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Are Brown Bears Less Aggressive in Europe Than in North America?

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Abstract: According to conventional wisdom, brown bears (*Ursus arctos*) are less aggressive in Europe than in North America. However, that has not been previously verified by quantitative comparison of attack rates between these continents. On the contrary, our prior study showed that bear-inflicted injuries/1000 bears, and of predatory attacks/million bear-years were higher in Scandinavia (Sweden and Norway) than in southwestern Canada (British Columbia and Alberta). That is herein verified using more recent data. However, conventional wisdom is consistent with *this* analysis of a much larger dataset derived via literature search by Bombieri et al. (2019) encompassing most brown bear populations in Europe. In keeping with conventional wisdom, we found that total injury rate, and especially fatal injury rate, per bear per person actually were lower in Europe. In 8 European countries where injuries occurred, none were fatal. Although no North American brown bear population lives in a region where human population density is as high as is typical in European nations, injury rates per thousand bears relative to human population density in North America tend to be at least as high, if not higher, than in Europe. This is consistent with a theory that selection pressure tending to curb brown bear aggression toward humans has been underway longer in Eurasia than in North America, from the mid-Pleistocene through the 1800's. It is also consistent with the alternate theory that brown bears in the interior of North America evolved to be larger and more aggressive to cope with giant short-faced bears *Arctodus simus* and other Pleistocene megafauna that were especially common in habitats where escape-trees were scarce. By contrast, European brown bears – like North American black bears -- were more specialized for forest habitats where larger bodies and greater fierceness were not advantageous. Although European brown bears once competed with the cave bear *Ursus spelaeus*, this latter species went extinct shortly after humans (*Homo sapiens*) became common in Europe, roughly 40 kya. Despite those theoretical consistencies with brown bears allegedly being less aggressive in Europe, caution is warranted in interpreting the difference in attack rates and intensities. There has yet to be a direct comparison between continents of (a) bear temperaments or of (b) how attack risk and severity are contingent on other factors. Perhaps American brown bears are not fiercer once aggression has been triggered, but their aggression is triggered at longer distances from humans – i.e., they are less tolerant of human proximity.

Keywords: attack, Bombieri, bear attack, fatal, food concentration, habituation, injury, proximity, risk, salmon, selection, tolerance, ursidae

Introduction

Although it is commonly believed that brown/grizzly bears (*Ursus arctos*) are less aggressive in Europe than in North America (Zedrosser et al. 2019), that contradicts our (Stringham &

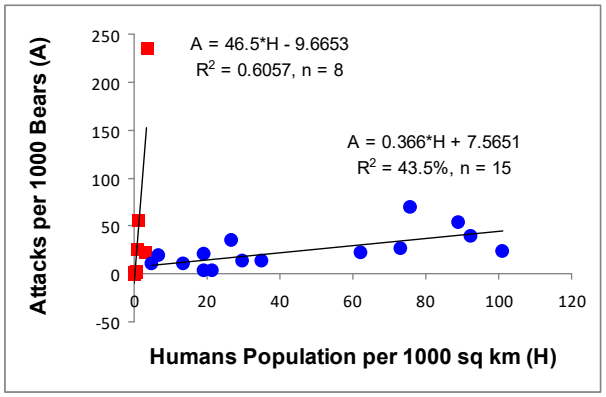
Rogers 2017) comparison of rates of non-fatal and fatal attacks in British Columbia and Alberta in southwestern Canada (Herrero & Higgins 1999, 2003) vs. Sweden and Norway (Swenson 1999). With more recent (2000 – 2015) data compiled from those and many other brown bear populations in both North America and Eurasia, Bombieri et al. (2019) found that attacks are much more common throughout Europe than in North America (a) during all seasons and times of day, as well as for (b) for all victim classes (juvenile vs. adult; male vs. female; and solo vs. in a group). Attack numbers ($p < 0.0001$) were positively correlated with year ($R^2 = 13\%$) and bear density ($R^2 = 39\%$), but negatively correlated with human density ($R^2 = 12\%$). Furthermore, attack rate increased over that 16-year time span on both continents. Revealing although those results are, they were not intended to address relative aggressiveness toward humans by bears on those two continents. To do that, we factored out the influences of bear and human abundances.

Methods

We re-analyzed the data of Bombieri et al (2019:Table 1) with their permission, to assess attack rate per 1000 bears relative to human density. Our minimum variance regressions and ANOVA analyses were done using the linest and fdist functions in Excel 2007.

Results

In both North America and Europe, there was a positive correlation between attack rate per 1000 brown bears vs. human population density (Figure 1), suggesting that brown bears were more likely to attack people in jurisdictions with a high human population density. However, North American states and provinces with brown bears have far lower human densities than countries with brown bears in Europe. Yet relative attack rate was less than 1% as high in Europe as in North America, judging from slopes of the regression equations (Figure 1).



North America: A/B = 46.5*H - 9.66
R² = 61%, n=8, F=9, p<0.05

Europe A/B = 0.366*H + 7.66
R² = 44%, n=15, F=14, p<0.005

Figure 1. **Attack rate per 1000 brown bears (A/B) relative to human population density per km^2** (for data see Table 1).

Furthermore, brown bears were more likely to kill the people they attacked in North America than in Europe. During 2000 – 2015, fatality rate was 19.7% (= 24/183) for North American bear populations. By contrast, the percentage of attacks that were fatal was 5.2% (= 29/345) in Europe. During 2000 – 2015, fatality rates were highest in the Ukraine (25% = 2/8) and Turkey (20.4% = 11/54), but moderate in Poland (12.5%) and Bulgaria (14.3%). By contrast, during

2000 – 2015, there were no fatalities (= 0/97 attacks) in eight other European countries: Norway, Finland, Slovakia, Slovenia, Spain, Croatia, Estonia, and Italy (although one fatality did occur in Italy during 2023). During 2000 – 2015, attacks were most common in Romania (131 total, 11 fatal), Slovakia (54 total, 0 fatal) and Turkey (54 total, 11 fatal).

Table 1. **Attack data for 2000 – 2015** (from Bombieri et al. 2019:Table 1)

	Attacks	Fatalities	Brown bears	H/km^2 human density	Attacks /1000 bears	Fatalities /1000 bears	% Attacks Fatal
N. America							
Idaho	8	0	34	3.5	**235.3**	0.0	**0.0%**
Wyoming	29	5	511	1.2	**56.8**	9.8	**17.2%**
Alberta	18	4	691	0.8	**26.0**	5.8	**22.2%**
Montana	25	2	1105	2.9	**22.6**	1.8	**8.0%**
British Columbia	42	2	15000	0.4	**2.8**	0.1	**4.8%**
Alaska	51	7	32000	0.3	**1.6**	0.2	**13.7%**
Northwest Territory	6	1	4000	0.01	**1.5**	0.3	**16.7%**
Yukon Terr.	4	3	6000	0.03	**0.7**	0.5	**75.0%**
TOTAL	183	24	59341				
MEAN				1.1	**43.4**	2.3	**19.7%**
Europe							
Poland	8	1	115	75.7	**69.6**	8.7	**12.5%**
Slovakia	54	0	1000	89	**54.0**	0.0	**0.0%**
Italy (Alps)	2	0	51	92.4	**39.2**	0.0	**0.0%**
Greece	12	1	350	26.8	**34.3**	2.9	**8.3%**
Slovenia	12	0	455	73.3	**26.4**	0.0	**0.0%**
Ukraine	8	2	350	101	22.9	5.7	**25.0%**
Romania	131	11	6000	62.3	**21.8**	1.8	**8.4%**
Spain	5	0	247	19.3	**20.2**	0.0	**0.0%**
Norway	2	0	105	6.9	**19.0**	0.0	**0.0%**
Turkey	54	11	4000	29.7	13.5	2.8	**20.4%**
Bulgaria	7	1	560	35.2	**12.5**	1.8	**14.3%**
Finland	17	0	1700	13.7	**10.0**	0.0	**0.0%**
Sweden	28	2	2900	5	**9.7**	0.7	**7.1%**
Croatia	3	0	1000	21.5	**3.0**	0.0	**0.0%**
Estonia	2	0	700	19.2	**2.9**	0.0	**0.0%**
TOTAL	345	29	19533				
MEAN				44.7	**23.9**	1.6	**5.2%**

Discussion

Prior Studies

During the last few decades before 2000, the rates of attacks per year per 1000 brown bears were 0.35 in Scandinavia vs. 0.16 in British Columbia and Alberta (Stringham & Rogers 2017). According to the data of Bombieri et al. (2019), those rates rose during the 16-year period 2000 – 2015 to 0.62 vs. 0.21 respectively. In other words, attack rates per 1000 brown bears were higher, not lower, in Scandinavia than in North America, contrary to conventional wisdom that brown bears are less aggressive in Europe (Swenson 1999, Zedrosser et al. 2019). However, that conventional wisdom is consistent with the overall dataset compiled by Bombieri et al., encompassing numerous additional populations on both continents.

Explanatory Hypotheses

Two hypotheses have been offered to explain the (apparently) lower aggressiveness by brown bears toward humans in Europe: selection pressure from (a) non-human enemies and prey vs. (b) from human enemies.

(a) ***Non-human enemies and prey:*** Swenson (1999) and Swenson et al. (2007) noted that brown bears in Europe are smaller and more arboreal than those in North America. Not only do European brown bears climb trees more readily, but they are more confined to forested habitats where they could have climbed trees for refuge from most enemies. By contrast, North American brown bears prehistorically made more use of habitats where refuge trees were scarce, forcing them to rely more on aggression to cope with Pleistocene megafauna including giant short-faced bears (*Arctodus* spp.), lions (*Panthera atrox*), sabertooth felids (e.g., *Smilodon*), dire wolves (*Canis diris*), and more recently timber wolves (Canis lupus). Although Eurasian brown bears also faced competition from large felids and wolves, their only large ursid rivals were cave bears (*Ursus spelaeus* spp.), which went extinct roughly 40 kya, about the same time that modern humans (*Homo sapiens*) colonized Europe.

If this hypothesis is valid, one would expect greater aggression and perhaps larger body size relative to food supply for brown bears in other areas of Eurasia where trees are scarce, such as the Gobi, or where bears have faced more competition from lions (*Panthera leo*), tigers (*P. tigris*) or leopards (*P. pardus*) – e.g., until a few thousand years ago in the mid-East and currently in the Russian Far East, where they are still occasionally preyed on by tigers (Vaillant 2011). However, we have found no reports that these brown bears are more aggressive than those in Western Europe. Indeed, they apper more vulnerable to tigers than are the smaller, more arboreal black bears (*Ursus thibetanus*) (Sergey Kokchin, pers. commun. 2023). Vulnerability to such enemies presumably also favored relatively small body size and high aboreality among North American black bears. As the absence of brown bears has declined in areas of the Ungava Peninsula tundra, black bear abundance there has increased (Jonkel & Miller 1970).

(b) ***Human enemies***: European brown bears might be less aggressive because they have been under selection pressure from human aggression for several times as long in Europe as in North America.

Prehistorically: Eurasian brown bears have been interacting with *Homo sapiens* for roughly 54 kya (Slimak et al. 2022), following a few hundred thousand years of interaction with Neanderthals (*H. neanderthalensis*). By contrast, brown bears have shared North America with humans for no more than 25 kya (Praetorius et al. 2003). Granted that all North American brown bears originated in Eurasia, and that the Eurasian ancestors may have interacted with humans; but the first brown bear clades to reach North America did so at least 50 kya (Sallis et al. 2022), followed by 30-40 kya of minimal human contact. But question remains as to how long humans on both continents have had the weapons, skills and assistance from dogs and fire to kill enough brown bears to substantially reduce the frequency of genotypes promoting aggression toward humans.

Historically: Efforts to eradicate brown bears from the mid-East and Europe apparently began a few thousand years ago, whereas they were delayed until the early or mid-1800s in North America (Swenson 1999; Zedrosser et al. 2011).

(c) ***Reaction Distances:*** According to third theory, once provoked, brown bears in Europe are as aggressive as those in North America, but the latter are easier to provoke. For example, the distances at which aggression is triggered toward humans or other bears might be shorter in Europe (Herrero et al. 2005, Smith et al. 2005; Smith pers. commun. 2023), Evidence that attack distance can vary among populations is provided by the longer overt [alarm] reaction distances (ORDs) by brown bears in inland habitats of North America than by those on the Pacific seacoasts of British Columbia and Alaska, where salmon (*Oncorhynchus* spp.) abound in spawning streams. Shorter ORDs have been attributed to a combination of natural selection and of habituation allowing bears to forage for salmon near one another with minimal combat. However, it has yet to be shown that European brown bears do indeed have shorter ORDs towards one another or toward humans, or that ORDs tend to be especially short where European brown bears historically preyed on Atlantic salmon (*Salmo salar*) or depended heavily on any other food (e.g., hardwood mast or soft fruit) that was typically concentrated in small patches.

Although brown bears even in a continental interior might aggregate at a concentrated food source, such as where bison drown crossing a river (Lewis & Clark 1904), whale carcasses on the Arctic coast, or at garbage at dumps in Yellowstone National Park (Craighead, Sumner & Mitchell 1995), bear-bear and bear-human tolerance at such sites may not be as high as on the Pacific coast. We know of no evidence that brown bears in the interior of either continent tolerate humans within a meter or two of them while sleeping, resting or nursing cubs – a phenomenon common on the northern Pacific coasts of the

Kamchatka Peninsula (Russell & Enns 2002), Alaska and British Columbia interior (Stringham 2009, Walker & Aumiller 1993; Fair & Aumiller 2017) – all areas where Pacific salmon abound and climates are milder than in the continental interior. Such close tolerance by brown bears on the Pacific coast of Alaska occurs only where they are commonly viewed at close range. Over the course of the last three decades and millions of bear-human encounters, virtually no one has been injured while viewing these bears. We suspect that this exceeds the number of close brown-bear human encounters in Europe during that same period. Yet other Alaskan brown/grizzly bears have injured people in hundreds of confrontations (Smith & Herrero 2018). Until these and other circumstantial effects can be factored out, no comparison of bear temperaments among continents can be definitive.

(d) ***Circumstances:*** A fourth theory is that differences in attack and fatality rates between Europe vs. North America, are not a function of differences in temperament, but in the frequency of circumstances provoking aggression. Even though attack and fatality rates are lower in Europe than in North America, there are regional differences. For example, just the opposite trend was found when Stringham & Rogers (2017) compared just Scandinavian brown bears with those in southwestern Canada up until a few decades ago (see Herrero 1985, Swenson et al 1999) – a finding confirmed herein using Bombieri et al's (2019) data for 2000 – 2015. Our earlier database included anecdotal information dating back to the early 1800's in North America and to the late 1700's in Scandinavia (Swenson 1999), to supplement published scientific data from Alberta and British Columbia 1960-1997 (Herrero & Higgins 1999, 2003), versus Sweden and Norway 1976-1995 (Swenson et al. 1995). The earlier analysis revealed that: (a) The rate of non-fatal maulings per 1000 brown bears was 2-fold higher in Scandinavia than in southwestern Canada. (b) The rate of predatory attacks per million bear-years was up to 3-fold higher for Scandinavian brown bears (8 - 11) than for North American brown bears (3.4), and up to 10-fold higher than for North American black bears (<0.7). Perhaps brown bears are more aggressive in Scandinavia than in rest of Europe, as well as in North America,

However, a more critical consideration is that attack risks are not just a property of bear temperaments – which have yet to be quantified on either continent – but also of the circumstances when encounters occur. Two temperament metrics might be (a) likelihood of a wounded bear attacking a nearby hunter, and (b) severity of injury inflicted on a human victim, relative to size of the bear.

We'd predict severity to be directly correlated with bear body size and strength, all else being equal. Although we don't know of any data that could be used to test this prediction for the bears which actually attacked people, we note that mean brown bear body size tends to be larger in North America than in Europe (Swenson et al. 2007; Zedrosser et al. 2011:Table 1), and that North American black bears tend to be even smaller than European brown bears and

to have even lower rates of serious or fatal injury (Herrero & Higgins 1999, 2003; Herrero et al. 2011; Smith & Herrero 2018).

One should also consider relative commonness of other factors which affect attack risk (Stringham & Rogers 2017). Among the factors identified by previous investigations (Herrero 1985, Herrero & Higgins 1999, 2003; Herrero et al. 2011; Smith & Herrero 2018; Swenson et al. 1995, 1999; Stringham & Rogers 2017) are bear abundance and density, distances at which bear and human first detect one another (which in turn depend on visibility and other habitat features), habituation, food conditioning and the lure of human foods, natural food supply, whether the victim was accompanied by a dog, how many people accompanied the victim (i.e., group size), victim's activity when attacked (e.g., gathering food, tending livestock, or hunting), and whether the bear was wounded or defending cubs, a prey carcass, or a den site.

Bombieri et al. (2019) echo that caution, as well as our (Stringham & Rogers 2017) hypothesis that rates of perceived conflict might be higher where bear populations are expanding into new habitat where people are less familiar with bears and with methods of minimizing conflict or are less willing to implement those methods.

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Competing interests

The author(s) declare no competing interests.

Data availability The data analyzed here were published by Bombieri et al. (2019:Table 1).

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