



Growth in a young male brown bear (*Ursus arctos* L., 1758) (Mammalia: Carnivora) captured and tagged with GPS-GSM collar

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Abstract: Body growth in mammals is an aspect of their biology that has always been interesting and carries important information about the individual's development. The relationship between growth patterns and factors that are affecting them, such as parasitism, is not entirely clear. In this short communication, we provide information obtained from a young brown bear (*Ursus arctos*), shot a year after being collared. Analysed growth patterns show a noticeable increase in the weight and circumference of the chest and head. The established low to moderate infestation with *Baylisascaris transfuga* in relation to absence of other parasites, has not affected the growth processes.

Keywords: body conditions, body mass, body size, brown bear cub

Introduction

Increase of body size in mammals is extremely important during the early stages of the life cycle, especially in predators (McNab, 1989). Brown bears are no exception. Individuals continue to grow for about 14 to 15 years (Blanchard, 1987), with the growth rates being more intense during the first couple of years. Rapid growth in the first months after birth is crucial for the survival of the cubs outside the den, especially considering Ursidae have lighter neonates (% of mother body mass) than all other Carnivora families (Gittleman, 1986). Therefore, their weight increases from 500 g (at birth) to 12 kg for females and 14 for males during the first five months (Tumanov, 1995). This rate stays a constant in the next three years.

Growth patterns vary depending on sex, diet, duration of mother care and other factors. Females usually

wean the cubs before or during the breeding season which is April – June (Shimozuru et al., 2017). Some studies have found that the measured weight in the first three years has almost a double annual increase (Blanchard, 1987), even in orphaned individuals (when they have managed to survive) (Swenson et al., 1998). Male individuals have significantly larger body size (skull, body and hind paw length) after the first year and rapid growth is especially important for them, since they tend to roam at unsuitable habitats in the search of available territory and resources (Leland, 1977).

One of the factors affecting the growth rate is the presence of parasites in the body of the animals. Infestation by different organisms can affect not only the accumulation of mass but also the survival rate of the young individuals.

Baylisascaris transfuga (Nematoda: Ascarididae) is the dominant endoparasite in brown bears for the

past few years in various countries like Slovakia, Romania, Poland and Italy (Borka-Vitalis et al., 2017; De Ambrogi et al., 2011; Gawor et al., 2017; Orosova et al., 2016; Štrkolcova et al., 2018). It is also the leading nematode species in European wild bears (Rigg & Adamec, 2007). Zoonotic potential (human larva migrans syndrome) of this nematode species increases its significance as parasitic pathogen from wildlife (Kazacos, 2016). *B. transfuga* is highly infectious parasite and studies have shown that 50–100% of bears harbour it, including cubs that can get heavily infected (Foster et al., 2011; Sprent, 1968). Heavy infestation can even lead to death (Testini et al., 2011).

Material and methods

Study area

Stara Planina Mountains is a home to one of the two large subpopulations of brown bears in Bulgaria. Approximately 100 bears inhabit that region, according to data from the annual national monitoring of the species (Executive Environmental Agency (Ministry of Environment and Water), 2016). Abundance of resources and suitable terrain are a prerequisite for the northern side of the mountain to have a higher bear density. The presence of forestry and hunting enterprises, which have higher level of security and provide additional food, is possibly another factor for the suitability of the territory. Parts of the study area falls within the borders of the largest national park in Bulgaria (Central Balkan), where some of the largest old-growth beech forests in Eastern Europe can be found (CB Administration, 2019).

First measurement

During the capture, two standard Aldrich snares (Aldrich Snare Co., Washington) were used, forming a trapline and placed near a tree with bait on it. MMS camera-traps (Ltl Acorn/ model LTL5210-MG) were used as capture alert system during the night, to minimise the bear stay in the trap. This made the process of capturing to be around 40 min. from the first picture alerting the animal is in the trap to first dart.

The collared bear (CB9) was a second-year cub, led by his mother (present at the capture site). It was captured on 2 November 2016 on State Hunting Enter-

prises (SHE) Rusalkas' feeding station, also called "Gorna Marishnitsa". Upon capture, the bear was immobilised with Teledart CO₂ injection gun from a car using a Tiletamine/Zolazepam (Zoletil Virbac 50; 5 mg/kg) (Arnemo & Fahlman, 2007). Due to a fast recovery from sedation (28 min.) only 9 measures were taken (Fig. 1): mass, body length, head length, neck circumference, hear circumference, chest circumference, width of left front food, width of left hind foot, length of hind pad without claws.

The bear cub was marked with GPS-GSM collar Followit (Tellus GPS Medium Plus, Followit, Lindesberg AB, Sweden). The collar worked properly until the 1 September 2017 (1130 fixes).

Second measurement

The second measurement was performed one year and 20 days after the tagging. On 23 November 2017, CB9 carcass was found in the area of Kartala located near the village of Enina, at 43 km (by air) southeast from the core area of its home range. The individual had been shot dead and the body was in extremely preserved state. There was a layer of snow covering the corpse, which indicates that the death occurred before the last snowfall on 18 November 2017. Thirty measurements were taken (Table 1).

Helminthological study

Partial helminthological necropsy was performed on the bear's carcass. All parts of gastrointestinal (GI) tract, internal visceral organs and diaphragm striated muscle sample were obtained for helminthological examination. Fecal sample taken from the rectum was tested for the presence of parasitic sexual products (eggs and oocysts) by salt and Sheather's flotation tests (Zayac & Conboy, 2012).

Results and discussion

The results of the measurements confirm the previous observations of extremely fast body growth in brown bears during the first years of their lives. Weight gain is almost double between two measurements (92.2 %). High degree of skeletal growth is also present – head circumference (21.7 %), chest circumference 31.5 %),

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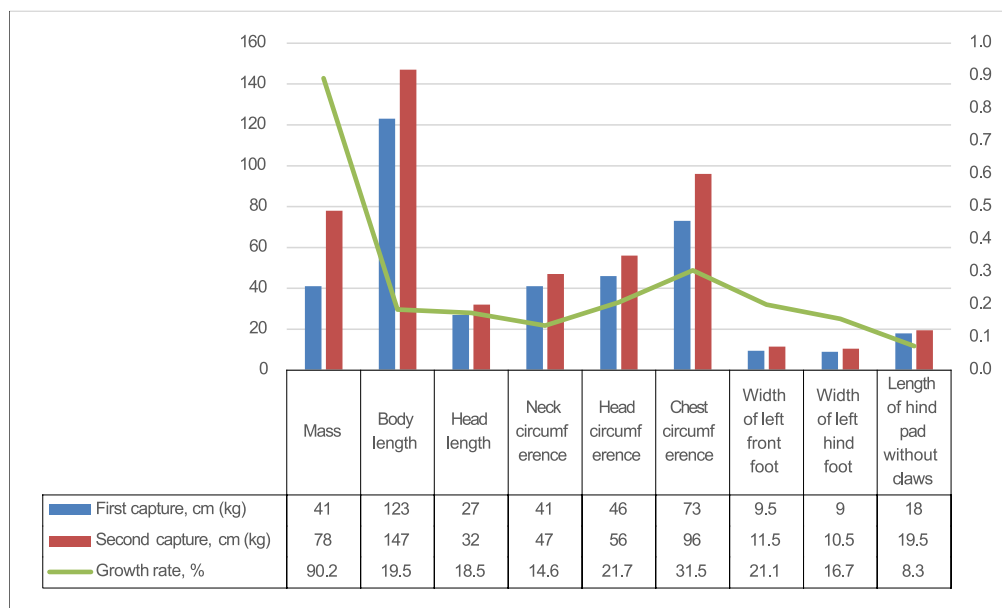


Fig. 1. Comparison of measurements between the two captures.

Table 1. Second body measurements.

Measurement type	Measurement (cm)	Measurement type	Measurement (cm)
Tail length	9	Front foot. Left. Length with Central Claw	14
Shoulder height	82	Front foot. Left. Length with pad (no claw)	17
Distance from eye to nose	12.5	Front foot. Left. Length of Central Claw	4.5
Distance between ears	16	Front foot. Right. Width	12
Head width	21	Front foot. Right. Length	9
Length of ear LEFT	11	Front foot. Right. Length with Central Claw	13
Length of ear RIGHT	12	Front foot. Right. Length with pad (no claw)	18
Tooth wear Canines	4-4C	Front foot. Right. Length of Central Claw	5
Tooth wear Incisors	6-6I	Hind foot. Left. Length	20
Length canines. Upper left	33	Hind foot. Left. Length with Central Claw	21.5
Length canines. Upper right	34	Hind foot. Left. Length of Central Claw	2
Length canines. Lower left	31	Hind foot. Right. Width	11
Length canines. Lower right	30	Hind foot. Right. Length	20
Distance between canines UPPER	61	Hind foot. Right. Length with Central Claw	22
Distance between canines LOWER	58	Hind foot. Right. Length with pad (no claw)	19.5
Front foot. Left. Length	10.5	Hind foot. Right. Length of Central Claw	2.5

head and body length (18.5 % and 19.5 %). The least pronounced change is the width of front food and length of hind food and the circumference of the neck (14.6 %). The data from the second measurement are shown in Table 1. The comparison between first and second measurement results are presented in Fig. 1.

Our results provide a basis to agree with data from previous surveys, showing that the weight of brown bears is growing rapidly, from the end of the first year to the end of the third (Huber et al., 1993; Kingsley et al., 1988; Kojola & Laitala, 2001; Swenson et al., 2007). The measured autumn body mass is not relevant to the absolute mass of the individual, especially in brown bears, whose mass varies widely before and after hibernation. However, several parameters give a sufficiently clear idea of the growth rate in this particular male individual – the increase in weight, the expansion of the circumference of the thorax and the significant increase in the size of the head.





The infestation with nematode *B. transfuga* in an individual from Bulgaria once again confirms the species being the most common parasite for bears, especially brown bears (Schaul, 2006). However, only five specimens of a nematode in the small intestine would not affect the normal growth and health status of the animal, since it is considered low infestation, especially it is assumed that bears raised in a controlled environment are uninfected (Huber et al., 1993).

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