ZOOL 567
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Literature Review Part 3: Topic Summary

Cooperative breeding in the family *Corvidae* was characterized by a breeding pair obtaining assistance from helpers, often kin or offspring from previous breeding seasons that have chosen to delay their dispersal in favour of helping through nest defence, nest building, or food provisioning (Bresgunova, 2013; Canário et al., 2004; Baglione et al., 2002). Ecological factors such as the environment and interspecific interactions could be contextual factors that help determine this behaviour.

An environmental facet that researchers were interested in was the climate, specifically in how latitude and weather influenced this behaviour. Ekman and Ericson (2006) were interested in the former and used phylogenetic trees to assess whether breeding system distribution corresponded to latitude. They determined that cooperatively breeding corvids tended to frequent habitats in the Southern Hemisphere (Ekman and Ericson, 2006). Canário et al. (2004) investigated the role of weather in influencing helping behaviour. Using observational and bodily measurements, they found that cooperative breeding may be beneficial during tough times by providing additional nourishment (Canário et al., 2004). Both suggested that climate could play a role in whether birds choose this breeding strategy. In addition, latitudinal distribution and its correlation with climate/environment may influence breeding systems (Ekman and Ericson, 2006). Bad weather could also induce cooperative breeding as an alternative fitness strategy for helpers (Canário et al., 2004).

Climate was not the only environmental factor influencing this behaviour. The role of year-round residency against habitat stability was another area of interest for researchers.

Baglione et al. (2005) and Bresgunova (2013) studied this, with the former utilizing observations, tagging, and habitat saturation and territoriality measurements, while the latter compiled a review of previous studies. From this, Baglione et al. (2005) found that year-round residency may confer benefits to natal philopatric behaviour. Bresgunova (2013) reviewed similar results and inferred living together increased kin interactions, thereby conferring more benefits to those that remain with their natal groups. Thus, both studies suggest that year-round group living could be advantageous to juvenile birds, which could be the reason for delayed dispersal and cooperative breeding in corvids (Baglione et al., 2005; Bresgunova, 2013).

Not only was the physical environment influential, but the social environment could also be deterministic. Baglione et al. (2002) was interested in the role of the rearing environment and utilized behavioural data and experimental samples in their study. They found that the rearing environment impacted whether delayed dispersal occurred as birds raised in cooperatively breeding populations ended up displaying the same behaviour; this suggested that the environment in which birds develop could be a factor in whether corvids utilized helping behaviour (Baglione et al., 2002).

Aside from the environment, factors influencing nesting success could also contextualize the behaviour. For instance, nest defence against predation was a component in the studies accomplished by various researchers. Both Innes and Johnston (1996) and Ren et al. (2016) utilized tagging and behavioural studies in their research, with both determining that helpers aided in reduced nest predation. Thus, helpers could contribute to overall nest success by protecting nestlings from predators (Innes and Johnston, 1996; Ren et al., 2016).

Another possible factor was that cooperative breeding aided against nest parasites. Canestrari et al. (2009), using observational studies, found that helper number reduced

opportunities for brood parasites. Similarly, Wascher et al. (2019) investigated cellular parasitism as a factor influencing helping behaviour through behavioural and experimental sampling and found that helper presence lowered parasite egg presence. This suggested that helpers limit parasitism opportunities, thereby raising nest success.

Finally, Valencia et al. (2006) were interested in how helpers affected nestling immunity. Using injection treatments and body measurements, they found that nestlings with helpers had increased immunity relative to nests lacking helpers (Valencia et al. 2006). This suggested that helpers increased nestling fitness, possibly due to better food provisioning or parasite removal (Valencia et al. 2006).

What remains unknown are the other advantages that helpers may obtain by partaking in this behaviour (Canário et al., 2004). Therefore, future studies could be conducted over extended periods to confirm present results (Valencia et al., 2006). In addition, there should be investigations into the other benefits that helpers obtain from this behaviour (Canário et al., 2004).

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