ch2 - Shifts in the individual size distribution decouple the long-term trends of abundance, biomass, & energy use of N. American breeding bird communities.

scope

Ok, so here we're going to take a more synthesis-oriented view of how changes in community ~~function affect~~ structure modulate the long-term dynamics & different dimensions of community function. ~~Specifically~~, we're ~~going~~

Δ abund

Specifically, we're going to look at the long-term changes in community-wide abundance for bird communities across North America: overall, are we seeing declines, increases, ~~no change~~ or no clear overarching directional change in abundance? & how does this signal depend on how we measure abundance?

Working at the community scale this can help slot into an important niche in our ~~work~~ and appreciation for how biological diversity is changing. ~~Most work in this space~~ In contrast to focusing on the trajectories of individual populations, or continent-wide or even global changes in abundance, at the community scale we see the interaction between population trends and community ~~ecology~~ level properties - such as competition and compensation, or shifts in composition to track changing conditions, in an echo of the phenomena we dealt with in ch 1 - that can buffer community abundance against changes at other scales. We're going to explore the consequences of these community-level changes for how we think about the relationship between different currencies for dimensions of change in abundance.

community scale

currencies

~~There~~ There are different ways of ~~to~~ quantifying community-wide abundance. We can think in terms of the total number of individuals, or in terms of total biomass or total metabolic flux. These tell us about slightly different dimensions of community properties. If nothing else changes about a community over time, we'd ~~naturally~~ expect the long-term dynamics of

currencies.

these currencies to fluctuate proportional to each other.

Decoupling

However, if the ~~species composition~~ distribution of <u>body sizes</u> of individual organisms in the community changes, the dynamics of N, M, B may become de-synchronized. For example, a ~~systematic~~ community-wide shift favoring larger species → ~~an~~ potentially no Δ in total biomass, even if N ↓.

Decoupling can signal functional Δ!

Changes in the size structure can be indicative of important functional shifts in a community. Body size is strongly correlated with numerous ~~of~~ functional traits, and so [swap order] . ~~We~~ ~~The~~ ~~body size~~ ~~The~~ We've seen this, for example, at our field site where the rodent community has shifted in favor of small bodied species due to a major habitat transformation. Similar principles [also] crop up in, for example, fisheries management where the relationship between abundance and biomass is used as an indicator of ecosystem status.

thesis stmnt - why currencies, why decoupling.

So we are interested in how these currencies change ~~relative to each other~~, both bc they tell us different things on their own, and bc nuances in how they change <u>relative to each other</u> may be indicative of more extensive Δs within a community.

Gap & why:

While there's a deep history of this work in aquatic and tree communities, we know relatively little about how N, B, E, and the size structure behave for terrestrial animals.

data stats

This work ~~is~~ has ~~been~~ been constrained by 2 primary issues:

1) a lack of data, and 2) that it's actually ~~for~~ statistically quite challenging to disentangle these different quantities for these systems.

Here, we [solve those], using recent ~~stat~~ stat dev, modern compute, and BBS.

challenges

Re: a lack of data, ~~[illegible]~~ most of the data we have on terrestrial animal communities is restricted to just one "currency", so measured as abundance or biomass, etc but not both. Re: statistics, the size distributions ~~[illegible]~~ we find in these systems are more complex than what we find in aquatic or tree communities, so we have to adjust to accomodate that. Finally, it's a nontrivial question to quantitatively compare long-term trends in abundance that are intrinsically related but on very different scales of measurement, as biomass / energy use / number of individuals are.

cont'd

Here, we'll make use of modern developments that give us a way around these challenges. We can use allometric scaling to generate estimates of community size data, ~~[illegible]~~ based on species' abundances and mean body size, ~~[illegible]~~, and we can combine a simple null model with recent statistical models and traditional community ecol. metrics ~~[illegible]~~ to compare long term trends in N, B, E and relate this to underlying changes in the size ~~[illegible]~~ and species structure of the community.

~~[illegible]~~

Here we

Moreover, we're able to apply this approach at scale to look for common themes in these trends + how they relate to each other, thanks to long-term community science programs and modern high performance computing infrastructure. ~~[illegible]~~ We look at ~1000 communities drawn from the North American Breeding Bird Survey to identify the common themes in

1) long term trends in N, B, E
2) frequency w/ which they // or decouple
3) examine how changes in spp. composition + size structure propagate to modulate the relationship btwn community-level properties

Ch 2.1 - BBS size R package

scope

As a coda to this project, I want to talk about another dimension of this work that I think is equally if not more exciting than the threads that I personally have been able to pull out in this preliminary, broad scale study.

open. sci motivation

Through this work I've developed the infrastructure to simulate size structure data for birds based on either their species ID, or, with some allometry, their average body size. This is a resource that can open up lots of questions at different organizational, temporal, or spatial scales, that are otherwise difficult or impossible to get at. Most of these questions are ones that I don't have the perspective or foresight or time to develop myself, so this is a space where it's potentially very fruitful to make this resource easy to access and easy to find. not just available, but easy to use and easy to find for other researchers.

what it means here

So one of the ongoing dimensions of this work that I'm especially excited about is that I'm packaging the software I've developed in this study as an R package that can be put to general use, and working to make that resource as user-friendly and findable through tutorials & online support as a publication in Joss. (?) (too ambitious to say?)