# Free-ranging dogs (*Canis familiaris*) in Lithuania: their distribution and impact on wildlife

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Vytautas Magnus University, Agriculture Academy, Studentų St. 11, 53361 Akademija, Kaunas district, Lithuania The dog (Canis familiaris) is one of the most common predators in the world with a population of about 900 million, which continues to grow. Only 20% of the world population of dogs are considered pets. There are irresponsibly cared, free-roaming, or completely homeless individual dogs or their groups in the natural environment of Lithuania. The paper represents a study into the distribution of free-ranging dogs in the hunting areas of Lithuania and their impact on wild fauna. A telephone survey was conducted between 2019 and 2022 to find out the location of free-ranging dogs and their contact with wildlife between 2017 and 2021. Six-hundred-and-eighty users of hunting area units agreed to participate in the survey. In places where dogs were frequent, scats were collected and analysed. The conducted survey showed that in 361 hunting area units, the respondents observed free-ranging dogs at least once during the last five years, which makes 39.5% of all hunting area units in Lithuania. The dogs were observed in groups of 2-5 individuals that usually were larger than 15 kg. Free-ranging dogs interact with animals in the environment, the highest proportion of contacts (51.4%) is with roe deer (Capreolus capreolus); 35.4% of those contacts resulted in the death of roe deer. Plant residues were detected in 92% samples of scats, but roe deer residues accounted for the highest biomass consumption (49%).

Keywords: dog, free ranging dogs, feral, fauna, distribution

#### **INTRODUCTION**

The domestic dog (*Canis familiaris*) was domesticated about 32,000 years ago and since then has spread to all continents along with humans (Wang et al., 2016). It is currently one of the most common carnivores in the world, with a population of around 700–900 million that continues to grow. In Europe alone, the rough estimate is about 74 million individuals (Gompper, 2013; Hughes, Macdonald, 2013). Only 20% of dogs in the global population are kept as pets, others are free-roaming or feral (Lord et al., 2013). Around the world,

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free-roaming dogs are known to be observed in natural environments (Amaral et al., 2014; Krauze-Gryz, Gryz, 2014; Silva et al., 2018; Allemand et al., 2019; Gering et al., 2019; Saavedra-Aracena et al., 2021), where they interact with the fauna around them by hunting or chasing it, causing competition for territory and food resources, performing hybridisation with other representatives of the genus (Canis) (Young et al., 2011; Lessa et al., 2016; Wierzbowska et al., 2016; Mella-Méndez et al., 2019; Plaza et al., 2019; Rebolo-Ifrán et al., 2021). Such dogs are effective carriers of zoonoses, parasites, and other diseases (such as rabies, Echinococcus graunlosus) that they can transmit to humans or other animals (Kachani, Heath, 2014; Harriott et al., 2019; El Berbri et al., 2020). Dogs are listed as the third most invasive mammal with the greatest negative impact on biodiversity (Doherty et al., 2016). Although the problem is known worldwide, no similar research has been carried out in Lithuania until now. In this study, the distribution of the population of free-ranging dogs, their interactions with other animals, diet, and occupied territories in the units of hunting grounds of Lithuania were investigated.

#### MATERIALS AND METHODS

To collect information about free-ranging dogs in the wild, representatives of hunting area users were contacted by phone and asked to participate in a survey. The survey was based on the recommendations by Gaižauskaitė and Mikėnė (2014). Information from the users of hunting grounds was collected using a questionnaire consisting of four open and five closed questions about free-ranging dogs observed in the hunting areas in the last five years, their quantity, and size. We asked for information and visual material about contacts of such dogs with other fauna. All collected data were processed statistically by calculating averages and percentages with Microsoft Excel 365.

In this study, dog classification according to human dependence was used:

1. Dependent and restricted: these are the dogs whose survival is completely dependent on a person, for example, dogs living in apartments or dog enclosures that do not have the freedom to move independently and are constantly controlled by their owners.

2. Dependent freedom: these are dogs whose freedom of movement is not restricted, but they receive their main food ration directly from the owner. They include yard and livestock guarding dogs.

3. Homeless: these dogs do not directly depend on humans but use the resources of food and living space provided by humans. Most of the dogs in this group have not yet lost their social connection with people, they do not normally avoid them, but they may feel fear/aggression towards them.

4. Free dogs: feral and free dogs that do not use food or shelter provided directly by humans. There is no evidence of their socialisation with humans, they deliberately avoid contact with humans and live mainly in the natural environment.

This classification allows considering the individual development of social connection with humans and the ecology of dogs (Boitani et al., 2007). According to the breakdown of this classification, dogs of categories 2–4 were studied in this research.

To evaluate the nutritional composition of the canine diet, excrements were collected during winter (January, February) and early spring (March). Dog scats were collected in three areas: 33 samples in Sudargas (Šakiai district), five samples in Ilgakiemis (Kaunas district), and 12 samples in Byliškės (Kaunas district). A total of 50 samples were collected during winter (January, February) and early spring (March). The average sample weight was 4.03 g.

Collected dog excrements were placed in nylon bags with tied ends, placed in a washing machine LG WM4000HWA (LG Electronics Inc., South Korea) and washed on a gentle cycle without any detergents (Orr et al., 2003). After washing, the samples were placed in a dryer LG DLG7151W (LG Electronics Inc., South Korea) at medium heat. The dry samples were removed from the bags and placed in Petri dishes. The dry samples were weighed with an electronic scales SF-400C (Quancheng, China) with an accuracy of 0.01 g. The remnants of bones, feathers, and hair were identified with an EDM11S LCD digital microscope (Elikliv, USA) according to the keys proposed by De Marinis and Asprea (2006) and Teerink (1991). Food composition was expressed in two ways: (1) detectability compared to all excreta, and (2) biomass of the components from the total biomass consumed. The biomass of food components was calculated by multiplying the residue mass by the digestibility factor:

 $M \star K = B$ ,

where M – the residue mass; K – the digestibility coefficient; B – consumed biomass

The following coefficients were used: rodents and insectivores – 23, medium-sized mammals – 50, ungulates – 118, insects – 5, plants – 4 (Goszczyński, 1974; Goszczyński, 1986; Krauze-Gryz, Gryz, 2014).

### RESULTS

Out of 915 representatives of the units of hunting grounds (hereinafter UHG), 680 completed the questionnaire, which is 74.3% of all representatives of Lithuanian UHGs; 235 could not be contacted due to inaccurately provided contacts or their complete absence. Of the UHG representatives who agreed to complete the questionnaire, 361 (53.1%) wrote that they had noticed free-running dogs in the hunting areas under their supervision at least once, which is 39.5% of all UHGs in Lithuania. The remaining 319 (46.9%) representatives did not record free-ranging dogs (Fig. 1).

Comparing the years 2017–2021, the sighting of free-running dogs by the representatives of UHGs grew from 249 UHGs in 2017 to 283 UHGs in 2020 (Fig. 2). In 2020–2021, a drop in the numbers observed may have been caused by the events of 9 June 2020, when numerous puppy mills with terrible conditions for the dogs were discovered in Lithuania (www.lrt.lt) and the public began to actively

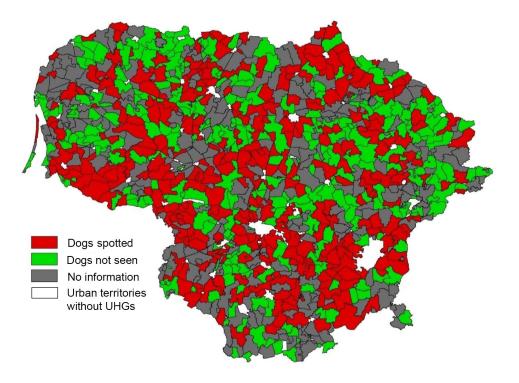


Fig. 1. Data on observed free-ranging dogs between 2017 and 2021 provided by the questionnaire respondents

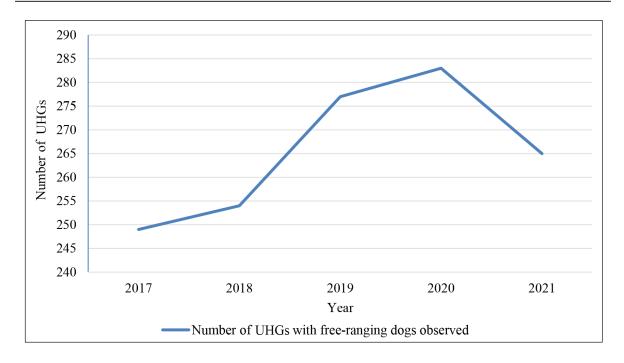


Fig. 2. Dynamics of the number of UHGs with free-ranging dogs observed between 2017 and 2021

pay attention to illegally bred or poorly-cared for dogs. A few months later, an amendment to the animal welfare law was passed, which made it more difficult to purchase animals, strengthened control and responsibility of veterinarians, and ensured that all dogs must be microchipped (Law on animal welfare and protection of the Republic of Lithuania, 2021).

The representatives who completed the questionnaire claimed that dogs were regularly seen in 229 UHGs, usually in the areas near cities. In these areas, the same dogs were seen for more than a week or different dogs were seen every week. In 158 UHGs, dogs spent less than a week or were seen once.

The number of dogs seen per UHG varied from one to 20 individuals. Most often (36% instances of spotting) two dogs were observed. Dogs that were seen alone (19.8%) were in the territory for a short time or were spotted once. According to the respondents, most of the time these dogs were abandoned, escapedlost dogs, or dogs that found themselves in such a situation recently and did not manage to find a group. In 39% of UHGs, dogs formed groups of 3–5 individuals. These groups were in contact with wild fauna most frequently. Five per cent of the groups were larger than five individuals. Such groups rarely last for more than one season, because they are noticeable and begin to cause problems not only for wildlife but also for domestic fauna. As they instil fear in local residents, people do not ignore them and report problems to the elders, which are solved by catching the dogs or hunters dealing with such dogs themselves by hunting them. The average size of the spotted group of dogs was 2.6 individuals. The situation is similar in Central Poland, where 40% of the dog groups seen consisted of 2–5 individuals (Krauze-Gryz, Gryz, 2014).

The respondents were asked to divide the dogs into groups by size: small dogs (up to 15 kg), medium (15–30 kg), and large (>30 kg). Medium and large dogs dominated, accounting for 35% and 34% respectively, with small dogs accounting for 9%. Other representatives of UHGs did not distinguish the size and said that there were dogs of various sizes; they accounted for 22%. The results obtained in our study differ from the study conducted by Polish researchers, where medium-sized dogs dominated (Krauze-Gryz, Gryz, 2014). Such results were possibly influenced by the fact that larger dogs were easier to notice than small ones; since they are seen as a greater threat to the fauna, they attract more attention. Of all dog sightings, 93.9% of the dogs were identified as mixed breeds. Of the dogs spotted whose breeds the respondents were able to identify, the majority were attributed to the breeds of laika and the German shepherd (4.7%).

The collected data show that free-ranging dogs interact with other fauna by hunting, disturbing, and chasing. Sometimes they become prey of predator hunting (Fig. 3). In the graph, sheep, calves, cows, goats, and poultry are classified as farm animals. Foxes (*Vulpes vulpes*), beavers (*Castor fiber*), raccoon dogs (*Nyctereutes procyonoides*), badgers (*Meles meles*), and moles (*Talpa europaea*) are classified as other animals.

Mostly, animals are disturbed by groups of dogs of 2–5 individuals existing for more than one hunting season. Respondents stated that when hunting, dogs were divided into roles depending on the size and composition of the group. If the group consisted of dogs of different sizes, the smaller dogs usually chased the animal, while the larger dogs lay in wait for the animal to be brought towards them and ambushed it.

A total of 319 contacts of dogs with fauna were registered. Free-ranging dogs were most often observed hunting roe deer (*Capreolus capreolus*): 164 cases of such contact were recorded, and 58 (35.4%) of them resulted in the death of a roe deer.

Contacts with other species of fauna were observed up to 20 times, the most common of which were hares (Lepus), red deer (Cervus elephus), and fallow deer (Dama dama). Mortality is dominated by poultry and rodents, with 100% of such contacts resulting in death. Hares were killed in 37.5% of cases, domestic animals (goats, sheep, calves, birds) did not survive in 65.2% of the contacts with observed dogs. Also, free-roaming dogs killed domestic dogs living in farms: the latter did not survive in 80% of cases. Wild boar (Sus scrofa) and foxes survived 100% of encounters with free-ranging dogs. Contacts with moose and red deer were fatal to their young or females. Four instances were recorded when free-ranging dogs became victims of

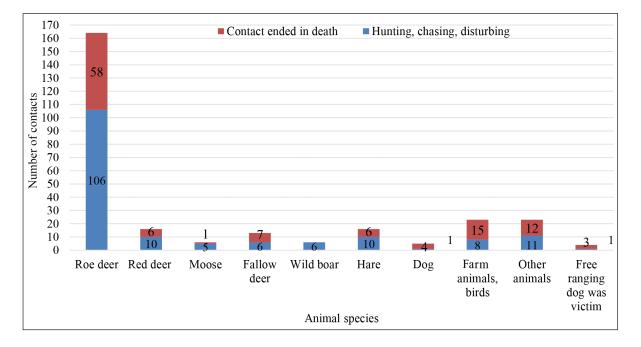


Fig. 3. Contacts of free-ranging dogs with animals registered between 2017 and 2021, according to survey responses

hunting: once a badger killed a dog, and in other instances wolves hunted dogs. Once the dogs managed to spot the wolves sneaking up in time and climbed on hay cones to avoid them.

Remains most frequently found in dog scats were plants, which were found in 94% of the samples collected in Sudargas, 80% in Ilgakiemis, and 91.7% in Byliškės; they accounted for 75%, 68.5% and 60.6% of the remains, respectively. Plant remains were found in 92% (46 samples) of excrement, averaged 71% of the remains, and dominated all collection sites. They consisted of cereal husks, nut shells, cranberries, stems and leaves of herbaceous plants, pieces of charcoal, and needles.

Remains of animal origin were found 41 times (Fig. 4), of which: roe deer remains were found in 26% (13 samples) of all excrement. Animal remains consisted of hair, fur and bones. Wild boar remains were found only in the samples of dogs excrements of the Sudargas area. They was found in 9.1% of the samples. Wild boar bristles accounted for an average of 16.6% of the volume in the excrements found. Hare remains were found in two samples (4%) of excreta; they comprised 100% and 15% of the volume of the remains found. Bird remains were found five times:

three times near Byliškės and twice near Sudargas; they and were detected in 10% of all samples and made up on average 19.6% of the volume of dry samples. These remains consisted of feathers, eggshells, and bones. Rodent remains were found in 26% (13 samples) of excrement and were found in all areas and on average accounted for 49% of excrement volume. The dogs' own hair was found in seven samples. In 11 dry samples, the remains of inedible objects such as ropes, fragments of plastic, pieces of carpet, agricultural film, and aluminium foil were found; these materials were probably ingested by the dogs by feeding on household waste. On average, it came to 17.3% of the excrement volume.

In total, it is estimated that the dogs consumed 2891.3 g of biomass to produce the excrement collected (Fig. 5). Roe deer accounted for almost half of the consumed biomass (1326.4 g). Plants took the second place with 500.3 g of biomass and rodents were the third with 395.4 g of biomass. Hares accounted for 159.2 g. Both birds and wild boars accounted for 5% of the total biomass, with 146.7 g and 137.1 g, respectively. Roe deer, plants, and rodents were the only objects of the diet whose share exceeded 10%. Anthropogenic objects

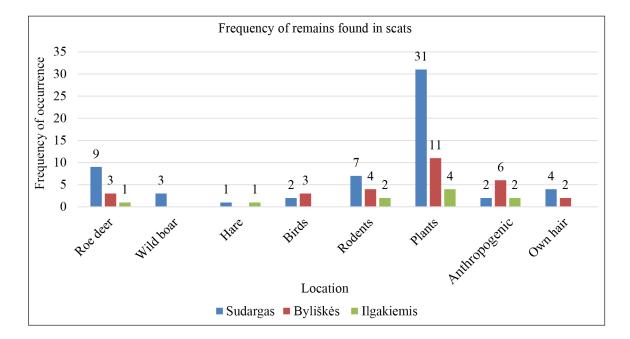
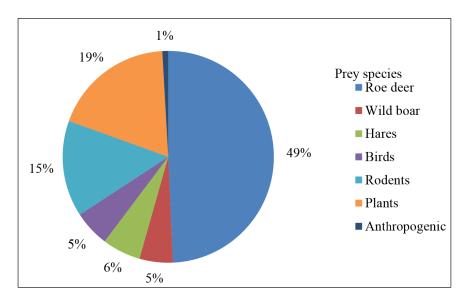


Fig. 4. Frequency of remains found in the samples of free-ranging dog scats



accounted for 24.8 g, and although they had no biomass and were indigestible, they had their share in excrement.

#### DISCUSSION

After cats and rodents, domestic dogs are listed as the third most invasive mammal with the greatest negative impact on biodiversity. They are responsible for the extinction of at least 11 species and threaten 188 endangered species, including 96 mammals, 78 birds, 22 reptiles, and three amphibians. Among these species, 30 are listed as critically endangered (Doherty et al., 2017). In this research we found evidence that the presence of free-ranging dogs affected at least 15 species of wild animals.

Wild animals perceive dogs as a threat, so they change their behaviour to avoid domestic dogs. A study conducted in Australia near Sydney found that walking dogs in parks and national parks reduced bird abundance by 41% and species diversity by 35%, even when dogs were kept on leashes (Banks, Bryant, 2007).

Although dogs are found almost everywhere, their greatest impact is concentrated in Central and South America, South-East Asia, and the Caribbean, where dogs threaten 28 to 30 endangered species. Other hotspots include Australia, Polynesia, and the rest of Asia (Doherty et al., 2016).

**Fig. 5.** Anthropogenic biomass consumed by free-ranging dogs based on the analysis of scat samples

Predation is the most reported impact of dogs on wildlife. Dogs are typically omnivorous and can therefore strongly affect species diversity (Doherty et al., 2017). Free-roaming dogs in New Caledonia killed 19 extremely rare kagu birds (Rhynochetos jubatus) in 14 weeks. Endangered species with small populations are particularly susceptible to such predation attacks (Hunt, Hay, Veltman, 1996). In addition to killing animals, dogs also have other effects on wild fauna: they transmit diseases or parasites, reproduce with other representatives of canines, compete for resources such as food or territory, and disturb animals by chasing them (Woodroffe et al., 2012; Hughes, Macdonald, 2013; Kachani, Heath, 2014; Lessa et al., 2016; Zapata-Ríos, Branch, 2016; Harriott et al., 2019; Plaza et al., 2019; El Berbri et al., 2020).

In the survey of this study, the respondents claimed that in the areas frequented by freeranging dogs, populations of small mammals were scarce, and the growth of the roe deer and fallow deer populations was slower than in regions without free-ranging dogs.

Comparing this study to the study conducted in Poland by Krauze-Gryz, Gryz (2014), who analysed the composition of excrements, residues of plant origin were found in 45% of the samples (94% in our case), but the composition of plant remains did not differ. In Poland, rodents were found in 7% of excrement samples, and in 26% in Lithuania. Deer remains were detected in 12% in Poland, and in 26% of scat dry samples in our study. In both studies, hare remains were detected in 4% of samples. Although the percentages of remains detected differ in the two studies, the main components of the dominant composition of excrements does not.

#### CONCLUSIONS

Free-ranging dogs are regularly sighted in the hunting grounds of Lithuania. They form groups and interact with other fauna in their environment. This problem requires more research but in the meantime, stricter control should be imposed on free-ranging dogs.

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## LAISVAI LAKSTANTYS ŠUNYS (*CANIS FAMI-LIARIS*) LIETUVOJE: PAPLITIMAS IR POVEI-KIS LAUKINEI GYVŪNIJAI

#### Santrauka

Šuo (*Canis familiaris*) yra vienas iš labiausiai paplitusių plėšrūnų pasaulyje. Jo populiacija siekia ~900 mln. ir auga toliau. Tik 20 % pasaulinės šunų populiacijos yra laikomi kaip augintiniai. Lietuvos gamtinėje aplinkoje pasitaiko neatsakingai prižiūrimų, valkataujančių ar visai bešeimininkių pavienių šunų ar jau susiformavusių jų grupių. Straipsnyje pristatomas 2019–2022 m. atliktas laisvai lakstančių šunų paplitimo Lietuvos medžioklės plotuose ir jų poveikio laukinei gyvūnijai tyrimas. Siekiant sužinoti, kur yra laisvai lakstančių šunų, apie jų kontaktą su laukiniais gyvūnais, buvo atlikta apklausa telefonu. Apklausoje sutiko dalyvauti 680 medžioklės plotų vienetų naudotojai. Atlikta apklausa rodo, jog per pastaruosius penkerius metus 361 medžioklės ploto vienete, t. y. 39,5 % visų Lietuvoje esančių medžioklės ploto vienetų, respondentai bent kartą pastebėjo laisvai lakstančius šunis. Tokie šunys sudaro 2–5 individų grupes ir dažniausiai yra stambesni negu 15 kg. Laisvai lakstantys šunys sąveikauja su aplinkoje esančiais gyvūnais, didžiausia dalis kontaktų (51,4 %) pastebėta su stirnomis (*Capreolus capreolus*); 35,4 % jų pasibaigdavo stirnos žūtimi. Augalų liekanų aptikta 92 % ekskrementų, tačiau stirnų liekanos sudarė didžiausią suvartotą biomasę (49 %).

**Raktažodžiai:** šuo, bešeimininkis, laisvai lakstantys šunys, sulaukėjęs, fauna, paplitimas