The feeding and foraging behaviours of Brown Bear in relation to salmon;
Topic Summary

To maximize their fitness, brown bears (*Ursus arctos*) need to feed on salmon, making it the major food source for these animals (Gende & Quinn 2004). Brown bears mostly inhabit and fish in the western areas of Alaska and British Columbia. Over years of evolution, brown bears have developed various fishing strategies to optimize foraging, getting the most energy per annual salmon run. Some of the behaviours studied are the choices brown bears make based on the salmon's abundance, sex and size, and how bears ensure maximum energy intake in a social class.

One topic that was widely studied was how brown bears changed their fishing behaviours based on the different salmon abundances (Quinn et al. 2003; Deacy et al. 2016). These studies came to similar conclusions using different approaches. Quinn et all. 2003 studied the bear's density-dependent predation behaviour by observing the area of study and conducting surveys to count the dead salmon. Deacy et al. 2016 studied how brown bears followed the salmon resource wave using cameras. Bears would fish where the salmon was most available, which was the falls and streams early in the run, and in the rivers and lake beaches later in the run (Deacy et al. 2016). This related to what was discovered by Quinn et al. 2003, that brown bears will feed in areas with the most salmon to maximize their energy intake. Adding to this behaviour, Quinn et al. 2003 also found that in low salmon abundance, bears fished more as they believed the food source to be limited.

Two different articles studied how brown bears maximized the energy obtained while fishing and came to different conclusions. Gende et al. 2001 and Quinn & Kinnison 1999 studied if the bears chose to consume male or female salmon. Gende et al. 2001 used tree stands to observe the bears using cameras, and Quinn & Kinnison 1999 made physical counts for alive salmon. Gende et al. 2001 found that females were consumed more due to them having eggs (roe) which were high in energy, and Quinn and Kinnison 1999 stated that bears would consume bigger salmon (males) more to maximize energy. A possible difference in these findings can be due to a difference in the areas of the bears, proving that geographic variations may play a role in bear behaviour. (Quinn and Kinnison 1999).

Three studies related the brown bear fishing behaviour to social dominance. Gende & Quinn 2004 used tree stands to observe the bears. Dominant bears had the highest energy intake as they spent the most time on the streams (Gende & Quinn 2004). Although despite dominant bears invading the area, non-dominant bears were able to consume sufficient salmon. The reason was found by Gill & Helfield 2012, stating that non-dominant bears worked their way around this problem possibly over years of evolution, using counter strategies like visiting various streams to maximize intake. Another study related to dominance was the ability of adult male brown bears to be more efficient while fishing at night (Klinka & Reimchen 2002). It was observed using night cameras that male bears opted to fish during the night, and females did not participate to protect their cubs from aggressive male bears (Klinka & Reimchen 2002).

There were two important behaviours studied that did not fall into the major categories. Wirsing et al. 2018 found through video observations that brown bears stayed in the same neighbourhoods over spawning seasons as that is what they are familiar with (Wirsing et al. 2018). The relationship between salmon and brown bears also benefited the environment around them as stated by Helfield & Naiman 2006. The interaction between salmon and brown bears is the most important and effective relationship when it comes to marine-derived nitrogen.

lot is to learn about brown bears and salmon, such as how social classes have evolved over years of evolution and their influence on foraging (Gill & Helfield 2012). Through receiving these articles, a possible future research study conducted could be on the efficiency of nocturnal foraging with relation to salmon abundance. Many of the studies for brown bears were conducted during daytime, these can be replicated for nocturnal foraging to compare the results to observe consistency.

Citations:

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