2020). The Lodz Province is a lowland, and its climate is transitional between continental and oceanic. The mean annual temperature is 7.8 °C (Kłysik, 2001), and the mean annual precipitation is 582 mm (Wibig and Radziun, 2019).

This study reports five cases of direct pine marten and black stork interactions at three black stork nests in Lodz Province registered by camera traps or network camera (Fig. 1). Pine marten identification on photographs and videos was based on the presence of an undivided yellow-orange patch on the throat and on the black or grey-black colour of the nose (Pucek, 1981). The black stork nests were located in different and non-adjacent forest complexes. The distance from the Kolumna1 nest to the Kolumna3 nest and the Grotniki2 nest was 30.4 km and 55.5 km, respectively. The distance from the Kolumna3 nest to the Grotniki2 nest was 36.8 km. So, undoubtedly, the three nests were visited by different individuals of pine marten. The Kolumna1, Kolumna3, and Grotniki2 nests were situated in oak trees at the heights of 11.5 m, 15.1 m, and 13 m respectively.

In the Kolumna nest in the Kolumna Forest Directorate, a camera trap (Bushnell no-glow 119776) was placed 1.7 m from the nest. The camera trap was set to take one photograph and record 10-second video when triggered, followed by a 1 h period of inactivity. On 1 April

2016, the camera trap recorded one adult black stork guarding the nest throughout the night. On the same day at 21:57 (UTC + 01:00) the camera trap recorded a pine marten trying to enter the black stork nest (Fig. 2). The stork immediately spread its wings and directed its bill towards the intruder. As a result, the pine marten retreated. Ultimately, no eggs were laid, and the nest remained empty during the 2016 breeding season.

Altogether, from 8 February to 30 April 2016, the camera trap recorded the pine marten at this nest 17 times. However, a direct encounter between a pine marten and the black stork was registered only once, on 1 April. All pine marten visits to this nest took place between 17:35 and 05:18, in the dark

In the Grotniki2 nest in the Grotniki Forest Directorate, the network camera (Hikvision IR DS-2CD2522FWD-IS) was placed 1.1 m from the nest. The network camera was available online to all viewers at <https://www.lodz.lasy.gov.pl/bocianyczarne> during the 2017 breeding season. On 1 May 2017 at 22:42 (UTC + 02:00), the network camera registered a pine marten (only one screenshot is available) on the tree behind the black stork nest (Fig. 3) where the parent stork was brooding four eggs. The stork stood up, and the pine marten immediately withdrew. The black stork returned to brooding the eggs. The pine marten was not seen again that night

A pine marten was recorded at the same nest (Grotniki2) on 24 May 2017 at 20:28:00 (UTC + 02:00). The weather was very rainy that evening. The pine marten emerged from under the nest (Fig. 4) where the stork was brooding four small nestlings. The oldest nestling was four days old (hatching day = age one day). The stork stood up, spreading its wings, and turned towards the pine marten. The pine marten withdrew immediately and hid under the nest. The stork stood with its



Figure 2 – Pine marten attempting to enter black stork nest (Kolumna1).



Figure 3 – Pine marten climbing the tree behind a black stork nest where the stork was incubating four eggs (Grotniki2 nest).

wings outspread for about 10 seconds and slowly calmed down. The pine marten was not seen again that night.

At the same nest (Grotniki2) on 19 June 2017 at 01:43 (UTC + 02:00), the network camera recorded a pine marten walking down a large bough towards the nest (Fig. 5). Of the four black stork nestlings that hatched in that nest, two nestlings were predated by the goshawk *Accipiter gentilis* in the first half of June. The two black stork nestlings which remained were lying silently on the nest floor. The age of the older nestling was 30 days. At 01:43:25 the alarmed nestlings raised



Figure 4 – Freeze-frame taken from a video where a pine marten approaches the nest with a black stork brooding small nestlings.



Figure 5 – Freeze-frame taken from a video of a pine marten approaching a black stork nest. No adult black storks were guarding the nest.



Figure 6 – Freeze-frame taken from a video of a pine marten with one black stork egg (Kolumna3 nest). No adult black storks were guarding the nest.

their bodies, spread their wings, and started to utter loud, low-pitched, and guttural growls interspersed with bill clattering. The pine marten stopped about 0.8 m in front of the nestlings and immediately after the pine marten heard the voices of the chicks, it turned back on the same branch and disappeared out of the camera frame. The nestlings calmed down and sat down at 01:45:35. Adult storks were not guarding the nestlings that night. The pine marten was not observed again during the time the chicks remained in the nest. Two nestlings were reared in that nest and the last left the nest on 28 August 2017.

In the Kolumna3 nest in the Kolumna Forest Directorate, a camera trap (Ltl Acorn no-glow 6310WMG) was placed 1.6 m from the nest. The camera trap was set to take one photograph and record 10-second video when triggered, followed by a 1 h period of inactivity. On 14 April 2017 at 22:34, the camera trap recorded a pine marten and one black stork egg in the nest (Fig. 6). The nest was not guarded by adult storks, although it should have been (Janssen et al., 2004). The pine marten first examined the nest contents, then ran along the bough of the tree supporting the nest and returned to the nest. The video ends with the pine marten sniffing the egg. We are almost certain that the pine marten took the egg, as in the next photograph taken by the camera trap on 15 April at 06:26 after a great tit triggered the camera, the nest was without an egg, which means that the camera trap had not been triggered by any living object in the meantime. The black stork, always one specimen, visited the empty nest for a short time during daylight hours on 15, 16, and 19 April, 11, 13, 14, 16, 19, 20, and 21 June, and 10 July. After 14 April 2017 a pine marten visited the empty nest only once, on 4 July 2017 at 5:06 in daylight.

In the cases described above, black storks were observed to effectively defend the nest against pine martens at all stages of the breeding cycle, e.g., when the nest was without eggs, with eggs, and with nestlings. Only in the fifth case (Kolumna3 nest) was a black stork egg taken by a pine marten, but this nest was not guarded by an adult stork. This nest situation was very unusual because the camera trap registered only one black stork on all occasions. There was likely no pair formed at this nest, and that is why the female showed no care for the one egg she had laid.

In the Grotniki2 nest on 19 June 2017, the pine marten even retreated when faced with black stork nestlings. Black stork nestlings at the age of about 30 days are unable to harm an adult pine marten as their beaks are still relatively soft. Our experience from ringing black stork nestlings is that a nestling's bill is hard enough to harm human skin only at the age of about 40 days. The pine marten retreated because it was misled by the low-pitched growls and bill clattering of the nestlings. Bill clattering is used by both nestlings and adult black storks to scare away predators (Janssen et al., 2004). Thus, in a possibly risky situation the pine marten retreated to avoid harmful pecks from already alarmed (potentially large) nestlings or adult black storks, as in black storks at least one adult always guards nestlings day and night until they are about 3–4 weeks old (Janssen et al., 2004).

The pine marten recorded in Belgium devouring black stork eggs (Ornithomedia, 2011) climbed 14 m up the tree, jumped into the nest, fought with an adult black stork and was thrown 14 m down from the tree by the stork, but after a while returned to the nest to finish its meal. We do not know how hungry the pine marten was, but its behaviour (climbing, fighting with the stork) means it is reasonable to suppose that this individual was in good physical condition and able to find food with lower risk involved (small rodents) in the forest. A possible explanation for this case of predation is that there is inter-individual variability in risk-taking behaviour within a population of pine martens and the specimen recorded in Belgium was a bold, risk-taking individual. Bold individuals might be more effective at foraging, but at a potential cost to survival, while shy specimens prioritise survival over risky behaviour (e.g. Réale et al., 2007).

Undoubtedly, devouring black stork eggs or nestlings defended by an adult black stork is a risky behaviour for the pine marten. In Belgium (Ornithomedia, 2011) shortly after the pine marten entered the nest containing four eggs, the adult black stork started to peck the pine marten all over its body, especially trying to hit the head of the marten.

During that time the pine marten turned its back on the stork and was devouring the eggs. While consuming the eggs the pine marten received 37 pecks in the neck and head region within 72 seconds (our counts). We can suppose that pecks to the head region in particular have the potential to cause severe damage to the pine marten. Eventually, the black stork managed to catch the pine marten by the neck, lift it into the air and make it fall 14 m. However, the pine marten returned after 110 seconds and continued to consume the eggs, devouring four eggs altogether (Ornithomedia, 2011).

This paper concludes that pine martens visited black stork nests in central Poland during the breeding season but were scared away where storks were guarding the nests, and as a consequence no brood losses occurred. Generally, it sometimes happens that pine martens predate black stork nests, but the role of the pine marten as a predator of black stork nests might be smaller than previously thought. ☞

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