Predators play a crucial role in regulating prey populations (Murdock et al. 2003), which can have widespread effects on the structure and function of ecosystems (Estes et al. 2011). For example, predators can alter the density and size distribution of prey (CITE), the distribution of primary producers (CITE), and the way nutrients flow through ecosystems (CITE). Understanding the strength of interaction between a predator and its prey it essential towards understanding the community level consequences of predation, particularly when predator-prey are considered in the complex web of interactions characteristic of many ecosystems (Berlowe et al. 2009). The classic method of estimating the interaction strength between a predator and prey is to quantify the relationship between per capita consumption rate and prey density, or the predator’s functional response (Wooten and Emmerson 2005). The per capita consumption rate can increase as a linear (Type 1), hyperbolic (type II), or sigmoid (Type III) function of prey density (Holling 1959, Real 1977x11).

While this relationship can take many forms, per capita predator consumption rate generally increases with prey density until some saturating density at which consumption is limited by the time it takes to manipulate, ingest, and digest prey. Traditional models of predator-prey dynamics treat the functional response, or the interaction strength between predator and prey, as constant over space and through time. However, interactions strengths can be highly variable. Any spatio-temporal process that shifts the density of predators and prey, such as stochastic variation in mortality and recruitment (Navarrete and Berlowe 2006), could therefore result in variation in the strength of interactions across a metacommunity (CITE). Furthermore, predators can interact with prey differently in different habitats (Menge et al. 1994), habitat dimensionality and complexity can drive shifts in the strength of predation (Parwar et al. 2012, Barrios-O’Neill et al. 2017), and variation in metabolic capacity amongst individuals can shift foraging requirements (CITE).

The functional response offers a method of not only experimentally estimating the strength of predation, but also for linking consumer and resource populations in theoretical models of population dynamics. Dynamic predator-prey models are very sensitive to the parameterization of the functional response (CITE). Thus understanding what drives variation in the functional response is essential towards understanding the stability of predator-prey interactions and the ecosystem level consequences of consumer-resource dynamics.

Historically, theoretical models of predator-prey interactions have treated the interactions strength between a predator and its prey as dependent on prey density, predator density, or their ratios. However, many other factors can drive variation in the functional response, or the interaction strength between a predator and its prey, can vary across space and time due to myriad factors other than variation in predator and prey densities. For instance, habitat dimensionality and complexity can alter the

predators can interact with prey differently in different habitats, habitat dimensionality and complet

there is a growing appreciation for the dynamic nature of interactions strengths. Indeed, the interaction strength between a predator and its rpey can vary across space and time.

Holly, in your reading of the literature on age/stage structured models. Is the FR often parameterized differently for each stage?

While the shape of this relationship can vary widely, consumption rate generally increases as a function of prey density and can be described as

Where is the number of prey eaten per predator per unit time, is the density of prey, is the capture rate of the predator in units of area searched per unit time, is the maximum ingestion rate of the predation, and is the scaling exponent that determines the shape of the curve at low prey densities.