Nectar is one of the most ubiquitous foods on earth (Nicolson, 2007), and certainly one of the most important. Nectarivores include legitimate pollinators as well as nectar robbers, “accidental” pollinators (e.g., some butterflies and flies whose pollination efficiency is well below “primary” pollinators such as bees), predators or parasitoids that defend plants against herbivores in exchange for a nectar reward, and insectivores and/or herbivores that supplement their diet with nectar. The nectar characteristics most studied in the literature involve the primary constituents water and sugar—nectar volume, sugar concentration, and total sugar mass—although recent studies are paying more attention to amino acids, volatile organic compounds, microbial content, and other non-carbohydrate ingredients.

Different animal species require different nectar characteristics, based primarily on mouthpart physiology and metabolic needs. The two primary mechanisms for ingesting nectar are licking or lapping with a tongue, and sucking nectar through a hollow tube like a straw. Most bees, flies, birds, and mammals are tongue feeders, while butterflies, moths, and Neotropical euglossine bees suck nectar through a long, hollow proboscis (Kingsolver & Daniel, 1995; Krenn et al., 2005). Different nectar concentrations are optimal for the different feeding styles—suction feeders require less viscous nectar and therefore lower nectar concentrations, while tongue-lappers generally do better with a more highly concentrated nectar (although see the discussion on bird flowers below). Empirical studies on hawkmoths, butterflies, and euglossine bees suggest an optimal nectar concentration between 30% and 40% (Warburg & Galun, 1992; Josens & Farina, 2001; Pivnick & McNeil, 1985; May, 1985; Hainsworth et al., 1991; Borrell, 2004), and these numbers are consistent with predictions by Kingsolver and Daniel (1995). Tongue-feeding bees have been found to optimize their energy intake at concentrations of 50% to 65% (Harder, 1986; Roubik & Buchmann, 1984). Seeley (1986) demonstrated that honeybees are very sensitive to differences in nectar concentration.

The metabolic requirements of different nectar consumers also strongly influence optimal nectar characteristics for each species. Feeding while hovering is metabolically expensive, so hummingbirds, sunbirds, hawkmoths, and hovering bats generally require larger nectar volumes (on the order of 100-1000 µL), while bees, butterflies and most moths make do with smaller quantities (on the order of 1 µL) (Nicolson, 2007). Interestingly, birds nectar on copious amounts of dilute nectar—Nicolson and Fleming (2003) investigated 255 hummingbird species and 158 sunbird species, and found concentration means of 25% and 21% respectively. Several reasons have been proposed for the low sugar concentrations consumed by birds. Baker (1975) suggested that because the viscosity of nectar increases exponentially with concentration, low viscosities enable more efficient extraction of nectar by bird tongues, especially during hovering (see also Nicolson, 2007). Alternately, dilute nectars may encourage birds to visit more flowers by not satisfying their energy requirements immediately (Martínez del Rio et al., 2001; Nicolson, 2007).

Nectar characteristics are related to other physiological and ecological effects in addition to eating dynamics and metabolism. The water balance of birds and honeybees is strongly affected by the amount of water they take in with nectar, and both taxa have developed physiological processes to deal with a negative water balance, in the case of flying honeybees (Roberts & Harrison, 1999), or chronic diuresis, in the case of birds (Nicolson & Fleming, 2003). Ecologically, Chittka & Schürkens (2001) have suggested that the reason *Impatiens glandulifera* (Balsaminaceae), a Himalayan annual, successfully invaded Europe is because it offers bumblebees higher rewards than native plants. We will return to this point about the ecological effects of changes in nectar characteristics below.

Nectar volume, sugar concentration, and sugar mass are just three characteristics of nectar that interact with the physiological and ecological needs of nectar consumers. In fact, the most ubiquitous food on the planet determines a continuous, multivariate, ecological “niche space”, defined by the range of values of nectar characteristics such as volume, concentration, sugar mass, amino acid content, microbial contamination, etc. Nectar niches might be occupied by generalists, who have relatively broad tolerances and comfortably fit in a wide niche space, or by specialists, bound by physiological or ecological requirements into narrow niche spaces with a small range of values in one, many, or all nectar characteristics. Without calling it such, work in this area has already been done, most recently by Ollerton & Watts (2000), who conducted a multivariate ordination of classical pollination syndromes. They created a nectar space with their model, and the clusters that fell out defined the niches.

With this conceptual framework in mind, we can ask two general questions: Would changes in nectar niche space alter the community of nectar consumers, and if so, how? We leave this very important question to future research programs, although it seems extremely unlikely that changes in nectar characteristics would \*not\* alter in some way the community of consumers that use and often depend on the resource. What is the relationship, in direction and degree, between changes in nectar and changes in the consumer community? Changes in which characteristics would have the strongest effect, and for which characteristics are consumers best buffered? Investigations into these types of questions are essential to understanding how changes in nectar characteristics, caused by natural and anthropogenic changes in biotic and abiotic systems, might affect the communities that depend on this critical source of nutrients.

…Which hints at the other general question we can ask about nectar niche space, namely, what biotic and abiotic changes in natural systems might cause shifts in that space? What factors determine, at an ecological time scale, the precise nature of the characteristics nectar presents? This question becomes more pressing as we begin to feel the effects of anthropogenic climate change. Fortunately, there is a large literature already investigating this question, and good reviews have been published by Pacini et al. (2003) and XXX. Nectar volume, composition, and concentration are all influenced by temperature, though it appears that few studies have addressed these topics in the context of climate change (Scaven and Rafferty, 2013; but see Mu et al., 2015 and Takkis et al., 2015).

Thus far, we have discussed how nectar affects its consumers, but what biotic and abiotic processes affect nectar characteristics?