# **Chapter 3: The need for ecological studies in social species**

**Introduction**

Sociality is widely observed in the animal kingdom, and it has been documented that social behavior enhances learning (Aikens et al. 2022). From migration to mating and chick-rearing, sociality seems to bring benefits to all individuals in the group. While the role of sociality in grouping is still not fully understood, is increasingly recognized that many birds and mammals live in social systems that are structured by long-term affiliative and agonistic relations (Kappeler, 2019; Massen, 2018). Feeding in groups is a foraging strategy that brings numerous benefits to group members, such as increasing the likelihood of locating food and enhancing vigilance for predator detection (Marinero et al., 2018). These benefits may increase survival of individuals and overall fitness.

Among animals, social grouping has been mainly studied in mammals. Conversely, in birds, these studies are somewhat limited. Among birds, most studies have been conducted in corvids given their notably sociality and cognitive skills (Emery et al., 2007; Emery & Clayton, 2004). Corvids establish strong social relationships and social hierarchies, and they show sophisticated reasoning and problem-solving abilities. These fascinating features, however, have not been studied in other bird species.

Vultures, just like corvids, are scavengers. Similarly, vultures are also highly social species. Among this group, several species have been documented using communal roosts where several individuals gather for the resting period (Campbell, 2015; Van Overveld, Gangoso, et al., 2020), as well as individuals gathering around carcasses when foraging. Beyond this example of sociality, there is also research done in despotic behavior and hierarchies within and across species. For instance, a study conducted in East Africa with seven types of scavenger species showed that there’s niche partitioning between the species in the study system (Kendall, 2013). In concrete, the author found that species that have greatest search efficiency or greater sociality (e.g. Bateleurs, Ruppell’s, Lappet-faced, and White-backed vultures) had access to patches of better quality than their counterparts, hence establishing dominance. Likewise, a study done on Andean Condors (*Vultur gryphus*) shows that sex, age and pigmentation drive hierarchy in this highly despotic species. As seen above, while sociality may benefit individuals in a group, it may also increase competition in the group for food resources, which is particularly important when resources are limited (Moreno-Opo et al., 2020).

**Why vultures?**

Vultures, unlike corvids, are obligate scavengers. This means that they depend entirely on carrion for their energy supply. Carrion is an ephemeral resource heterogeneously distributed and often limited in space and time (Barton et al., 2013; DeVault et al., 2003; Ostfeld & Keesing, 2000). Because of its scattered and unpredictable nature, competition at these feeding sites is high with agonistic behavior and hierarchies established. Interestingly, this high competition has in turn led to the evolution of specific behaviors to reduce competition for resources such that the community finds balance. Such mechanisms include niche segregation among the different species (Savolainen et al., 1988; Schuette et al., 2013). Albeit, when dominance is established in individuals of the same species, niche partitioning becomes less likely. From a conservation point of view, this is important two reasons. First, if resources are limited, population may select in favor of adult individuals, which may decrease juvenile recruitment thereby impacting the population fitness. Second, if resource partitioning does not occur within a species or a guild and individuals are forced to gather around one resource, a significant portion of the population may be prone to threats while feeding.

**A note on the Information Center Hypothesis**

In Chapter 2 we highlighted the importance of communal roosts as a place where individuals gain access to location of food sources, as explained by the Information Center Hypothesis. It is important to say that the information transfer is usually unintentional. This is relevant because transferring information about a food source location does not inform about the quality of the resource itself. If individuals are foraging on suboptimal food sources and other individuals in the roost follow, this could have a severe impact at a population level. Several roosts for vultures are located near anthropogenic food sources like garbage dumps given their greater predictability such that it is less energetically costly to access food, despite its poor quality. Noteworthy, vultures are among the most threatened group of birds in the world, most species showing steep declines in their population (McClure et al., 2018). Notably, these declines are exacerbated due to their gregarious behavior. When individuals follow others and forage together at a single carcass, it amplifies the risk of mass mortality when the carcass is poisoned (D. Ogada et al., 2016; D. L. Ogada, 2014; Santangeli et al., 2016)). Thus, the use of social information when feeding may become an ecological trap (Curk et al., 2025) with cascading effects.

**Size matters: The Andean Condor – A peculiar case study**

Given their obligate scavenging nature, old and new world vultures rely highly on communal roosting behavior. In black vultures, for instance, individuals may roost up to 200 individuals together. These large roosts provide several opportunities to access foraging sites by increasing accuracy of the food location by following more knowledgeable individuals (Sassi et al., 2024), leading to more cost-efficient movement (Rafacz & Templeton, 2003; Williams & Safi, 2021). Evidently, the larger the size of the roost, the greater probabilities to find communal food sources. In the wild, however, these opportunities are constrained by population sizes of the species in question.

With a wingspan of 320 cm, females weighting up to 11 kg and males up to 15 kg (Houston et al. 2020), the Andean Condor (*Vultur gryphus*) is the heaviest extant soaring bird. It is an obligate scavenger, and a highly social species (Donázar et al. 1999), that uses communal roosts when they are not breeding, with aggregations adding up to 50 individuals. Despite their widespread distribution, large portions of the population are concentrated in specific locations, where these communal roosts exist.

Like other vultures, Andean Condors are also obligate soarers. This means they rely on thermal updrafts to search for carcasses. When foraging, these birds gain altitude by riding a thermal updraft (hot air masses created as a consequence of heated surface that rises), and they use it to move in the landscape in search for food (Sassi et al., 2024). This remarkably energy-efficient flight mode allows them to reduce energy expenditure. Given their size and feeding guild, Andean Condors highly benefit from this flight strategy. Some geographical features promote the occurrence of thermals like cliffs and slope inclination and aspect (Scacco et al., 2019). It is likely that when selecting a communal roosting site, they select roosts that will allow them to exploit these thermals to commute to and from foraging grounds. In fact, a study by Sassi et. al (2024) shows that vultures movement decisions relied highly on social information.

Collectively, all of these lines of evidence suggest that communal roosting sites are crucial for the population structure and dynamics in Andean Condors. Much has been hypothesized about the importance of communal roosts for information sharing and feeding resources. Nonetheless, more research is needed to understand how the information transfer operates in these roosts, and how valuable each connection is for information transfer. As concluded by(Curk et al., 2025), the value of social information was only evident with a large number of vultures in the area. These findings stress the need to have healthy populations that can self-sustain (Van Overveld, Blanco, et al., 2020), especially as natural food becomes more limited.

Undoubtedly, communal roosts are areas of high conservation priority (Dermody et al., 2011). As with many other vultures, Andean Condor populations are decreasing throughout its range, with all major threats being anthropogenic. In particular, habitat loss, poisoning due to human-wildlife conflict and wind power development are of greater concern, which frequently act synergistically. Because of their size, ecology (e.g., long lifespan, low reproductive rates, obligate soaring species – which requires longer learning periods (Hertel et al., 2023)), scavengers), behavior (social species), and conservation status (globally Vulnerable), this emblematic Andean species is a peculiar study system and good model (Poessel et al., 2018) to test the hypotheses on the effects of sociality on foraging efficiency as they represent an extreme in the spectrum of extant flying birds.

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