Inaturalist and Bee lab database collections comparisons
By Sam Droege, 9/2021

I am a fan of iNaturalist and contribute photos regularly, mostly of plants, moths, and random insects/spiders. It has added quite a number of new county records of bees for our Bees of Maryland project and is both a place of learning and permanent contribution for the world of biodiversity and inventory/monitoring.

Recently, I became curious about what sort of portrait iNaturalist paints for bees and what follows is an initial poke at that, comparing iNaturalist data from Maryland to data we have collected in the Maryland. I don't plan on publishing this myself, but I think such an evaluation (particularly if done in several parts of the world) would be a valuable documentation of the value/limitations of iNaturalist types of approaches and how we should think about these data in relation to understanding the conservation status of species and as a replacement or sister to traditional collecting techniques.

So, here goes

The USGS Native Bee Lab has used a variety of techniques to collect bees over the years 2002 to present (netting, bowl type traps, malaise). In the past I have contrasted the results between netting and bowl trapping. The sum of that comparison is that both capturing the bee fauna of the region, but in quite different ways (i.e., capture rates by genus were often very different).

I have lumped all the bee lab collections together and eliminated ambiguous taxonomic categories in both datasets.

For Maryland we have collected 149,543 specimens of 398 species (spreadsheet is either attached or you can request from sdroege@usgs.gov).

iNaturalist is primarily a camera based survey technique, specimens are largely photographed alive and taken while in the field. Though there is no restriction to portraying captured specimens, it is rarely done. Data collection has been open for roughly 10 years (I actually don't know the earliest record) and 6928 bee specimens have been documents of 100 different species in Maryland.

The top 10% of the most common species in the Bee Lab data represent 118, 912 specimens; 80% of the total.
The top 10% of the most common species in iNaturalist represent 5649 specimens; 82% of the total.
The top 25% of the most common species in the Bee Lab data represent 141,092 specimens; 94% of the total.
The top 25% of the most common species in iNaturalist data represent 6498 specimens; also 94% of the total.

So, some evidence of similar collections curves (obviously this could be done better, using graphing and other statistical techniques)

In both datasets there are many single observations of species, a strong indication that as a portrait of the region's bee species both surveys are incomplete. Separately we have accumulated a total list of bees for the state of Maryland (DC is included (it was not included in the data pull from the Bee Lab's data), though almost nothing is restricted to DC except a couple of historical records) of roughly 450

species. When using a species estimator (SPECRICH in this case) we find that an estimated 594 species are present in the state based on Bee Lab data and 123 for iNaturalist (an amazing difference....I ran the numbers twice just in case).

Correcting and standarizing the counts for iNaturalist for the differences in total numbers of bees found we find the following:

The 10 species where the Bee Lab has far more relativized collection records:
Agapostemon splendens
Lasioglossum pilosum
Augochlorella aurata
Andrena erigeniae
Ceratina strenua
Ceratina calcarata
Lasioglossum versatum
Lasioglossum hitchensi
Calliopsis andreniformis
Lasioglossum tegulare

The 10 species where the iNaturalist has far more relativized collection records:
Xylocopa virginica
Apis mellifera
Bombus impatiens
Bombus griseocollis
Bombus bimaculatus
Augochlora pura
Bombus perplexus
Bombus pensylvanicus
Anthophora villosula
Megachile sculpturalis

Note: I checked and iNaturalist has not added any species to the total list that the Bee Lab had not already collected

The top 10 abundant species in Bee Lab completely missed by iNaturalist
Lasioglossum versatum
Lasioglossum hitchensi
Lasioglossum tegulare
Osmia pumila
Lasioglossum bruneri
Ceratina dupla
Lasioglossum callidum
Andrena perplexa
Lasioglossum illinoense
Lasioglossum trigeminum

What to make of this?

For those who spend a lot of time studying bees, the results are really no surprise. Small tricky bees are detected by traditional techniques and big common bees are recorded by both, but relatively more frequently by iNaturalist. As in any comparison of survey techniques you really don't know what the true relative abundance of your critter group might be out there in the wilds. Are large bees more common that small bees? Or, is it the reverse? Addressing that question with different techniques gives different answers, but we are left unsatisfied because we really have no absolute standard in which to compare.

Given that iNaturalist is largely a non-lethal approach to sampling, it resonates with most people. Thus it would be tempting to use it as a means of assessing bee populations rather than using lethal approaches. I would expect this issue of using iNaturalist as a core means to sample bees to increase as the use of iNaturalist and similar techniques grows. The longer term problem is that (as hinted by the estimates of total number of species) some species of bees are essentially invisible on iNaturalist...they are so difficult to id and so small that they cannot be safely differentiated with a camera in the field except under extraordinary circumstances. Witness that the to 10 species missing as records in iNaturalist but common in Bee Lab captures are all within the top 10% of overall bee lab captures and represent many thousands of individuals. Many of the most sensitive and uncommon bees are these small and difficult to id species, I must conclude that iNaturalist records cannot supplant traditional techniques as much as we all would like that.

On the positive iNaturalist ledger are the many people now engaged with nature and learning how to identify species. Many of these people are new and programs like "Seek" and similar provide remarkable access to identifications, some are initially wrong, but the culture of iNaturalist allows for corrections in a most gentle and learningly way. Young people interested in natural history are given access to our world more than ever before. Additionally, detection, distribution, and population shifts of large bees are greatly advanced (witness the usefulness of Bumblebee Watch and iNaturalist sightings of rare and uncommon Bumble Bees).

In sum of these summaries, at the government and NGO level we need to focus our cash dollars on traditional techniques given that we have no other avenues for understanding status and biodiversity that captures the breadth of subtle and difficult creatures in our landscape. That means re-funding museums, taxonomy, and natural history. Crazy, I know.

As a side note, many taxonomists (e.g., John Ascher for the bees) are active users of iNaturalist and their help with the technical iNaturalist taxonomic backbone, make the collection of photographs by everyone work. Without their help, iNaturalists utility is greatly diminished. iNaturalist too will benefit from increased funding of classical work.