

## CHANGES IN THE DISTRIBUTION OF THE RACCOON DOG (*NYCTEREUTES PROCYONOIDES*) IN POLAND IN 1992–2015

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### ABSTRACT

The distribution of raccoon dogs in Poland was analysed on the basis of annual bag reports collected from most of about 5000 hunting districts existing in the country. In 1992/93 – before the fox vaccination against rabies, raccoon dogs were rarely hunted, mainly in the north-eastern region of the country. In the hunting season 2002/03 the spread of this species in Poland was found, particularly in western regions of the country. In 2015/16 the raccoon dog was being shot in majority of hunting districts in Poland (60%) but only rarely in the central part of the country and in the Carpathians. The expansion of the species at the turn of the 21st century was most probably driven by a lower mortality rate resulting from a reduced risk of rabies and adaptation to new habitat types.

**Keywords:** raccoon dog, distribution, oral vaccination, rabies

### INTRODUCTION

The raccoon dog, a carnivorous mammal from eastern Asia, had been introduced since 1920s to the European part of the Soviet Union. In 1935 this species appeared in Finland, then in 1950s and 1960s it settled in Romania, Poland, the Czech Republic, Bulgaria, Hungary, Germany and Austria. In 1970s it reached France (Kauhala and Kowalczyk, 2011).

It is assumed that the raccoon dog appeared in Poland in 1955, when first individuals were hunted near eastern borders of Poland. In 1962–1963 it inhabited mainly north-eastern Poland but it was already noted in areas adjacent to the western borders of the country (Nowak and Pielowski, 1964). The situation continued until 1980s, although the species was then more often hunted also in some other regions, especially in the

north-western and eastern parts of Poland (Pielowski et al., 1993).

At the end of the 20<sup>th</sup> century the number of cases of rabies increased in wild animals in Poland, especially in red foxes. In 1992 there were 2079 cases of rabies found among the species, and only 470 among other wild animals – including 231 among raccoon dogs. Therefore in 1993 – in voivodeships close to the western border of Poland – the oral vaccination of red foxes against rabies began. In the following years the fox vaccination has spread to the western part of Poland and certain central voivodeships, and in 2002 the treatment covered the entire country. As a result, a marked decline in the prevalence of rabies among wild animals was observed in Poland and in 2009 the

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number of rabies cases amounted only to 8, including 6 foxes and 2 bats (Program..., 2015).

The vaccination against rabies was mentioned as the most important reason for the increase in red fox abundance in Poland in the 1990s and early 2000s (Kamieniarz and Panek, 2008). Therefore it can be expected that this treatment affects also the course of raccoon dog expansion. The aim of this study was to describe changes in the distribution of raccoon dogs in Poland directly before as well as after the introduction of vaccination against rabies.

## MATERIAL AND METHODS

Changes in the distribution of raccoon dogs in Poland were analysed on the basis of data concerning the number of hunting districts (the average area of 50 km<sup>2</sup>), where at least one individual of this species was culled in a given year. This number was being compared with the number of all hunting districts with the available data. The information came from annual reports from the hunting districts leased by hunting clubs (4.7 thousand districts, that is 93% of all the units in Poland) that were collected in the database of game monitoring carried out by the Polish Hunting Association and its Research Station in Czempin. The data covered hunting seasons (from 1<sup>st</sup> April till 31<sup>st</sup> March) from 1981/82 to 1995/96 and from 2002/03 to 2015/16, as in the years 1997–2001 the raccoon dog was removed from the game species list. This species was shot in Poland occasionally during hunts for other animals.

The following hunting seasons have been chosen for the below analysis:

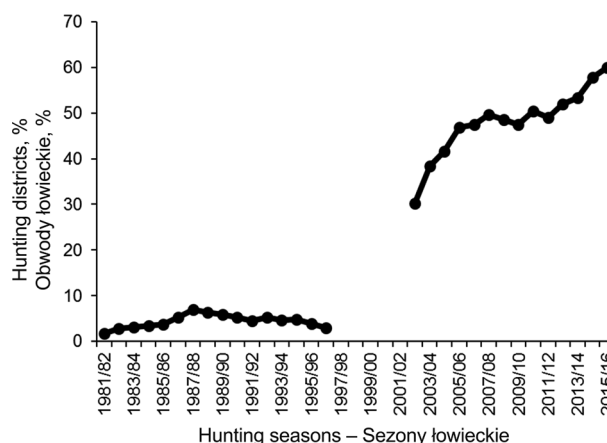
- 1992/93 – before the fox vaccination in Poland
- 2002/03 – the fox vaccination had been already present in western Poland for several years but just started in most of the eastern part of the country
- 2009/10 – the vaccination campaign covered the whole country for several years; the year with the smallest number of rabies cases found among wild animals in Poland
- 2015/16 – vaccinations were stopped in the western part of Poland due to the lack of rabies cases among wild animals, excluding bats (Program..., 2015).

The percentage of hunting districts in which raccoon dogs were culled in the above mentioned seasons

was calculated for the whole country as well as for some selected regions. Firstly, the hunting districts were grouped into 49 hunting regions (until the 1998 administrative reform these regions were consistent with former voivodeships). Secondly, these regions were divided into the western group (W Poland), where the vaccination action started in 1993–1995 (approximately to the line between Gdańsk and Katowice), and the eastern group (E Poland), where this treatment was initiated mainly in 2002. Because almost all hunting districts existing in the country were taken into account in our analyses, no statistical tests were used to compare the observed variation in the percentage of districts with raccoon dog cull.

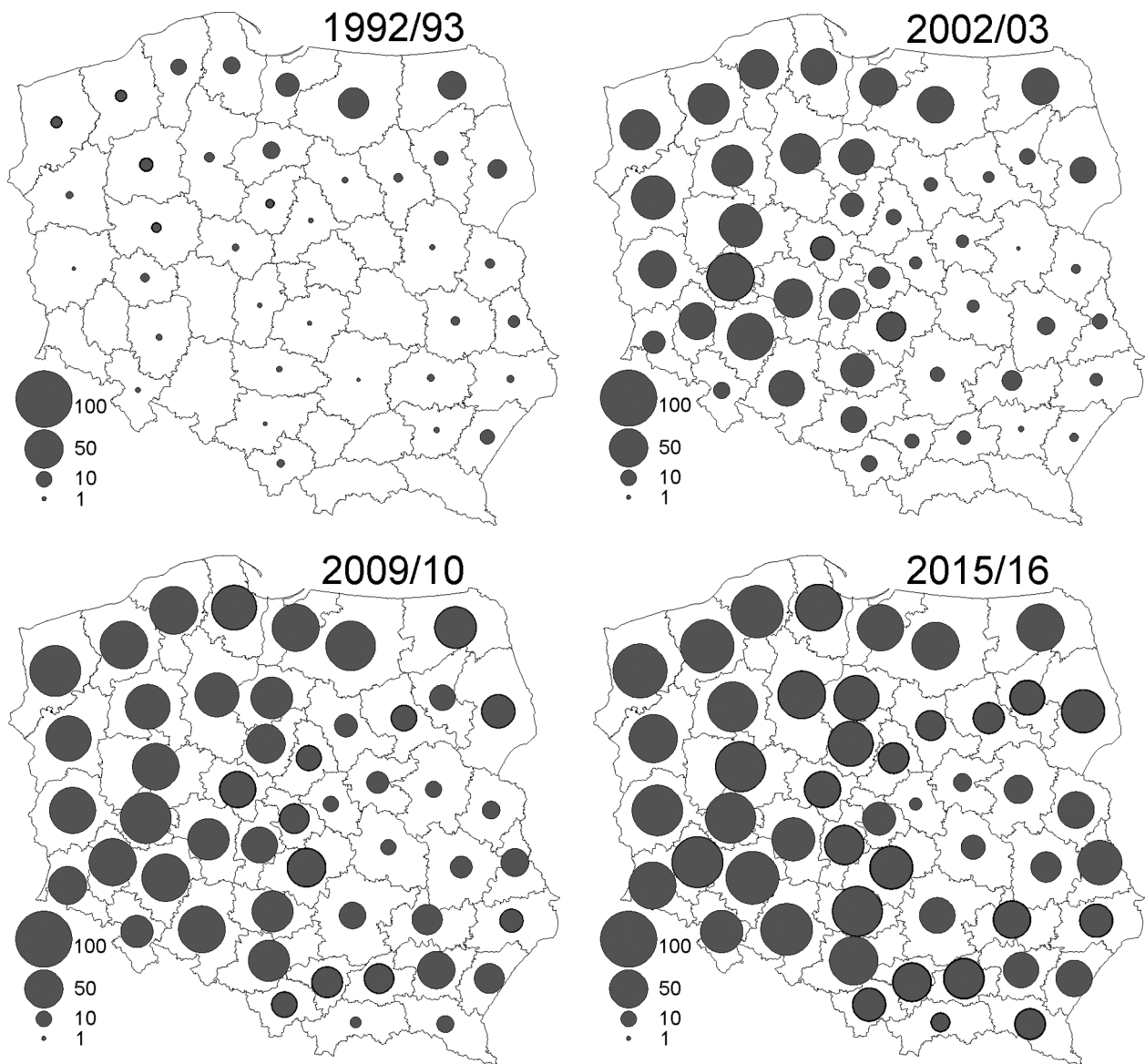
## RESULTS

In the hunting season of 1992/93 the data concerning the raccoon dogs' bag came from 5.5% of the total number of hunting districts in the country. It was a typical situation for the turn of the 1980's and the 1990's (Fig. 1). This species was then more often hunted in the north-eastern region of Poland (Fig. 2). Other sites of the species' occurrence were situated mainly



**Fig. 1.** Changes in the share of hunting districts with raccoon dog cull in Poland during the hunting seasons of 1981/82–2015/16 (from 1997 to 2001 the species was not culled because it was excluded from the game species list)

**Rys. 1.** Zmiany udziału obwodów łowieckich w Polsce, w których odstrzelono jenoty w sezonach łowieckich 1981/82–2015/16 (od 1997 do 2001 roku nie był obiektem polowań z powodu nieumieszczenia tego gatunku na liście zwierząt łownych)



**Fig. 2.** Percentage share of hunting districts where raccoon dogs were culled in a given hunting region in Poland in the seasons of 1992/93, 2002/03, 2009/10 and 2015/16

**Rys. 2.** Udział procentowy obwodów łowieckich, w których odstrzelono jenoty w poszczególnych okręgach łowieckich w Polsce, w sezonach 1992/93, 2002/03, 2009/10 i 2015/16

in eastern and north-western parts of the country. Consequently, raccoon dogs were culled in 3.4% of hunting districts in W Poland and in 6.8% in E Poland.

In the 2002/03 season raccoon dogs were hunted already in 30.2% of hunting districts. This species was regularly shot in the north-eastern and in the entire western part of the country (Fig. 2). It was culled less

often in central and eastern Poland, and in the Carpathians it still was not being hunted at all. Therefore, raccoon dog bag was then recorded in 47.0% of hunting districts in W Poland and in 17.0% in E Poland, so a considerably higher increase in this index of the species occurrence in relation to the above mentioned season took place in W (14 times) than in E (2.5 times).

A growing trend also characterized the next years. In the hunting season of 2009/10 the information about raccoon dog cull came from as many as 47.5% of hunting districts. The share of districts in which this species was hunted grew especially in south-eastern as well as in north-eastern Poland (Fig. 2). Taking into account the two parts of Poland, this share amounted to 64.6% in W and 33.9% in E. This means that a clearly higher increase compared to the previous season occurred in E (2.0 times) than in W (1.4 times).

In 2015/16 raccoon dog was shot in over half (60,0%) of hunting districts in Poland. In this season, hunting regions with the high share of areas with raccoon dogs' bag spanned the majority of the country, except for its centre and the Carpathians (Fig. 2). The value for W Poland was 77.1% and 46.4% for E Poland, thus the scale of increase in relation to the 2009/10 season was similar in the two parts of the country (1.2 times and 1.4 times, respectively).

## DISCUSSION

The colonization success in Europe the raccoon dog owes to its plasticity and high reproduction rate (Kauhala and Kowalczyk, 2011). The expansion of the raccoon dog in Poland, whose rate increased in the 21<sup>st</sup> century, most probably resulted from its growing density in the areas already inhabited by the animals that might have been caused by a reduced mortality rate in this species. The mortality rate was sometimes particularly high in early spring and autumn – in the weaning period – as a result of greater pressure from predators (including domestic dogs) and rabies (Kowalczyk et al., 2009; Włodek and Krzywiński, 1986). Therefore, changes in the occurrence of the rabies could have been one of the factors supporting for growth of the raccoon dog population. In the end of 1980s the species became the second, following the red fox, vector of the disease; however, the epizootic risk for both species clearly decreased only in the middle of 1990s that is after the start of a campaign of dropping oral vaccines to immunize foxes against the rabies virus (Smreczak, 2003). This trend continued in the following years and was especially visible after 2008 when a radical decrease in morbidity occurred (Program..., 2015). Similarly, in Lithuania about a half of the examined raccoon dogs proved to be positive

for vaccination indicator and the prevalence of rabies cases in these animals considerably decreased in this country as a result of the vaccination campaign (Zienius et al., 2011). The observed pattern of changes in the occurrence of raccoon dogs in various parts of Poland was fairly consistent with the development of vaccination action in the country. Such a correlation in time and space should not be regarded as a strong evidence, but these findings undoubtedly support our prediction that the vaccination against rabies affects spreading raccoon dogs in Poland.

Similar relationship probably occurred in another alien carnivore species in Europe. In Germany – during the period of rabies eradication (from 1983), the growth of raccoon population was observed and the distinct increase in its population size and range started in the second half of 1990s (Tomaschek, 2008). In the 20<sup>th</sup> century raccoons were only rarely met in Poland (Głowaciński, 2011) and in the 21<sup>st</sup> century they settled especially in north-eastern parts of Poland – adjacent to Germany (Kamieniarz and Panek, 2008).

However, also other factors probably influenced the abundance of raccoon dogs in Poland during last decades. For example, in the 1990s another raccoon dog mortality factor, namely hunting, was periodically eliminated. In 1997–2001 – for some unknown reason – the raccoon dog was not on the list of game animals in Poland. This most probably helped in the territorial expansion of these animals, and therefore they occurred and thus were available for hunters in a much higher percentage of hunting districts when they re-entered into the game species list than some years ago. Re-opening of the hunting period for the raccoon dog did not stop the process of the expansion of the species. The raccoon dogs were hunted only in part of the inhabited districts and, moreover, the cull rate was relatively low (Kamieniarz and Panek, 2008).

The spread of the raccoon dog in Poland can also be supported by the observed adaptation to new habitat types. The species prefers deciduous forests with bogs and lakes as well as river valleys and other areas with abundant shelters, especially near water reservoirs (Drygala et al., 2008; Jędrzejewska and Jędrzejewski, 2001; Kauhala, 1996) but nowadays it also inhabits agricultural areas (Drygala et al., 2000). It is confirmed with sightings in western Poland, i.e., in agricultural areas with a low forest cover, which is

nowadays regularly inhabited by the raccoon dog. Although first encounters with the animals took place in habitats typical of the species there, they were soon observed also in small patches of woods surrounded by arable fields, and even in open farmland. In the last case, during seasons with no crop vegetation, the animal took shelter in seasonally dry, underground drain lines and stacks of pressed straw bales (Kamieniarz and Panek, 2008). The advantage of agricultural areas is not only shelter, but, most probably, also high availability of food, including carrion and maize corn, which this omnivorous species is eager to use (Drygala, et al. 2013; Jędrzejewska and Jędrzejewski, 2001; Sutor et al., 2010). Research of foxes' diet indicates that there is a big availability of domestic, as well as wild animals carrion in agricultural areas in western Poland (Panek and Budny, 2017). At the same time, there was registered a multiple increase in maize acreage (grown for grain) in the entire country (Krasowicz and Kuś, 2010).

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## ZMIANY W ROZMIESZCZENIU JENOTA (*NYCTEREUTES PROCYONOIDES*) W POLSCE W LATACH 1992–2015

### ABSTRAKT

Jenot, gatunek pochodzący ze wschodniej Azji, od lat dwudziestych ubiegłego wieku był przesiedlany do europejskiej części ówczesnego Związku Radzieckiego. Za początek jego występowania w Polsce przyjmuje się 1955 rok, kiedy pierwsze jenoty odstrzelono przy wschodniej granicy kraju. W kolejnych dekadach gatunek najczęściej był rejestrowany w północno-wschodniej części kraju, ale także w innych regionach, zwłaszcza w północno-zachodnich i we wschodnich. Celem badań było opisanie zmian w występowaniu jenota w Polsce przed i w trakcie akcji szczepień lisów przeciw wściekliznie, którą rozpoczęto w 1993 roku. Występowanie jenota opisano z wykorzystaniem danych corocznej sprawozdawczości łowieckiej – z większości spośród blisko 5000 obwodów łowieckich w Polsce, zgromadzone w Stacji Badawczej Polskiego Związku Łowieckiego w Czempiniu. Analizowano zmiany udziału obwodów z pozyskaniem tego gatunku w 49 okręgach łowieckich (zajmowały one obszar podobny jak województwa sprzed reformy administracyjnej w 1998 roku). Dodatkowo porównano sytuację na zachodzie kraju (okręgi do linii Gdańsk–Katowice), gdzie szczepienia rozpoczęto w latach 1993–1995, oraz na wschodzie kraju, który w całości został objęty szczepieniami przeciw wściekliznie w 2002 roku.

W sezonie łowieckim 1992/93 jenoty pozyskiwano w nielicznych obwodach łowieckich w kraju (5,5%), częściej na wschodzie (6,8%) aniżeli na zachodzie Polski (3,4%). Po dziesięciu latach udział obwodów łowieckich z pozyskaniem jenota zwiększył się kilkukrotnie (do 30,2%), w większym stopniu na zachodzie (47,0%), aniżeli na wschodzie kraju (17,0%). Taki trend utrzymywał się w Polsce w kolejnych latach, ale udział obwodów z pozyskaniem badanego gatunku wzrastał w większym stopniu na wschodzie kraju (2009/10: 47,5%, w tym 64,6% na zachodzie i 33,9% na wschodzie). W ostatnim okresie jenot rozprzestrzenił się natomiast z podobną intensywnością na zachodzie i wschodzie kraju (2015/16: łącznie 60,0% obwodów z pozyskaniem, w tym 77,1% na zachodzie i 46,4% na wschodzie).

Ekspansja jenota w Polsce na początku XXI wieku była najprawdopodobniej konsekwencją ograniczenia śmiertelności – w następstwie zmniejszenia ryzyka zachorowania na wściekliznę oraz adaptacji gatunku do nowych środowisk, zwłaszcza terenów rolniczych.

**Słowa kluczowe:** jenot, rozmieszczenie, szczepienia doustne, wścieklizna