

Title: Exploring the Effects of Urbanization and Elevation on Chickadee Nestling Development

Objective: This project seeks to explore the effects of urbanization on nestling development in blackcapped and mountain chickadees along an urban-rural elevation gradient and characterize any differences within and between these species. Significance: Variation in nestling development between and within chickadee species in Colorado will provide insight into the role that different levels of urban disturbance may play on how species are affected by increasing anthropogenic interference. Results from this study might also help in understanding the potential outcomes of hybridization and the influence of elevation on life history as these species' ranges may shift in response to continued climate change. Introduction: Urbanization is rapidly altering natural environments and species that occupy urban spaces must adapt or leave. As urban areas expand, the ability for species to quickly adjust is tested. This can have significant impacts on life-history strategies, including breeding and reproductive success. The effects of urbanization on physiology has been examined but results remain inconsistent. Some studies have shown significant negative effects on nestling development (Bailly 2015, Satgé 2019) or mixed effects (Muller 2020), while other studies showed little to no effect (Meillère 2017), particularly in species more adapted to urban life. Also, the extent to which nestling development is impacted by urbanization has not been widely studied, despite the developmental period being the most crucial time in the vertebrate life cycle, as this sets the tone for adult performance later in life. The pace-of-life syndrome (POLS) hypothesis suggests that closely related species should differ in various physiological, behavioral, and morphological traits that are associated with variation in their life history (Réale 2010). This is also described as the fast-slow life-history continuum, where at the fast end species experience high reproductive rates, low parental investment, and shorter life spans, and the opposite of these traits is seen at the slow end (Boyle 2016). As elevation increases and anthropogenic disturbance decreases, this continuum shifts to slower life-history strategies as populations living at high elevation deal with environmental factors such as colder temperatures, shorter breeding seasons, and decreased food availability (Boyle 2016). I seek to explore how chickadee nestling development is affected by urbanization along an elevation gradient and to characterize how nestling development differs within and between chickadee species. Body size, weight at fledging, and wing condition are reliable proxies for evaluating developmental growth in nestlings (Biard 2017). I hypothesize that chickadee nestlings will have faster development in low elevation urban areas compared to nestlings in high elevation rural areas, regardless of species, and black-capped chickadees will have faster nestling development than mountain chickadees. Black-capped chickadees are generally a lower elevation species, and as such, should follow the fast end of the POLS framework (See Table 1). Study System: Black-capped (BC) and Mountain (MC) chickadees are small, nonmigratory passerines that occupy a range of habitats along elevational and urbanization gradients. BC can be found in deciduous forests and mixed tree forests, open spaces, and disturbed habitats near urban areas at lower DFO Research, Education, and Conservation Grant 2021 elevations, while MC prefer the high elevation coniferous forests of western North America. Both species are commonly found at backyard feeders across much of North America, and as cavity nesters, readily take to nest boxes. BC and MC experience ecological segregation based on their geographic range, but BC are more dominant over MC in areas of sympatry (Grava 2012). BC and MC are known to hybridize in areas of close proximity, but the long-term success of hybrid chicks has not been characterized (Grava 2012, prev. data). The main aim of this study is to characterize nestling development of both chickadee species across urban disturbance gradients at multiple elevations to identify differences between and within species.