

The wisent as food supply for large predators and necrophages

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Abstract: Analysed were interactions among large predators, necrophageous species and wisents of Bieszczady Mountains. Considered were data obtained in the continuous program for monitoring of wisent population in forest districts of Bieszczady since 2002. First confirmed successful attack of a bear was recorded in 2006 at Baligród Forest District. The frequency of bears and wolves attacks upon wisents become more frequent together with growing wisent numbers and the extent of their range. With photo traps, confirmed was feeding upon wisent carcasses by: wolves, brown bears, lynx and golden eagle. The amount of wisent carcasses available annually for necrophagous species in this region is estimated for about 3 tons.

Key words: European bison, Bieszczady Mountains, large predators, carrion eaters, biomass

Introduction

Wisents are present in the environment of Bieszczady since the 60-ties of 20th century. The first stage of their reintroduction was initiated at Stuposiany Forest District in 1963, and the second in 1980 at Komańcza Forest District. Because of those two stages, there are now two separate subpopulations of wisents: eastern (so called Tworylne and Górny San herds) and western (so called Baligród herd) (Perzanowski & Paszkiewicz 2000; Perzanowski & Olech 2014). As a result of reintroduction in the western part of the range, wisents are present in the natural environment of this area for over 40 years. During that time, wisents have dispersed, and the northern limit of their range has reached the river San at Forestry Malinki of Lesko Forest District

(Perzanowski 2002–2018). Natural conditions of Bieszczady range allowed for their full assimilation in local environment, and this species became a permanent component of Bieszczady ecosystems.

Wisents, what was already described in earlier papers, being large herbivores, require vast areas for proper functioning of their population (Kraśnińska & Kraśniński 2017; Perzanowski & Marszałek 2012). They move within their annual home range in a rotational way, searching for optimal habitats and coexist there with other wildlife including ungulates and predators. Because of their body size they do not have many natural enemies, but they may become the prey for large predators (Okarma & Tomek 2008). On the other hand, such dead animal because of its body mass is a valuable source of food for all necrophagic species as well as for predators feeding upon the carcass. The aim of this paper is to call the attention towards that aspect of wisents' presence in natural mountain environment of Western Bieszczady, since presently there are only few places in Europe where regular interactions between large predators and their prey can be observed. In a majority of the continent, large predators have withdrawn from earlier inhabited areas due to large scale deforestation and encroaching build up (Paszkiwicz 2014). However, environmental conditions of Bieszczady and historic changes in the region allowed for the maintenance of the flagship group of those species until present time.

Study area

Presented data concern the western wisent subpopulation of Bieszczady i.e. so called Baligród herd. This herd dwells at the area of four forest districts: Baligród, Cisna, Komańcza and Lesko with total size of 72 249 ha. The whole region has a mountainous character, with the highest peak Chryszczata of an elevation of 997 m above sea level. The lowest elevations there are of 316 m a.s.l. The most preferred by wisents however are elevations within 550 – 750 m a.s.l. (Perzanowski *et al.* 2008). Human density in this area is low – 25 people/km² on average, while in Cisna commune it is only 5 people/km² (Luboński 2000). The degree of urbanisation is very low and the share of forest cover is close to 90% (Perzanowski *et al.* 2008). The whole area is highly mosaic, with a mixture of various natural forest stands, openings and forest meadows. Such environmental conditions favour the occurrence of game species like roe deer (*Capreolus capreolus*), red deer (*Cervus elaphus*) and wild boar (*Sus scrofa*) as well as protected large predators including brown bear (*Ursus arctos*), wolf (*Canis lupus*), lynx (*Lynx lynx*), and even the golden eagle (*Aquila chrysaetos*). As a result of reintroductions performed there since 1980, a new representative of large herbivores – the wisent, has permanently established.

Materials and methods

Because the wisent belongs to protected species, its population in Bieszczady was subject to the program of continuous monitoring (Perzanowski 2002–2018). This program was initiated in 2001 and includes: spatial distribution, migrations, health status, mortality, sex and age structure and genetic analyses (Perzanowski 2002–2018, Marszałek & Perzanowski 2018).

Required is also the determination of the cause of death of all recovered dead wisents with a division for natural (age, diseases, predation, injuries) and anthropogenic (poaching). During the autopsy, also the age, sex and general health status of the animal before death (diseases, emaciation) are determined. The autopsy is performed by the county veterinarian at the presence of representatives of State Forests and the Carpathian Wildlife Research Station of Polish Academy of Sciences at Ustrzyki Dolne.

Since 2013, the program of wisents' monitoring was supplemented with a system of photo traps using the equipment of Ecotone Ltl Acorn. Usually, after situating the wisent mortality site, and after the autopsy, one or two photo traps were installed in a near vicinity. They were recording during a couple of weeks up to over a month, depending on the state of the carcass and confirmed presence of predators. Data were retrieved usually every several days (an exchange of memory card) (Fig. 1).

That provided an additional opportunity for monitoring the fate of dead animals. Those data are a valuable and reliable source of information how wisent carcasses are utilised by necrophages and predators. Localisations of sites where dead wisents were recovered, were introduced to database in GIS and processed with the software ArcView 9.2. This database is complementary with the standard for forest numerical maps. This allows for characteristics of sites where dead wisents were found. In this paper used were data from films and photos collected with photo traps, under the framework of continuous monitoring of wisent population within Forest Districts of Baligród and Lesko (the project: "Continuous monitoring of wisents at the area of Forest Districts in Bieszczady").

Results and Discussion

In the past, severe winters were the main factor in the regulation of wisent numbers, however significant also was the selective pressure of predators (Kraśńska & Kraśński 2017). In XIX century, several cases of predation by bears and wolves were recorded at Białowieża (Karcov 1903). However in last years only few cases of wisents being killed by wolves were reported there

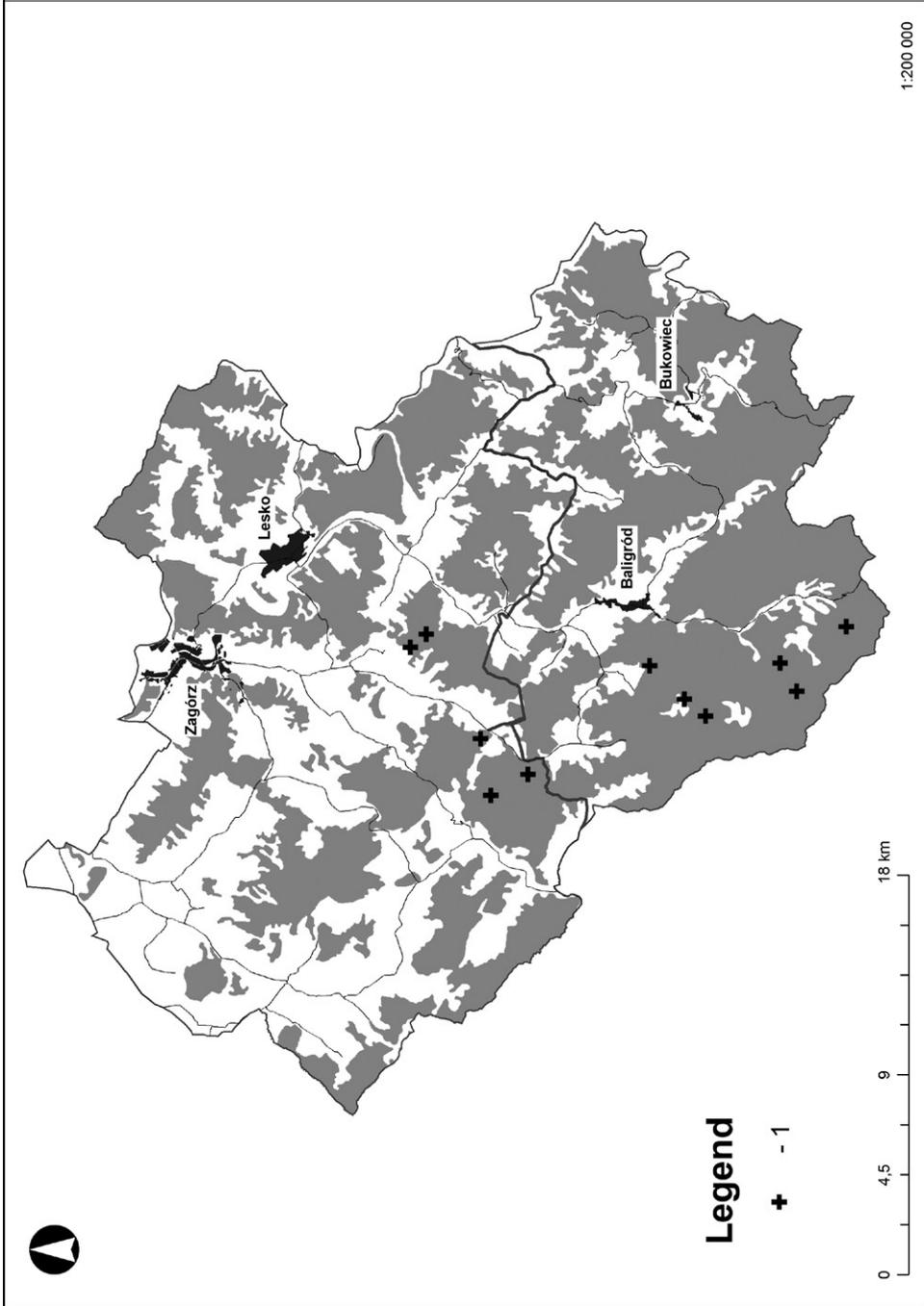


Fig. 1. Sites of photo traps set in Bieszczady in vicinity of wisent carcasses.

(Kraśńska & Kraśński 2017). It was confirmed by Jędrzejewski *et al.* (2000) through analyses of predation by wolves in Białowieska Forest – wisents were only a marginal component of wolves' prey in years 1985 – 1996. According to Pucek *et al.* (2004), wisents in Białowieska Forest presently do not have natural enemies. Khoyetskyy (2010) reports that in Ukraine between 1999–2010, there were only 2 cases of wisents being killed by brown bears.

In Bieszczady though, the pressure of predators seems to be more significant than in other areas inhabited by free ranging wisents. Both wolves and bears actively hunt wisents there. Between 2000–2013, among 84 recovered dead wisents, 16 were killed by predators (Perzanowski *et al.* 2014). The first effective attack of brown bear upon a wisent (several years old cow) was recorded at Baligród Forest District in 2006. Since then an increase of frequency of attacks of this predators on wisents is observed. During this monitoring program reported were 13 of such cases, and one of them was particularly interesting since in one site two dead wisents were found (Tabl. 1).

Table 1. Causes of mortality cases of wisents from Baligród herd between 2014–2018

Cause of death	Forestry District				Total
	Cisna	Baligród	Lesko	Komańcza	
Age	0	2	4	1	7
Predators	1	3	4	0	8
Injures	1	5	0	1	7
Diseases (other than TB)	0	4	2	3	9
Bovine tuberculosis	0	0	0	0	0
Poaching	0	0	1	0	1
Unknown	0	5	1	7	13

First suspicions concerning potential attacks of wolves were raised at Baligród Forest District in 2006, when two dead calves were recovered, possibly trampled by fleeing herd, however injuries of one calf indicated bite marks of wolves. In 2011 a dead calf was found at Lesko Forest District. Tracks on the snow suggested that it was separated from the herd and bitten to death by a wolf pack (Tabl. 2). In 2019, in the same Forest District the first fully documented attack of a wolf pack upon wisent was recorded (Tabl. 1).

Together with an increase of wisent population in Bieszczady, grows also the home range of Baligród herd (Perzanowski, Januszczak 2010). It is noticeable, that within the area being inhabited by wisents, first their interactions with predators take place only after several years since the first appearance of wisents (Tabl. 2).

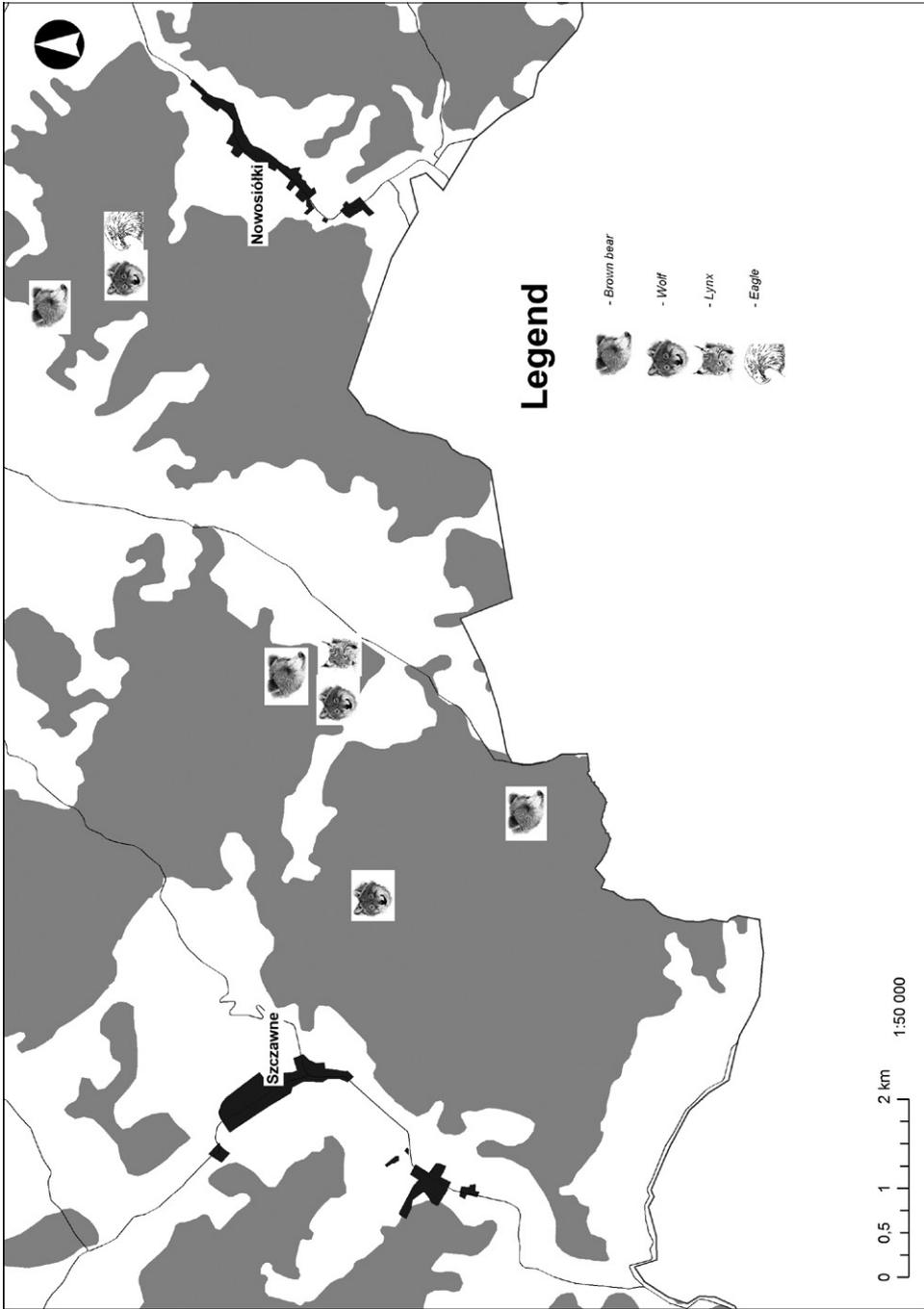


Fig. 2. Carrion eaters recorded at wisent carcasses within Lesko Forest District.

Table 2. The year of inhabitation of the forest district by wisents, and the first recorded attack by wolves or bears.

Forest District	Year of inhabitation by wisents	First attack of a bear	First attack of wolves
Baligród	1996	2006 (actual attack)	2006 (alleged attack)
Lesko	2001	2013 (feeding upon the carcass, uncertain attack)	2011 (feeding upon the carcass, alleged attack)

The second aspect connected with mortality of wisents in natural conditions is the utilisation of their carcasses as the food of carrion eaters. According to Paszkiewicz (2014), first observation of a bear feeding upon the wisent carcass was from 2006, where a cow was killed by this predator in Baligród Forest District. Next similar cases were recorded in 2008 (a carcass of 3 years old wisent with signs of feeding of a bear), in 2010 (a carcass of a cow with numerous mutilations), and in 2013 (a carcass found near the bear den). Data from photo traps confirm that bears willingly feed upon wisent carcasses, however indicate also other species utilising such biomass like: the wolf (*Canis lupus*), lynx (*Lynx lynx*) and also the golden eagle (*Aquila chrysaetos*) (Fig 1). In last three years, feeding of all large predators of the region was observed upon carcasses of already dead or killed wisents (Tabl. 3). Mortality of wisents was recorded in forestry: Średnie Wielkie (forest compartments No. 77 and 85) and Gruszka (forest compartment No. 131) (Fig. 2).

Records obtained from phototraps show successive, alternative use of carcasses by wolves, lynx and brown bear. A proximity of wisent carcasses to larger settlements was not an obstacle for large predators using this food supply. Similar records were obtained from the Baligród Forest District (forestries: Czarne, Kołonicze, Rabe) (Fig. 3).

Table 3. Large predators registered while feeding upon wisent carcasses.

Forest district	Forestry	Forest compartment	Feeding species
Lesko	Szcawne	165Ac	Brown bear
		166a	Wolf
	Średnie Wielkie	77d	Brown bear
		85a	Brown bear, Wolf, Lynx
	Las Nowosiółki	–	Wolf, Eagle
Baligród	Czarne	117a	Brown bear
		203Ad	Brown bear
	Kołonicze	154c	Brown bear
		160d	Brown bear
		168a	Brown bear, Wolf, Wild boar
	Rabe	203g	Brown bear,

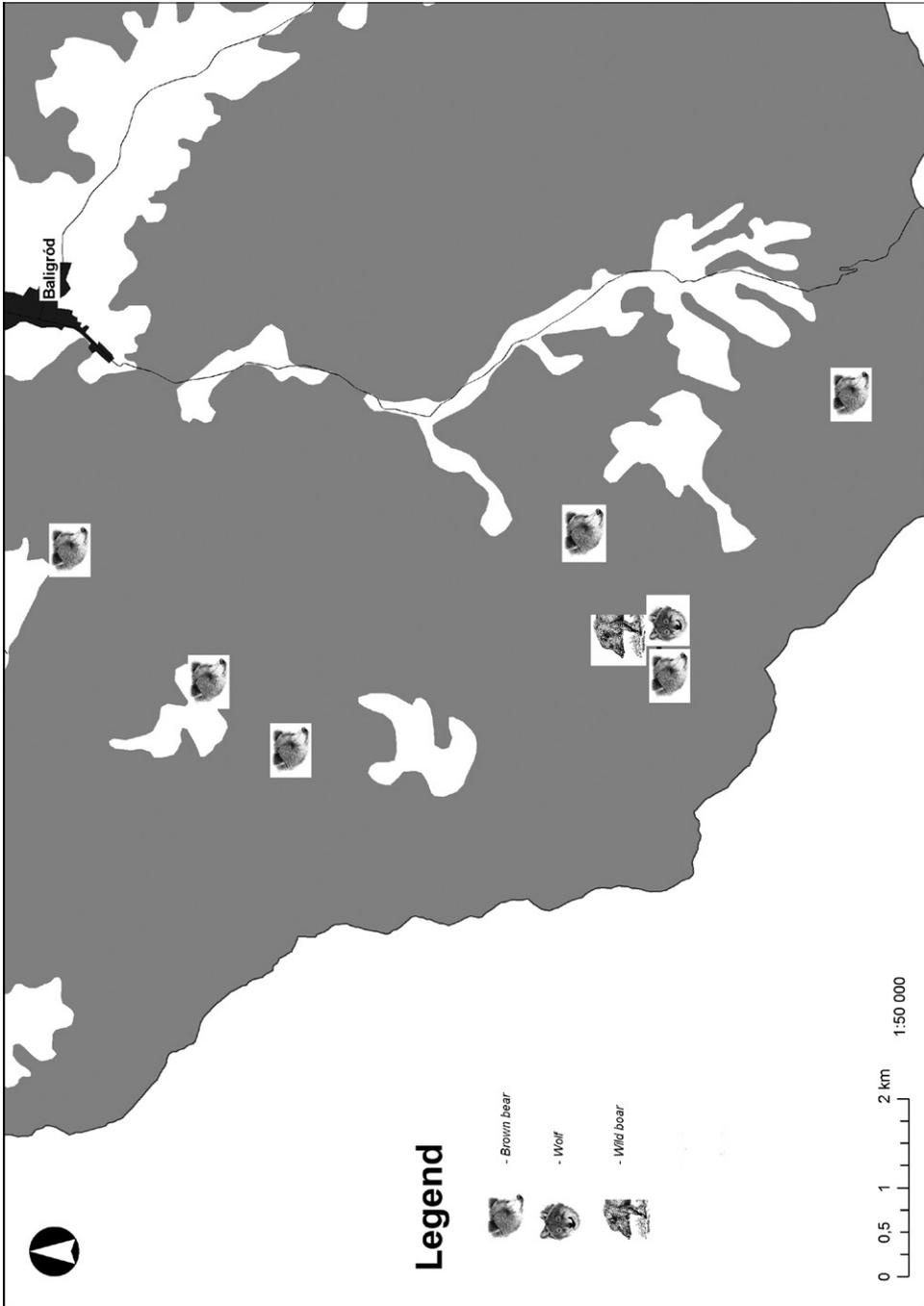


Fig. 3. Carrion eaters recorded at wisent carcasses within Baligród Forest District.

Wisent carcasses are also eaten by wild boars which was recorded at Kołonic Forest District. Because of the threat of tuberculosis, every dead wisent found in Bieszczady is examined against this disease. That allowed to confirm that since 2014 wisents of Bieszczady are free of TB so wild boars feeding on dead wisents are not a vector for this dangerous disease (Tabl. 1). Hence the health monitoring of this wisent population is an important component of the conservation of this species (Bielecki *et al.* 2014).

According to Okarma and Jędrzejewski (1996), at Białowieska Forest until 1996, wisents in practice were not among wolves' preys. Initially, similar pattern occurred in the Carpathians where interactions among wisents and large predators were only marginal (Perzanowski & Marszałek 2012). Nevertheless, following the growth of wisent numbers, predators become used to their presence and gradually consider them a possible source of food. In Bieszczady, after several decades of wisent reintroduction it is possible to say that this species became the permanent component of the natural food chain, enriching food supply for predators and necrophages. For the analysis of predation patterns, important is an estimate of the total biomass of ungulates per area unit (Jędrzejewska, Jędrzejewski 2001). Together with an increase of wisent population numbers and its dispersion, larger will be also an amount of biomass available to carrion eaters in the form of carcasses. Present wisent numbers in Bieszczady are estimated for about 500 individuals. Assuming natural mortality at the level of 6% (Perzanowski 2002–2018) and the average body mass (including calves) for about 100 kg, potential biomass available for carrion eaters can be assessed at about 3 tons annually. It can be also expected that in following years, wolves and bears of Bieszczady will also supplement their diet by the biomass originating from active hunting for wisent bulls, cows and calves, which to certain degree will influence population numbers of that species in the region.

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Żubr jako baza pokarmowa dla dużych drapieżników i padlinożerców

Streszczenie: Analizowano interakcje pomiędzy dużymi drapieżnikami, gatunkami padlinożernymi i żubrami w Bieszczadach. Uwzględniono dane uzyskane w ramach programu ciągłego monitoringu populacji żubrów w nadleśnictwach bieszczadzkich od roku 2002. Pierwszy potwierdzony skuteczny atak niedźwiedzia był zarejestrowany w roku 2006 w Nadleśnictwie Baligród. Częstotliwość ataków wilków i niedźwiedzi na żubry rośnie wraz ze wzrostem liczebności żubrów i zasięgiem ich areалу. Przy użyciu fotopułapek potwierdzono żerowanie na tuszach żubrów przez: wilki, niedźwiedzie, rysie i orły przednie. Biomasa martwych żubrów dostępnych w ciągu roku dla gatunków padlinożernych w Bieszczadach została oceniona na ok. 3 tony.
