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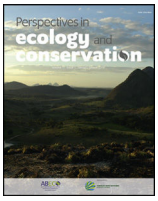

Policy Forums

Geographic bias in the media reporting of aquatic versus terrestrial human predator conflicts and its conservation implications

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ABSTRACT

Interactions or conflicts between humans and large predators occur globally, but an understanding of their spatial occurrence and associated media reporting remains limited. Media reach is now global and rapid, particularly through western news outlets and amplified by social networks. This has consequences for how the public perceive human-predator conflicts and in turn how this impacts species' conservation and management. To address this point, a literature search was undertaken to synthesize global records of predator-human conflicts followed be an assessment of media reporting of conflicts, for both aquatic (sharks) and terrestrial (lion, tiger, leopard, cougar, puma, bear spp.) species. We show that predator-human conflicts involving terrestrial mammals occur predominantly in developingñations (>90%) while aquatic predator-human conflicts occur (65%) and are principally reported from developed nations. Moreover, media reporting of sharks is dominated by attacks on humans and sensationalized documentation of incidences compared to those involving terrestrial species. As a result, high media coverage of shark-human conflicts may lead humans to overestimate the risk of being attacked. We recommend increased communication between stakeholders to establish ground rules for media reporting of shark-human conflicts, better informed reporting of attacks, further research undertaken to understand the public's perception of media reporting of conflicts and continued investment in communication, education, and public awareness programs. Through these actions it will be possible to rebalance the public perception of sharks to promote understanding and value of their ecological role and to minimize human-shark incidents.

The reporting of negative interactions between humans and large predators, particularly lions, tigers, and sharks, but also large and dangerous herbivores, i.e. hippos (*Hippopotamus amphibius* Linnaeus, 1758) dates back centuries (Coppleson, 1958; Patterson, 2004; Thirgood et al., 2005). These interactions that can result in human fatalities or injuries have often led to the culling of the individual animal/s involved in the conflict. Two famous examples are the "Tsavo Man-Eaters", a pair of Tsavo lions that were responsible for the deaths of workers on the Kenya-Uganda Railway in 1898 (Patterson, 2004), and the shark attacks along the New Jersey coast, USA in 1916, in which four people were killed and one injured (Capuzzo, 2001). Both led to dedicated programs aimed at eradicating the "man-eating" lions and sharks in Kenya and New Jersey, respectively. Nowadays, conflicts between humans and large predators (both terrestrial and aquatic) are still prevalent (Lennox et al., 2018; Torres et al., 2018), with recent study focused on consideration of the fundamentals for the coexistence between human and predators (e.g. Carter and Linnell, 2016; Gallagher, 2016; Lennox et al., 2018). However, two decisive facts shape the current public's perception of these conflicts; (i) media reach is now global and rapid, particularly through news outlets and amplified by social networks and (ii) this media reach would appear to be driving a geographical bias in the extent of negative reporting of shark (aquatic) versus terrestrial predator–human conflicts related to their region of occurrence (see Penteriani et al., 2016). Here we examine if there is a global geographic bias in the media-reporting of negative shark–human interactions compared to terrestrial conflicts and discuss its potential impact on predator conservation actions.

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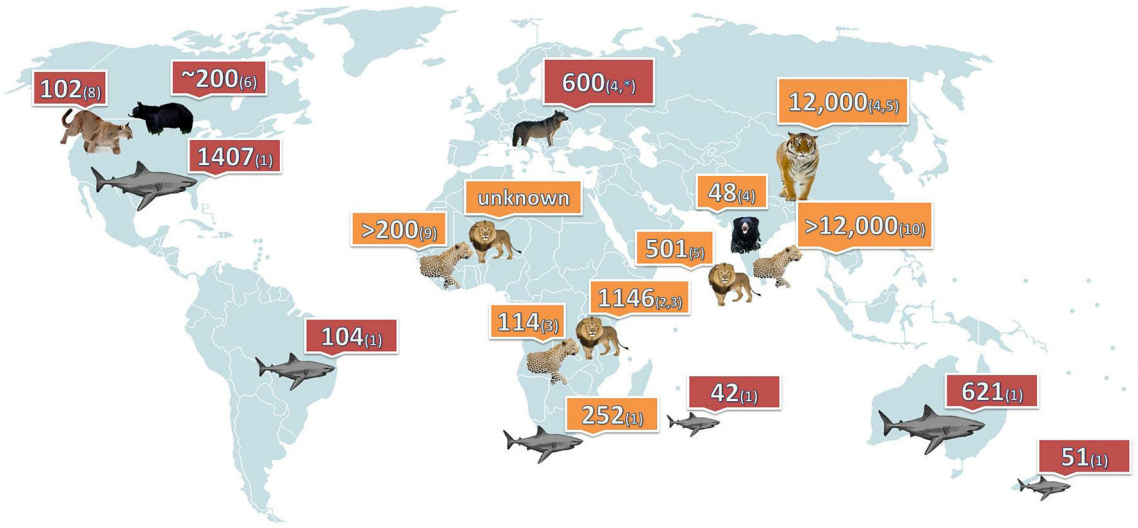

Fig. 1. Estimated number of conflicts among large terrestrial and aquatic predator species and humans. These examples illustrate the occurrence of conflicts in developed (red) and developing countries (orange) according to the Human Development Index in 2014 (http://hdr.undp.org/en/2014-report). See Supplementary material A1 for references. (Images are reproduced under Creative Commons license – https://en.wikipedia.org/wiki/Creative_Commons; Wikimedia and downloaded from Pixabay® – free download images; and shark cull from Sea Shepherd).

Data documenting records of global predator–human conflicts, focusing on sharks (aquatic) and key carnivores (black bear – *Ursus americanus*, brown bear – *Ursus arctos*, cougar – *Puma concolor*, coyote – *Canis latrans*, lion – *Panthera leo*, leopard – *Panthera pardus*, sloth bear – *Melursus ursinus*, tiger – *Panthera tigris*, and wolf – *Canis lupus*; terrestrial) were extracted and compiled. For incidents involving sharks, we used available information in the International Shark Attack File database (ISAF, 2018). These data included the date and location of unprovoked and provoked incidents between 1837 and 2017. For terrestrial carnivores, a standard literature search was conducted in Web of Science using a combination of the following terms: "carnivore attack" + "human" AND "carnivore conflict" + "human". We prioritized articles where conflict data were previously synthesized and compiled for species by year and location to minimize repetition of reported interactions. The search included data on incidents reported between 1875 and 2017 (See Supplementary material A1 for references tied with Fig. 1). The number and location of predator–human attacks/incidents were then plotted to illustrate the distribution of documented aquatic versus terrestrial human–animal conflicts in developed and developing countries according to the Human Development Index in 2014 (http://hdr.undp.org/en/2014-report).

To then assess the discrepancy in media reporting of aquatic versus terrestrial attacks/incidences compared to the actual reported incidences (compiled above), we undertook a standardized search of a major media outlet newspaper, the Telegraph (www.telegraph.co.uk). Three independent searches were conducted using the keywords, 'shark', 'leopard' and 'lion', and content for the most recent 100 search results examined. Specifically, we classified all news report in to two categories; (i) those containing information on attacks or a sensationalized event and (ii) other reports, for example news related to aquariums or zoos, or cases of non-negative issues such as reporting of scientific findings or conservation successes.

A total of 3301 shark incidents were reported by ISAF, with hotspots in USA ($n = 1407$; 42.6%), Australia ($n = 621$; 18.8%), South Africa ($n = 252$; 7.6%), Brazil ($n = 104$; 3.1%), and New Zealand ($n = 51$; 1.5%) (Fig. 1). Of these reported attacks, the majority, ~65% occurred in developed countries. In contrast, terrestrial carnivores were implicated in more than 25,000 incidents (97%) in economically poorer regions such as African and Asiatic countries. In developed countries, terrestrial carnivores (bears, cougar, coyotes and wolfs in North America and Europe) accounted for only 780 (26%) of incidents compared with 2225 (74%) for sharks (in Australia, USA, New Zealand, and Reunion Island). Overall these data show that aquatic predator–human conflicts principally occur in developed nations while terrestrial predator–human conflicts occur and are predominantly reported in developing nations (Fig. 1).

When considering our systematic search of the 100 most recent media articles for three top predators (shark, lion and leopard); a strong bias in content was observed. For sharks, more than 65% of media articles reported attacks or sensational events. In contrast, when this search was repeated for 'leopards' and 'lions', less than 5% reported attacks or sensational events. Moreover, the storyline of the lion–human incidences (despite only a few) were mostly linked to western people (basically hunters or visitors) and not conflict or interactions with local people.

Our results clearly identify that there is a geographic bias in negative reporting of shark human conflicts tied with a higher occurrence of shark attacks in developed versus developing nations. So, why is this trend apparent, are there more sharks in developed compared to developing countries, leading to the larger number of attacks in these regions? And/or is there a different perception or fear of sharks compared to terrestrial predators such as lions and tigers? Firstly, not all sharks (of ~500 living species – Compagno et al., 2005) are involved in human conflicts, in fact only a very small minority (~33 species) is (see data in ISAF, 2018). Secondly, the most dangerous species, tiger (*Galeocerdo cuvier*), bull (*Carcharhinus leucas*) and white sharks (*Carcharodon carcharias*) show a broad distribution in global oceans bordering both developing and developed nations. More the issue over contact appears to stem from the fact that with continuing human population growth (Hazin et al., 2008; West, 2011), more people are involved in aquatic recreational activities and interacting with the aquatic environment, especially in the developed world. This potentially drives an increase in shark encounters in countries such as U.S., Australia, South Africa, and Brazil (Hazin et al., 2008; West, 2011). Thirdly, shark–human conflicts are very rare (1 in ~1,370,000) and occur less frequently than for other species (e.g. dogs, crocodiles, hippos) (ISAF, 2018). Fourth, since movie Jaws by Steven Spielberg, there has been an exaggerated public fear of sharks and this fear has been propagated in

recent movies on aquatic predators, but rarely observed for their terrestrial counterparts. Consequently, the occurrence and inflated negative reporting of shark incidents in the western world would seem to evolve from a few cases, but exaggerated and focused media/social media reporting. Fifth, the level of human empathy for some taxonomic groups must be considered. Previous studies have reported that humans show more empathy for animal groups that are phylogenetically closer to hominids (see discussion in Ingham et al., 2015). Consequently, humans' fear of a shark attack and a negative bias in reporting may be linked to both the mystery of the unnatural environment they inhabit (i.e., the hidden nature of a shark attack – Ropeik, 2010), and/or that these predators are phylogenetically more distant groups.

In the terrestrial realm, the majority of large dangerous mammals (e.g. lions, tigers, leopards, hippos, elephants; exception are bears and cougars) inhabit African and Asian countries, where a large number of human–animal conflicts occur, even though actual numbers are likely under reported (Löe and Röskaft, 2004; Torres et al., 2018) (Fig. 1). In contrast, carnivore–human conflicts (by bears, wolfs and cougars) that occur in developed regions (Europe and North America) are all highly reported by media, increasing fear and the potential for negative attitudes towards species that are of conservation concern (see Penteriani et al., 2016), similar to the trend observed for sharks. Previous work has shown that the majority of Australian and U.S. media coverage (300 articles) emphasized the negative risks that sharks pose to people (>50%) when compared to reporting on threats facing sharks and associated conservation efforts (~11%) (Muter et al., 2013; similar to our media search results). This would indicate reduced importance placed on conservation actions for many shark species which are highly threatened, that may in turn influence available funding and impact of conservation outreach. This high media coverage on shark incidents in the developed world may consequently lead humans to overestimate the risk of being attacked through rare events (or null) through the 'Denominator Neglect' phenomenon (Reyna and Brainerd, 2008; Penteriani et al., 2016). Through extensive media coverage of individual shark attacks, the general public may perceive that shark populations are recovering and healthy and becoming problematic, potentially as a result of conservation measures (Braccini et al., 2017). While certain shark populations are recovering (e.g. Curtis et al., 2014), most are not, but unbalanced media reporting may suggest this outcome and/or that recovered populations are a nuisance. This coupled with increasing water based recreational activities, the fear factor of a shark bite and media reach may drive an accepted view of culling and/or fishing for aquatic threatened species (Cressey, 2013). It is this public perception of sharks shaped by media that has likely contributed to them being one of the most threatened vertebrate groups globally (Dulvy et al., 2014). At present, sustainable shark populations are at risk because of the high value of their body parts (fins) in international markets (McClenachan et al., 2016), and increasing pressure to provide security and protection to swimmers and surfers worldwide against shark attacks (Neff, 2012). Media portrayal of shark–human incidents in developed countries could be a key factor hindering progress towards public support to manage conservations issues related to sharks. We advocate that negative publicity towards sharks when compared to terrestrial predators, even in the current climate of enhanced conservation awareness, is linked to a geographic bias in mass media reporting of shark–human interactions.

But, while there is the potential for public misperception of conservations issues related to sharks, there is the potential for mass social media to drive a turn in the tide of cognizance. In 2015 a large number of beachgoers worked together to try and rescue two great white sharks (*C. carcharias* (Linnaeus, 1758)); stranded on a beach in Cape Cod, USA. This was likely a result of increased awareness of shark conservation actions because localized white shark research has received media popularity over the past few years (but these positive actions may be compromised after the fatal attack in Massachusetts in September 2018, the first since 1936). In Camboriú beach, southern Brazil, a bather rescued a stranded blue shark (*Prionace glauca* (Linnaeus, 1758)), and was acclaimed by the local people, while in Newfoundland, a passerby saved a stranded Greenland shark (*Somniosus microcephalus* (Bloch & Schneider, 1801)) that had ingested a large piece of scavenged meat. Beach users of Sydney, Australia, were against (>80%) the general culling of sharks, and also opposed (>70%) the strategy of catching and killing sharks following a shark attack (Gray and Gray, 2017). In Western Australia, many people take precautions (e.g. avoid dawn and dusk, swimming with others) in order to limit shark-incidents risk or dangerous encounters (see Gibbs and Warren, 2015). These cases, a few of many, provide evidence for optimism, and highlight that humans can learn to live with and respect sharks, even though they are wild, dangerous animals that inherently roam free unlike their terrestrial counterparts.

To address the issue over the current geographic bias in negative media reporting of shark–human conflicts and its impact on future shark conservation priorities, we recommend; (a) increased communication between scientists and stakeholders to establish ground rules on responsible media reporting of shark–human interactions, (b) scientists and stakeholders working more closely with media to better inform the general public following human–shark incidents and/or even just shark presence in a region through a more balanced perspective of the population status and role of sharks in general, (c) more studies undertaken to investigate the public perception of sharks and their interpretation of media events (building on the excellent work of Neff, 2012; Neff and Hueter, 2013; Pepin-Neff and Wynter, 2018) and (d) increased investment in communication, education, and public awareness programs to rebalance the media and public perception of sharks to promote understanding and value of their ecological role and to avoid human–shark incidents. Without a greater understanding of the publics' perception of shark–human conflicts and conservation and improved education, measures to mitigate shark attack and assist predator conservation will fail. It is the duty of media and all stakeholders (scientists, resource managers and the general public) to ensure that we as a society do not see sharks as a threat or "human killers", but as key elements in the maintenance of aquatic ecosystem services that are of essential value to human well-being (McCauley et al., 2015). Meeting the goals of protecting both people and predators is possible and will promote sustainable coexistence (Ferretti et al., 2015).

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.pecon.2018.12.004.

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