Sexual selection plays an essential role in shaping the evolution and adaptation of a species to its natural environment, with individuals more proficient in securing mates achieving higher fitness. Previous research has been disproportionately focused on the evolution and maintenance of male secondary sexual traits (SST) in species with pronounced sexual dimorphisms and polygynous mating systems, where sexual selection seems to play an obvious role. This has led to a persistent gap in our understanding of how sexual selection operates within and between the sexes in a specie with little apparent dimorphism. The aim of my PhD project is to address this gap, with the Alpine Swift (*Tachymarptis melba*) as a model species.

Alpine Swifts are long-lived and colonially nesting birds who provide biparental care to their offspring. Although they appear monomorphic to human observers, subtle sexual dimorphisms are present in addition to within sex variation: the characteristic white throat patch is larger in females while the tail is more deeply forked in males. The Swiss populations I will study have been closely followed at the individual level for over twenty years. As such, outstanding information has been collected detailing morphology, reproductive success, pairing decisions, and relatedness (essential for the quantitative genetic analyses I will perform).

I will address four central research questions (RQs). RQ1: How does sexual selection drive the evolution and maintenance of SSTs and what is their current signalling value? RQ2: What are the relative contributions of additive genetic (heritable) and environmental effects on phenotypic variation in SSTs? RQ3: What are the adaptive advantages of divorce (vs. mate retention) and of assortative (vs. non-assortative) pairings following natal dispersal in the context of local adaptation? RQ4: Do nest location and composition reflect parental quality and how does experience affect male, female, and total parental investment (and in turn fitness)?

I will investigate four SSTs: 1) achromatic throat patch size, 2) throat patch brightness, 3) tail fork length, and 4) breast patch melanization; as well as two mating strategies, a) divorce (vs. mate retention) and b) assortative (vs. non assortative) mating (following natal dispersal); and parental care. My research will build upon the existing individual-level long-term database with newly collected information on achromatic throat patch size and plumage UV reflectance using a novel photographic approach (obtaining joined size & reflectance information on the throat patch vs. using a spectrophotometer).

Quantitative genetic models: I will use animal models—mixed models linked to a pedigree—to understand the genetic basis of SSTs and mating strategies. These models will allow for statistical inferences about the additive genetic (co)variance (heritability) in SSTs in both sexes and the genetic correlation between the sexes, and to test the direct and indirect influences of mating strategies and parental care on fitness in a species with little apparent sexual dimorphism.

Methods: RQ1: Using selection models, I will investigate the signalling values and fitness association of SSTs in both sexes. RQ2: Using univariate animal models, I will quantify the sex-specific relative contributions of additive genetic (heritable) and environmental effects (e.g., rank in the brood, weather) on SST expression in both sexes. Using bivariate animal models, I will investigate the potential for intra-locus sexual conflict (wherein alleles that increase fitness in one sex decrease fitness in the other sex). RQ3: Using multivariate animal models, I will assess the adaptive value of divorce (vs. mate retention) and of assortative (vs. non-assortative) pairings following natal dispersal and how this may differ and reflect conflicts between the sexes. RQ4: Using linear mixed effects models, I will examine the link between parental quality, nest composition & location, experience and fitness.

Despite significant improvements in our understanding of sexual selection in recent decades, open questions remain as to how SSTs can evolve in both sexes, and how their evolution may relate to sexually antagonistic selection (wherein the sexes have conflicting fitness strategies) or be constrained due to shared genetic architecture between the sexes. My study will shed new light on the evolution and maintenance of SSTs in species where these traits have evolved in both sexes, intra- &inter-locus sexual conflicts and their potential resolution, as well as the fitness impacts of divorce, assortative mating, and parental care at both the phenotypic and genetic levels.