

## ZOOL 567 Literature Review 3 - Topic Summary

As large, predatory animals, American black bears (*Ursus americanus*) make challenging study participants (Rogers et al., 2020). They become even more fearsome once they are mothers, when around 3-8 years old, guarding their 1-4 young for 16-17 months. These make studying the development of cubs even more challenging as any disturbance risks harm to the researcher or abandonment of the cubs. However, modern innovations have allowed for novel solutions to these challenges and have revealed many influences on cub development (Mesa-Cruz et al., 2020). Understanding these influences is necessary when creating effective reintroduction strategies, especially for declining populations, to maximize their success by rehabilitating cubs as naturally as possible and returning them to the wild with minimal domestication.

One of the first influences on cub development is maternal conditions (Robbins et al., 2012). These are essential for understanding cub development since cubs are born altricial, which means they cannot care for themselves (Rogers et al., 2020). Studies like Robbins et al. (2012) utilize experimental data gathered by varying the diets of captive mothers, while those like Bridges et al. (2011) use data collected from immobilized bears and distant observations to describe this phenomenon. These showed that maternal conditions are vital in determining if and when pregnancies occur based on their weights, ages, and resource availability, with older, heavier bears producing larger cubs earlier. Most bears display seasonal reproductivity and can delay the embryo's implantation to synchronize birth timings with periods of high resource availability (Spady et al., 2007), demonstrating their control over these influences. Combining the altricial births of cubs (Rogers et al., 2020) with the impacts of maternal conditions on growth rate and masses (Robbins et al., 2012; Bridges et al., 2011) demonstrates the importance

of maternal conditions as one of the first influences on cub development as a factor to consider when determining the timing of reintroductions.

Following birth, maternal influences begin to share their impact on development with sibling interactions and are typically observed through remote den observations using digital cameras and microphones (Rogers et al., 2020). These show that mothers display warming, grooming, and nursing behaviours immediately after birth, necessary during harsh winters. Sibling interactions follow this and are responsible for milk release from the mother (Mesa-Cruz et al., 2020). This milk release increases with more cubs, as does its competition. Studies that observed these trends showed that twins had optimal growing conditions, suggesting ideal litter sizes for reintroduction strategies that utilize fostering methods (Mesa-Cruz et al., 2020). Social behaviours were also developed through interactions from mothers and siblings with tongue licking and play behaviours, respectively (Rogers et al., 2020). The results demonstrating these shared maternal and sibling post-birth influences on development indicate vital factors to consider when rehabilitating cubs separated from their families.

Captivity and rehabilitation also impact the development of cubs through habituation and stereotypic behaviour (Steinmetz et al., 2021; Vickery & Mason, 2003). These observations come from studying released individuals and comparing the survival and frequencies of human-bear conflict behaviours with wild individuals. The main issue of stereotypic behaviour is its connection to behavioural persistence (reduced adaptability), which is highly disadvantageous in complex, natural environments (Vickery & Mason, 2003). Habituation to people is another problem, which diminishes a bear's natural avoidance of humans and can lead to increased conflict behaviours as they enter human settings for food (Steinmetz et al., 2021). Considering these issues and the methods of reintroductions, which have varying success rates based on the

techniques (Alt & Beecham, 1984), are crucial to developing proper reintroduction strategies. Of these methods, natal den reintroductions that occurred early in the denning period showed the highest success rates. However, successful reintroductions are possible, as demonstrated by studies like Blair et al. (2020) and Beecham et al. (2015). They observed released cubs with survival rates and behavioural frequencies similar to wild counterparts, an essential criterion for reintroduction success..

What remains less known in these studies is the role of artificial enrichment in rescuing the trappings of captivity (stereotypy development or reliance on humans). Developing more efficient and successful reintroduction strategies before they are needed is critical to practical conservation solutions, providing orientation for future research areas. These studies could focus on the impacts of varying enrichment types on bear behaviours.

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