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Wolves in Poland: an overview of the current state

Key words: wolves, *Canis lupus*, predators, ungulates, forests, Poland

Introduction

The whole territory of Poland is situated within the huge primeval Eurasian natural limit of a wolf (*Canis lupus* L.). However, similarly to many regions all over the world, the limit of the species in Poland was reduced in the past, which was caused by the two following main factors: 1) human hostility as a primary agent and 2) decreasing area of suitable habitats (forests mainly). In last centuries there were clear fluctuations of both wolf range as well as number of the predator in Poland, which were clearly related to the occurrence of political conflicts. Namely, every war caused an increase in wolf number as well as its range and during military conflicts the predator spread from its traditional refuges in eastern Poland to other parts of the country. While, in times of peace, intensive hunting led to the distinct decrease of Polish population of the predator and shrinking of its range (KOWALSKI 1953, OKARMA 2015). The especially intent action against wolves took place after the Second World War, when, in 1955, a wolf control program (“the wolf action”) was established. Then, the government allowed and encouraged to extirpate the predator with all available methods (shooting, using iron traps, snaring, poisoning, picking up pups etc.). From 1950s to 1980s high awards for killing wolves were paid. Periodically, the prize for killing one adult predator could even exceed a mean monthly salary in Poland (OKARMA 2015). As

a result of “the wolf action”, in mid 1970s, the whole Polish wolf population was estimated for ca. 100 individuals occurring only in some areas of eastern Poland (OKARMA 1997). From 1975 to 1998 wolf became a game species, which involved e. g. that the protection period (April–July) was introduced and all killing methods with exception to shooting became forbidden.

It could be said that from 1980s new age has begun for wolves in Poland. Previously, almost none scientific researches had been conducted on the predator, while since 1980s until present they have become more and more frequent as well as more detailed. The obtained results have revised some previous incontestable myths on wolves which functioned in a society, i. a. with regard to the alleged common tendencies of the predator to attack humans or for surplus killing ungulates. On the contrary, the results highlighted positive functions of the predators in ecosystems. These findings, and subsequent more and more positive attitude to wolves in a society, had a great importance to introduce a full protection of the species in 1998.

Present wolf population after protection of the species in 1998

Basic facts on ecology

Since 1998, when a wolf has become a full protected species in Poland, it has been stated the

consequently growth of the Polish wolf population, which has concerned both range as well as wolf number. Before the protection the predators occupied constantly almost only eastern part of Poland (Fig. 1), and attempts to successfully recolonize forests in other regions were unfortunate. This concerned, for example, the forests of the Toruń Basin (central N Poland). In this region wolves periodically occurred in 1980s, however each time they appeared they were shot by hunters (ANDRZEJEWSKI & WOLK 1991, SEWERNIAK 2010). At present, after 20 years of *Canis lupus* protection in Poland, the species occurs in almost all the country, and the biggest areas in which wolf populations are not present are the least afforested regions in central Poland (Fig. 1). The spatial advance of the species range has correlated of course to the distinct increase in number of wolves in Poland (Fig. 2a). Namely, for 1990s the number was estimated for ca. 500–600 individuals (OKARMA 2015), while at present the population is estimated, according to different sources, to be ca. 3–4 times higher. The official data of GUS (Polish Central Statistical Office), based on estimations done by hunters mainly, reported 2139 wolves in Poland in 2016 (GUS 2017).

As it can be seen from the figure 3, the increase has resulted from the wolf recolonization occurred in the western and the central-northern part of Poland mainly. For example, according to the official statistics (GUS 2005–2017), in the Zachodniopomorskie Voivodeship the estimated number of wolves increased from 11 in 2005 to 262 in 2016, while in the Lubuskie from 5 to 263, respectively (Fig. 3). However, because of a methodological reason these data could likely be overestimated. Namely, primary sources for official reports on wolf numbers are separate accounts prepared for each hunting area. However, the average size of the area is ca. 50 square kilometers in Poland which covers a part only of a mean wolf territory (100–350 km²). Thus, it sometimes happens that for some adjacent hunting areas the same wolves are likely reported to official statistics and finally number of the predators is multiplied. This probably concerns the high number reported for 2016 for the Podkarpackie (732 wolves). The overestimation may be also relevant with regard to 2016 for the Zachodniopomorskie and the Lubuskie (262 and 263, respectively; Fig. 3). From the other hand, for some voivodeships the reported official num-

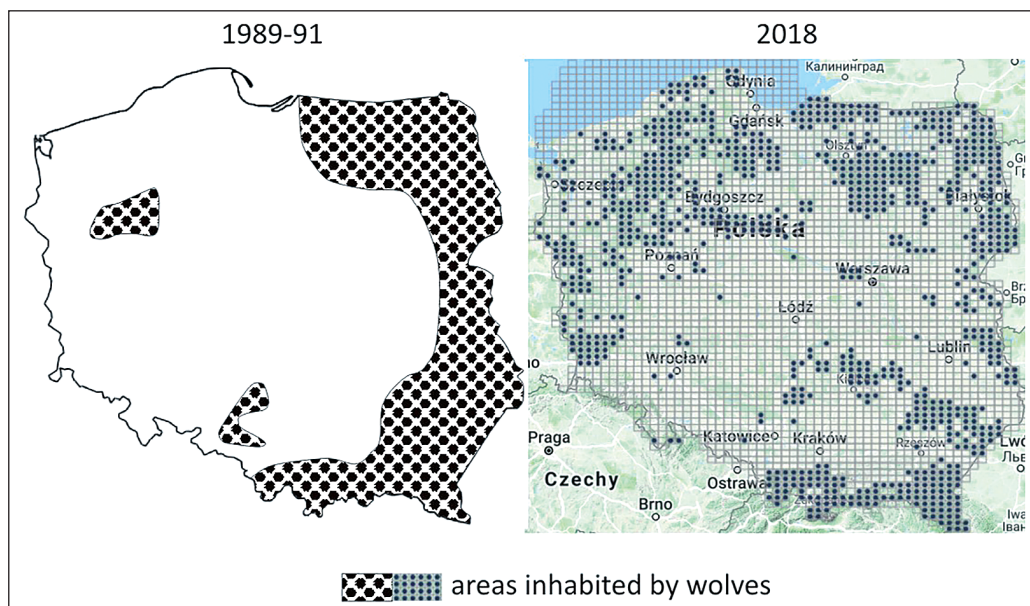


Fig. 1: Areas inhabited by wolves in Poland in 1989–91 (OKARMA 1997, modified) and in 2018 (INSTYTUT 2018)

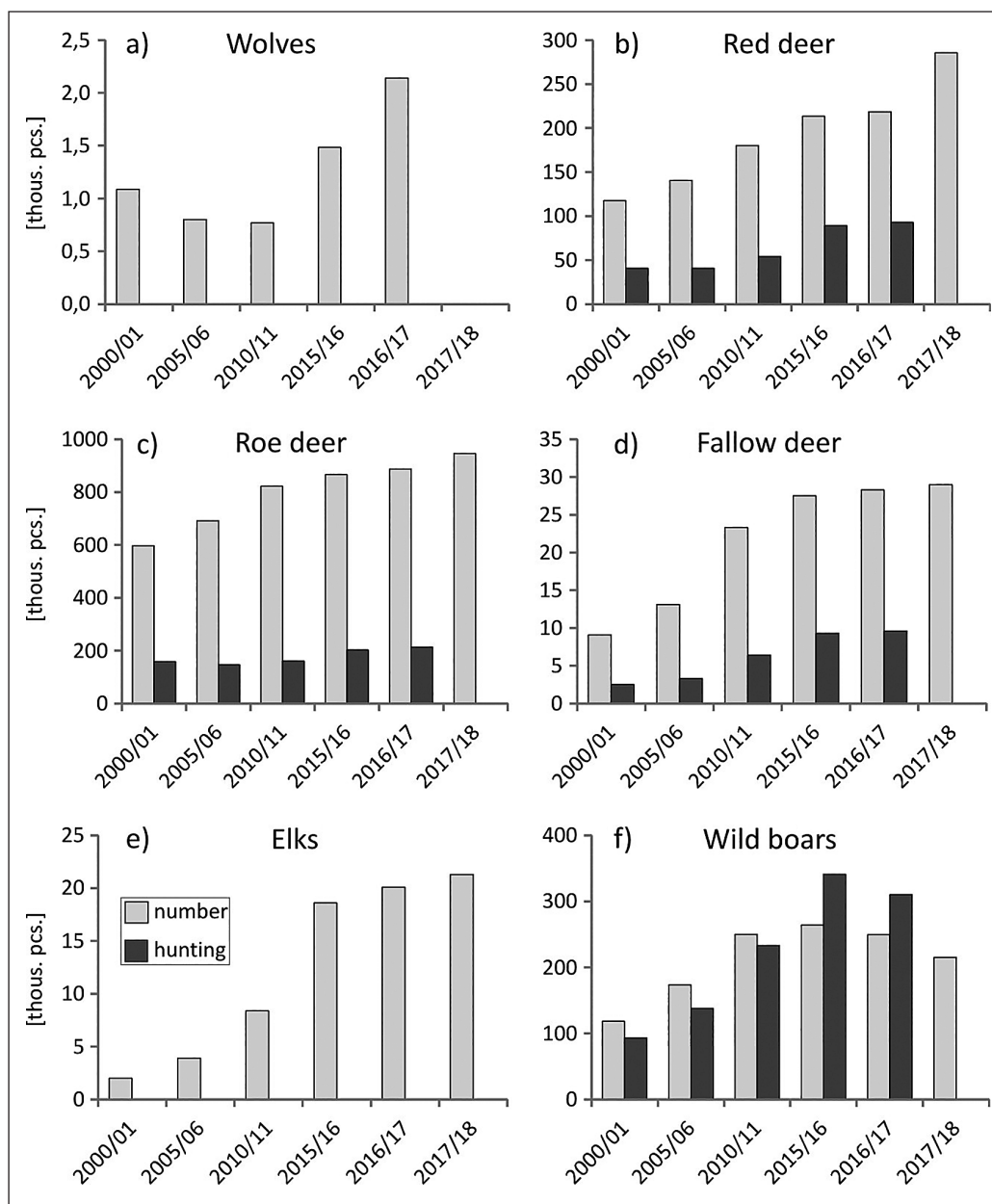


Fig. 2: Number of wolves as well as number and hunting of main game ungulate species in Poland after the protection of wolf in 1998 (GUS 2005–2017)

bers of wolves have been underestimated. This surely concerns the Kujawsko-Pomorskie, in which, both in 2010 and in 2016, wolf number, according to my investigations, was undoubted-

ly higher than reported by GUS (Fig. 3). Thus, finally, taking into account over- and underestimation of wolf number accounted for particular regions, the reported total present Polish wolf

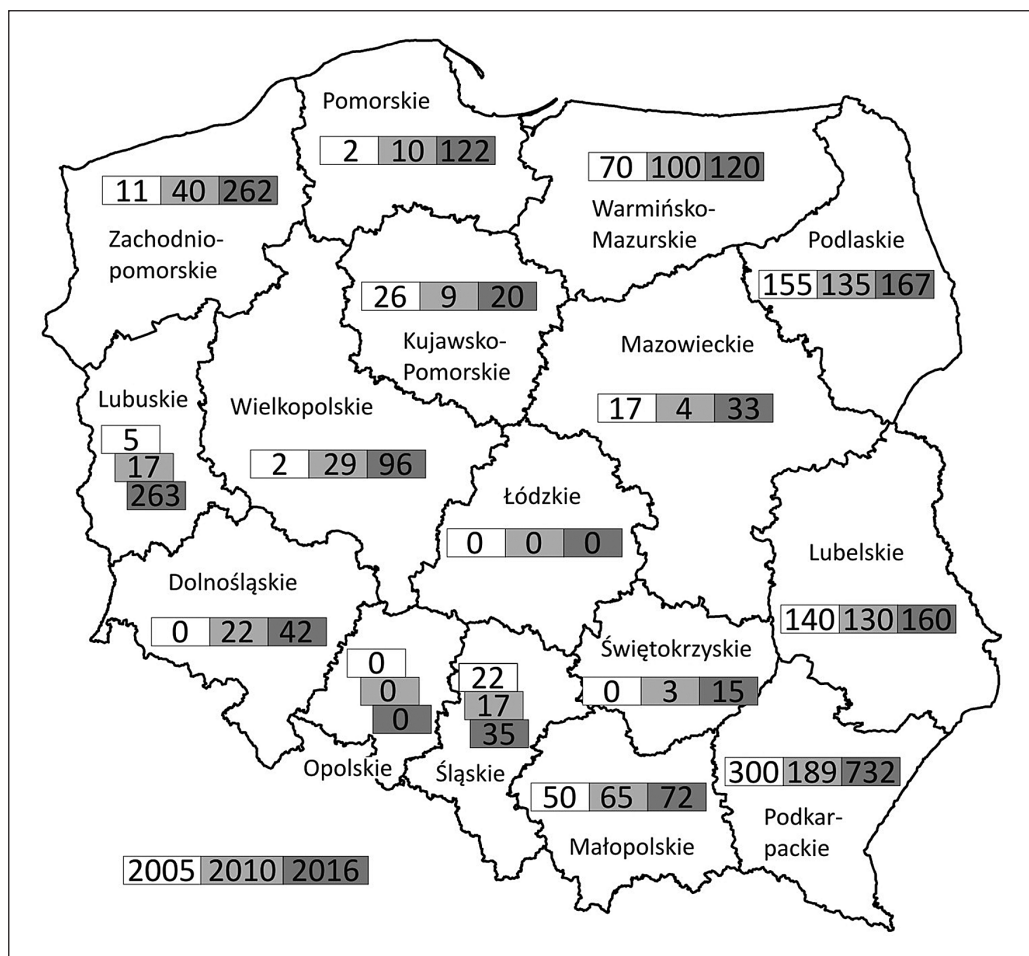


Fig. 3: Number of wolves (individuals) for 2005, 2010 and 2016 by voivodeships of Poland (own elaboration based on GUS OCHRONA ŚRODOWISKA 2005–2017)

population (ca. 2,000 individuals) seems to be reliable.

Based on application of different methods (regular followings, telemetric researches), the sizes of wolf pack territories were reported in Poland from ca. 100 to 350 km². In general, the territories are smaller in mountains than in lowlands. In mountainous areas they cover usually ca. 100–150 km² (ŚMIETANA & WAJDA 1997, NOWAK et al. 2008); however, territories of 4 wolf packs investigated in 2012–2014 by Pirga et al. (2015) were larger (161–276 km²). In turn, in the Białowieża lowland Forest, based on telemetric studies of 4 wolf packs, the territories averaged 219 km²

(137–323 km²). They were utilized unevenly: 90% of radio-locations were found within 74% of the whole territory, and 75% of locations on 42% of the territory (JĘDRZEJSKI et al. 2007). Interestingly, in the recently recolonized forests of central and western Poland the territories were the largest among all investigated in Polish studies and covered ca. 350 km² (SEWERNIAK 2010, MYŚLAJEK et al. 2018). This shows that low density of wolves can distinctly affect the well known negative relation between size of wolf territory and ungulate prey biomass (JĘDRZEJSKI et al. 2007). Namely, when no or low competitive effect of alien wolves occurs on a wolf pack, its

Table 1: Number (thous. pcs.) of main game ungulate species for voivodeships of Poland for 2005, 2010 and 2017 (GUS OCHRONA ŚRODOWISKA 2005–2017)

Voivodeship	Red deer			Roe deer			Wild boar		
	2005	2010	2017	2005	2010	2017	2005	2010	2017
Dolnośląskie	7.5	11.9	32.4	71.7	82	80.4	15.8	22.3	29.7
Kuj.-Pomorskie	5.2	6.8	9.3	36.3	40.1	51.6	7.9	10.8	8.4
Lubelskie	3.3	4.8	8.5	34.4	47.3	56.1	6.4	13.4	11.4
Lubuskie	8.3	9.9	15.3	39.4	48.1	51.7	14.5	15.9	13.7
Łódzkie	2.6	3.6	6.2	33.1	40.5	53.5	4.3	7.3	7.9
Małopolskie	3.8	4.1	8.7	26.6	29.3	45.1	1.8	4.2	6.5
Mazowieckie	2.7	4.4	9.1	37	48.4	72.8	8.4	14.6	15.9
Opolskie	6.3	8.4	12.3	27.7	32.1	43.8	7.5	9.6	8.2
Podkarpackie	6.9	8.4	18.2	33.3	40.3	51.2	4.6	8.5	8.3
Podlaskie	4.1	6	12.3	18.1	22.9	27.1	5.5	9.4	5
Pomorskie	10.7	14	31.6	42.2	52.1	75.5	12.1	17	18.7
Śląskie	5.9	7.8	11.2	28.7	33.4	37.8	5.2	8.1	7.9
Świętokrzyskie	1.4	2.1	4.5	11.2	15.3	31	1.8	3.9	5.5
Warm.-Mazurskie	13.2	15.7	25.9	51.2	59.7	71.5	15.9	24.7	18.5
Wielkopolskie	11.3	15.2	31.3	77.4	85.6	100.1	17.9	23.6	22.8
Zachodniopomorskie	18.4	23.3	48.8	68.1	85.5	96.4	25.6	34.6	26.5

territory can be large even though the density of ungulates is high. This concerns for example the Bydgoszcz Forest (SEWERNIAK 2010, 2015) and forest areas of western voivodeships of Poland (e.g. Zachodniopomorskie, in which very high numbers of red deer have been stated in recent years, Table 1).

The mean number of wolves in a family group equals in Poland on averaged 5–8 individuals and until recently, observations of larger groups have happened but they have been scarce (OKARMA 2015). In last years; however, such encounters have become more and more frequent, especially in recently recolonized areas in which density of wild ungulates is high. For example, in the Bydgoszcz Forest wolf packs including even ca. 15 individuals have been regularly encountered in some last winter seasons (Fig. 4).

Wild ungulates are undoubtedly the main position in the diet of Polish wolves. They constitute ca. 95% of preys as well as of biomass consumed by the predators, which was stated in many studies conducted in many regions of Poland (e.g. JĘDRZEJEWSKI et al. 1992, 2002,

GULA 2004, NOWAK et al. 2011). In turn, the differences were found with regard to the main ungulate species which was dominant in the wolf diet. Some studies reported red deer (*Cervus elaphus*, JĘDRZEJEWSKI et al. 1992, 2002, GULA 2004), while other roe deer (*Capreolus capreolus*, NOWAK et al. 2011) as a main wolf prey. The latter species was also indicated as the most important position in a diet of German wolves in Saxonia (ANSORGE et al. 2006). From a geographical analysis of the dominant wolf prey it can be presumed that larger ungulates like red deer are primarily hunted by wolves in regions with strong and stable *Canis lupus* population. In such regions wolf packs consist usually of higher number of predators. Furthermore, they likely include higher share of adult wolves which are experienced in killing large ungulates. While, in newly recolonized areas young, and thus unexperienced in hunting, wolves dominate, which hunt individually or in relatively small groups rather. These circumstances predispose such predators to hunt on smaller ungulates like roe deer.

It was found in the research conducted in the Białowieża Forest that mean kill rate (estimated



Fig. 4: A wolf pack of 14 individuals in the Bydgoszcz Forest

based on time interval between consecutive kills found in the field) was one prey per 1.9 days per a wolf pack which consisted of, on averaged (3–4 wolf packs were investigated), 4.4 predators (JĘDRZEJSKI et al. 2002).

Wolves as a potential problematic species for human interests

Potential wolf-induced dangers and conflicts to people are usually associated with the three following main fields:

- 1) wolf attacks on humans,
- 2) wolf depredation on livestock and
- 3) conflicts with interests of hunters caused by wolf predation on wild ungulates.

Even though the number of wolves has distinctly increased after protection of the species in 1998, and since then wolf-man encounters have happened more and more frequent, there have not been stated any cases of killings or even injuries of humans by wolves in Poland for the last 20 years. Furthermore, such events have not been recorded in Poland for the entire period after the Second World War. After the War, the only stated aggression of a wolf to a human was reported for the Bieszczady Mountains. Namely,

in 1999 some men had to shelter themselves in a car before a rabid wolf which had followed them and tried to attack the car (NOWAK 2017). Generally and globally, rabies in wolves was indicated as the main factor being associated with wolf attacks on people (LINNELL et al. 2002); however, for last decades the disease have been very rarely stated in Poland with regard to wolves. According to the official data, they were only 18 rabid wolves revealed in Poland between 1970 and 2012, which were recorded in southern part of the country mostly (OKARMA 2015). As stated by LINNELL and ALLEAU (2016), attacks of rabid wolves occur only in areas where the disease is endemic. Besides, the disease has been eliminated from most of Europe in recent years (LINNELL & ALLEAU 2016).

Wolf attacks on people were commonly reported in historical documents from 18th and 19th century, however the reliability of these reports was usually controversial (OKARMA 2015). From the other hand, as it was stated by OKARMA (1997), wolf attacks could surely be more often in the past, because of the frequent occurrence of wars and subsequently wolf predation on unburied human corpses. This got wolves familiar to prey on human meat, and consequently certainly could encourage the predators to attack

people. However, according to recent broad and global researches on historical and present cases of wolf aggression on humans, it was stated that the risk of people being attacked by wolves was incredibly low in the modern world (LINNELL *et al.* 2002, LINNELL & ALLEAU 2016).

Wolf depredation on livestock has been the primary reason for the eradication efforts that have occurred since the early years of pastoralism and continue to occur today (BOITANI *et al.* 2010). In Poland, this approach was strongly relevant to “the wolf action”, when, in the middle of the 20th century, wolves were strongly controlled primarily just because of the significant damages done by the predators in livestock (KOWALSKI 1953). However, many recent studies have shown that at present livestock constitutes only some percent of the eaten biomass by Polish wolves (see e.g. OKARMA 2015). The share was especially low in a recent research on the diet of wolves recolonizing Western and Central Poland. Namely, it was found that domestic animals (interestingly, exclusively cats and dogs) made up 1.0% of the food biomass only (NOWAK *et al.* 2011).

Nowadays, the Polish government pays compensations to farmers for livestock being killed by wolves. For each of some last years; however, the total sum for the whole Poland has equaled ca. 700 thousand zlotys (i.e. ca. 170 thousand euros a year, GUS OCHRONA ŚRODOWISKA 2014–2017). The intensity of wolf-damages has been clearly regionally differentiated. The voivodeships in which the frequency of the wolf attacks have been the highest are the Małopolskie and the Podkarpackie. In both these provinces the compensations paid in last years equaled ca. 200 thousand zlotys a year (Fig. 5). This relatively high sum results from both the comparatively high number of wolves (Fig. 3) as well as the most intensive sheep breeding occurring in these voivodeships compared to other regions of Poland. The secondary Polish “hot spot” of wolf-damages in livestock is north-eastern part of the country (the Warmińsko-Mazurskie and the Podlaskie), in which the yearly compensations have equaled ca. 100 thousand zlotys per a voivodeship in some last years (Fig. 5). So far, in western and central provinces the wolf-damages, if occurred, have been relatively scarce, and thus, consequently, have involved low compensations

paid to breeders (Fig. 5). This occurred despite the fact that the distinct increase in wolf number was stated for these regions in last years (Fig. 3). It could be explained by the fact that sheep breeding, on the contrary to south-eastern Poland, was not popular in these provinces. Besides, number of red deer is very high in the voivodeships of western Poland, when compared to other regions (Table 1).

In case the persistent wolf attacks on livestock occur in a given area, the local government gives an exceptional permission to cull wolves. Such grants, however, are rare. For example from 2014 to 2016 three such permissions were granted each year for the whole Polish territory, which allowed shooting 16 wolves, in total (GUS OCHRONA ŚRODOWISKA 2015–2017).

With regard to domestic animals, killing dogs by wolves have recently become the more and more problematic issue in Poland. Such events have regularly happened, especially in winter months, however the significance of the problem stays difficult to estimate. This results from the official status of such damages: the government does not pay compensations to the owners for the killed dogs so people usually do not report the damages to local authorities. In the elaborated project of the Polish Wolf Management Program (OKARMA *et al.* 2011), it was postulated to include such damages in the compensation system. However, until now, this has not been proclaimed to the applicable regulations. Generally, wolf predation can be seen as potentially conflicted to interests of hunters from quantitative and qualitative point of view. The quantitative approach analyzes how the wolf predation affects numbers of game species and subsequently its consequences for hunting bags. In turn, the latter approach investigates “quality” of wolf preys with regard to a value of a trophy to a hunter.

It is interesting that despite the ongoing clear increase in number of wolves, also number of main game ungulate species have increased in Poland for last years (Fig. 2). The only decrease has been recently stated for a wild boar for some last years; however, this was not caused by wolf predation but by the distinct increase of hunting harvest due to the intention to reduce the risk of African swine fever. The increases in numbers of ungulates concern the whole country; howev-

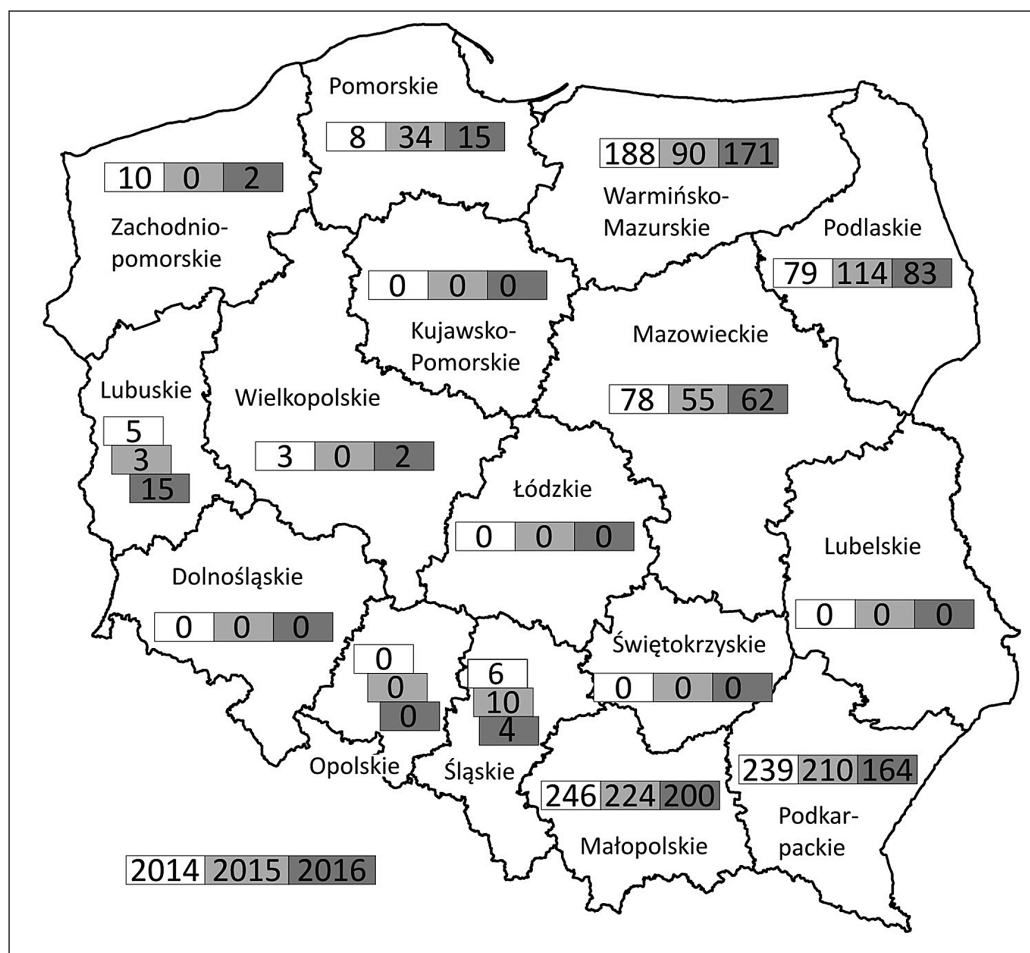


Fig. 5: Compensations (thousands zlotys) paid for damages caused by wolves in voivodeships of Poland in 2014, 2015 and 2016 (own elaboration based on GUS OCHRONA ŚRODOWISKA 2015–2017)

er, the dynamics are differentiated with regard to a game species. The highest increase was stated for the Dolnośląskie with reference to red deer. In this voivodeship the estimated number of the species for 2017 was more than 4 times higher than it was reported in 2005 (Fig. 6). Considering all the voivodeships and the three main Polish ungulate game species (red deer, roe deer and wild boar), the slight decrease was stated only for the Podlaskie and the Lubuskie with regard to wild boar (Fig. 6). Besides numbers of ungulates, also their harvest bags have distinctly increased after proclaiming wolf protection (Fig. 2). The above data proves that so far

densities of game ungulates have been in Poland high enough to enable wolves to successfully reduce numbers of wild ungulates in spite of the clear increase in wolf number that has occurred since 1998. From this point of view, wolf predation has not involved conflicts with interests of hunters, because the occurrence of the predators has not decreased neither harvest bags of game ungulates nor even their numbers.

Canis lupus is an opportunistic predator and it hunts on the most accessible animals (OKARMA 2015). This involves that hinds and juvenile red deer are preferred among wolf preys, and

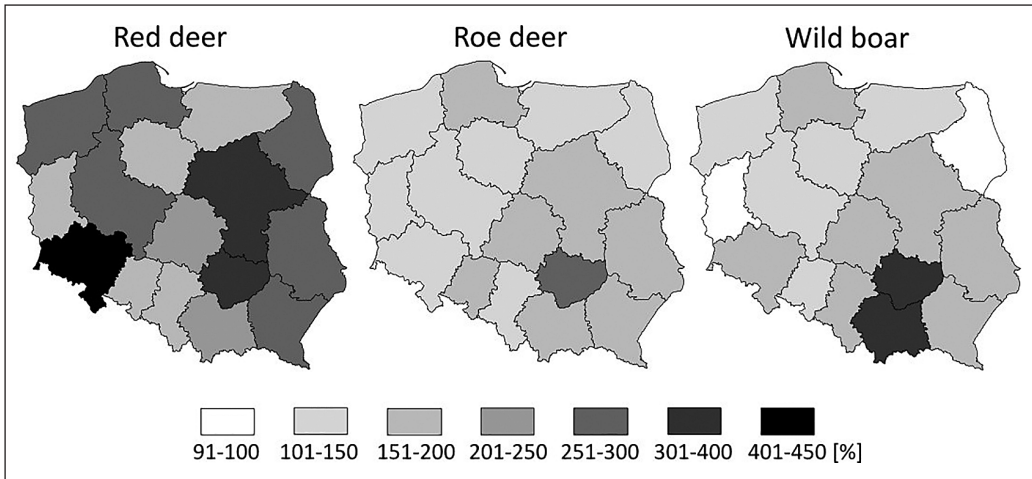


Fig. 6: Relations between numbers of main game ungulates by voivodeships of Poland in 2005 and 2017 (numbers stated for 2005 were taken as 100%; own elaboration based on GUS OCHRONA ŚRODOWISKA 2005–2017)

they are more frequently hunted than expected from their respective shares in the populations (NOWAK *et al.* 2005). I could be expected that this results also from the lower risk to wolves when hunt on such animals. Adult males of red deer, a moose or a wild boar are able to successfully defend against even some wolves (KOWALSKI 1953). From the other hand, it was reported for the Białowieża Forest that even a single wolf was able to hunt on an adult male red deer (JĘDRZEJEWSKI *et al.* 2002). However, in such cases it is usually difficult to arbitrate if the hunted animal had been earlier weakened by another factor (e. g. inaccurate shot of a hunter or a car accident). For the wolf population inhabited the Bydgoszcz Forest the cases of hunting by wolves on adult male red deer have been very rare (SEWERNIAK 2010). Besides, encounters of a wolf with female red deer were video documented presenting that a single hind did not show any fear to a wolf (SEWERNIAK 2015).

In general, it was stated in many studies (see OKARMA 2015) that wolves selectively choose preys. Namely, individuals which less fit and thus are easier to catch are primarily selected killed. For example, in many Polish studies (e. g. OKARMA 1991, GULA 2004, ŚMIETANA 2005) the preference of wolf predation for juvenile as well as old ungulates was found. The condition of the killed animals was investigated in Polish

studies based on the percentage of marrow fat content in femur, mainly. The results obtained in the Bieszczady Mountains clearly showed that in turn of winter and spring wolves killed red deer being in relatively poor condition (OKARMA 1991, GULA 2004, ŚMIETANA 2005). The relation was also found in the Białowieża Forest; however, it was stated only for juvenile but not for adult deer (JĘDRZEJEWSKI *et al.* 2002).

The factor which distinctly affects the hunting behavior of wolves is snow cover. The snow depth is positively correlated to wolf kill rate (deeper snow cover causes that ungulates are killed more often), which was found in the Białowieża Forest by JĘDRZEJEWSKI *et al.* (2002). It happens that the unusual snow conditions involves so called “surplus killing” on wild ungulates, which arouses aversion of hunters to wolves. Such situation happened in harsh winter 2005/06 in the Bydgoszcz Forest, when many ungulates were hunted by the predators within relatively short time (ŁOGIN 2007). However, in that winter, unusual as for Central Poland deep snow cover occurred (ca. 40 cm). Besides, the local populations of ungulates were not familiar to the danger of wolf predation, because the Bydgoszcz Forest was just after the recolonization by wolves (SEWERNIAK 2010). Moreover, some killed ungulates found are not hunted by wolves but feral dogs (Fig. 7).



Fig. 7: Feral dogs hunting a red deer hind in the Bydgoszcz Forest in winter 2005/06

It should be stated that it is commonly highlighted that in normal conditions wolves come back to hunted animals and finally juvenile individuals are entirely consumed while from adults only few remnants are left (e.g. JĘDRZEJEWSKI et al. 1992, 2002, OKARMA 1997, 2015, SEWERNIAK 2010). In turn, they play positive ecological function, especially in winter times when the remnants facilitate scavenger species to survive. In the Białowieża Forest it was found that 33 species only of birds and mammals scavenged, especially during harsh winters, on ungulate carcasses (SELVA 2004).

Main human-induced threats to wolves

Nowadays, the most important human-induced direct threats to Polish wolves are poaching and traffic. Despite the fact that since 1998 *Canis lupus* has been a full protected species, incidents of its illegal killing have been regularly revealed. Primarily, wolves are poached with firearms, and the bulk of illegal wolf shootings is perpetrated in Poland by hunters (REINHARDT et al. 2013). Secondly, wolves are poached as ac-

cidental victims in snares which are set targeting wild ungulates. The real number of poached predators is difficult to estimate. Between 1998 and 2012 there were 25 revealed poached wolves in Poland: 10 were shot and 15 were snared, of which 3 individuals were released alive (REINHARDT et al. 2013). Unfortunately, poachers often kill the biggest predator in an encountered wolf group, which usually is a dominant individual. Such incidents involve serious loss for local populations. This concerned, for example, wolves in the Bydgoszcz Forest. Namely, in 2013 the dominant 8–9 years old female was shot which had bred pups in this area in some previous years (SEWERNIAK 2015).

Traffic has become more and more serious threat to wolves in Poland in recent years. This results from both increasing number of the predator as well as the development of road infrastructure and the general increase in traffic. The number of wolves killed in car or train accidents is difficult to estimate, because such cases are rarely reported to a relevant government agency or scientific unit. The estimated magnitude of losses in wolf populations can be drawn from the data gathered

for the Bydgoszcz Forest. Namely, since 2004 when wolves successfully recolonized the region (SEWERNIAK 2010), there have been 14 documented cases of killed predators in traffic casualties for the Forest (covering c.a. 100 thousands hectares) and some its close adjacent areas. Fragmentation and isolation of wolf habitats, as well as disruption of ecological corridors are indicated as the main indirect threats to wolves in Poland (REINHARDT et al. 2013). Wolf is the specially endangered species for the threats because of huge territories occupied by wolf packs and long daily distances which are regularly travelled by the predators. These threats have become more and more serious in recent years due to the development of transport infrastructure as well as the encroachment of modern settlements into forest areas. The special, and also of rapidly increasing importance, threat to wolves is off-road motor driving, which very violently disturb the predators in their refuges. The problem concerns many forest areas in Poland; however, it is especially detrimental for the nature in military areas. They constitute important wolf refuges, and have been primarily recolonized by the predators in central and western Poland after full protection of the species in 1998 (e.g. SEWERNIAK 2010). However, recently, the military areas have become popular fields for off-road motor activity, probably because of a false opinion functioning in a society that nature within the areas is degraded by soldiers and thus additional damages caused by civil off-road are of little importance.

Summary

The paper introduces main data on ecology of the current wolf population in Poland. The main potential wolf-induced dangers and conflicts to people as well as the most important and timely anthropogenic threats to the predators were also presented. 2016: 2139 wolves were reported for Poland.

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