Working Title: Isotopic niche space, predator body size, prey composition, and prey trophic positions between high- and low-productivity habitats

Baby: Habitat productivity can shape the structure of food webs. Increased habitat productivity can increase food chain lengths as habitats support more species or as increased resources increases the ability of organisms to take advantage of different resource pools (e.g. Young et al. 2013, other food chain length studies). Something with Layman et al. papers related to niche breadth with resource availability as well.

Werewolf: While it has been established that habitat productivity can increase food chain length, there are multiple mechanisms by which this could occur.

1. Predators may shift to new resources at higher trophic levels (niche space stays the same but shifts location)
2. Predators may become more general and feed across broader trophic groups (niche space expands beyond its current span)

Multiple lines of evidence may help us understand how and why these niche shifts take place:

1. Predators may become larger in size to access different resource pools or in response to more available resources
2. We may be able to detect diet item differences alongside shifts in niche space (either expansions or shifts in space) that explain how predators respond to different environments.
3. Does predator niche space either shift in space or expand in habitats with higher productivity? *Yes, it shifts up*
4. Are predators larger in some locations than other, providing a mechanism or response to changes in niche space? *No, and higher trophic level does not equal higher niche, see recent paper sent by An from Ecology (August 2021)*
5. Can DNA diet items from DNA metabarcoding provide evidence of the resource pools that predators shift to-from across environmental contexts? *Resource pools are ~similar – is the shift happening elsewhere in the food web, then?*

Given these findings, thoughts from co-authors:

Dan – could increases in food chain length happen at lower trophic levels, not the top trophic level?

Common prey items for which we have isotope data:

Diptera - 2009\_Palmyra\_Insect\_Amphipod\_Isopod\_Isotopes

Hempitera - 2010\_Palmyra\_Insect\_Isotopes

Lepidoptera - 2009\_Palmyra\_Insect\_Amphipod\_Isopod\_Isotopes

Araneae - 2010\_Palmyra\_Day\_Spider\_Isotopes.xlsx & 2012\_Palmyra\_Day\_Spider\_Isotopes.xlsx

Orthoptera - 2010\_Palmyra\_Insect\_Isotopes

Could I also incorporate the DNA data from more spiders + the potential prey items I picked up somehow to answer these questions? Maybe top predators aren’t shifting their diets all that much but food chain length is increasing in the middle of the food web?

- this is challenging because i only have prey items from a few islands, and not at the ends of the spectrum.

Austen:

compare isotope and DNA dissimilarity via Mantel test?

dist(isotopes) ~ dist(diet) + dist(spider\_phys)

Analyses:

1. Does islet productivity shift trophic niche space?
   1. *Yes (Hillary paper along with other literature on this)*

Exploring mechanisms:

1. Does productivity shape predator body size?
   1. *Do this analysis!*
   2. *Isotopic trophic level is not driven by body size either – paper from An about body size trends in inverts could be good here.*
2. Does the trophic niche space shift correspond to a shift in diet items?
   1. *No (the isotopic niche is not equal to ecological niche literature is ripe here)*
3. Do prey items shift their isotope values along the gradient, suggesting that lower trophic levels are seeing the productivity boon, rather than the top predator.
   1. *Do this analysis!*