Data Driven Midway Assessment For Species List Goals

Introduction

Having spent many years moth-trapping and birdwatching, I have a passion for identifying the wild species around me and this has been a source of great enjoyment for me. In 2023 my wife took our son on an extended trip to visit her family and as a project to keep myself occupied, I wrote myself a spreadsheet with macros to facilitate easy systematic recording of species I encounter. Since then, I have used this spreadsheet to input around 6000 total records as well as several thousand bird records uploaded to the eBird platform over the same time period.

In 2024, I set myself a 5 year goal in terms of number of new species to see and identify. I used an overall total rather than splitting into lots of different categories, since there are a moderate number of groupings, some of which are fairly small (e.g. there are only 35 species of woodlice in the UK, compared with ~4000 species of beetle) and I felt it would be better to have one large goal as opposed to lots of smaller goals.

The two ways in which I have been actively endeavouring to increase my species count is by increasing my knowledge base and going on trips. Increasing my knowledge base allows me to identify more species and is generally done by purchasing more field guides and consulting with more knowledgeable people when I find difficult specimens.*

However, it is the second method that I am considering here. I have been on several out of county trips around the UK in the last two years. None of these were with the primary aim of nature study, but they have nonetheless added plenty of new species. I have also attended a couple of day trips with the Essex Field Club with the primary purpose of finding new species. In the meantime, I have still been making regular trips to my local sites.

Core Question and Methodology

My goal in this analysis is to evaluate how best to proceed in gaining new species in my list to head towards my self-imposed 5 year goal. I wish to analyse my methods to inform the best options going forwards.

The core question I want to answer is – how effective are trips to other parts of the country in gaining new species records, when compared to local day to day recording? I will be using various views of the data to examine the outputs and effectiveness of my different efforts in these areas. The intention is that this will guide my future plans in these areas.

Brief Glossary

- Bryophytes – Mosses and Liverworts
- Diptera – True Flies
- Hymenoptera – Bees, Wasps, Ants and Sawflies
- Lepidoptera – Butterflies and Moths
- Odonata – Dragonflies and Damselflies
- Orthoptera – Grasshoppers and Crickets

*There are some extremely knowledgeable people on various Facebook groups, who will freely identify photographs on the understanding that the record is posted onto a known platform (such as irecord). I frequently make use of this.

Measure Against 5 Year Goal (2000 species)

When creating my 5 year goal of 2000 species, I had no baseline to work from, so had to effectively pull a number out of thin air. Thus, I am hoping that this target is reasonable.

I made the goal early on in 2024, so I am considering that it should be complete by the beginning of 2029.

Fig. 0 shows my total species plotted against the required count to reach the target by 1st January 2029, assuming that species are added in a linear fashion.

Fig. 0 - Species Totals Mapped Against Linear Required Values
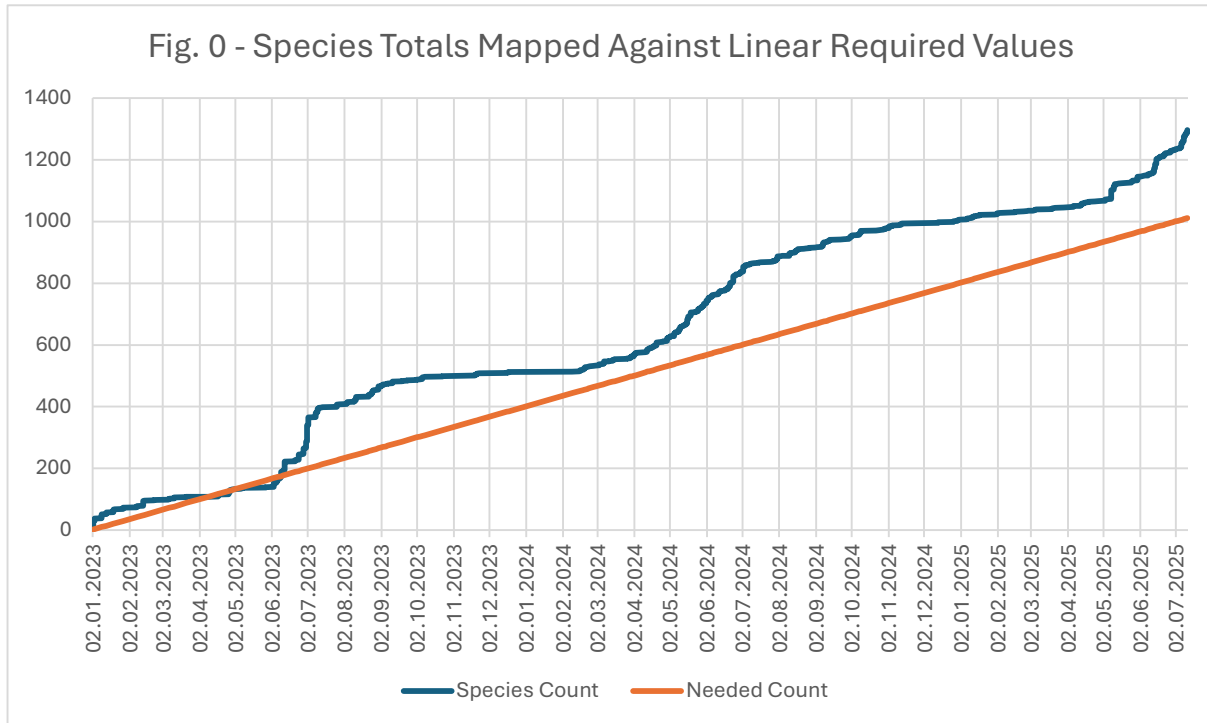
Whilst it may appear that I am making good progress, I suspect that the rate of species addition will slow down significantly in the coming years. The first species to be added tend to be the ones most easy to find and identify. Later I have to go further afield or put more effort in to the identification of new specimens and I expect the rate of their collection to slow down.

Another reason that I expect the rate of new species to slow is that I have now purchased all of the easily available guides to species in the UK that are within my expertise to use. These have each brought boosts to the number of species I am able to identify, but I do not think that any new boosts are coming.

Based on this, I am expecting the above curve of species count to plateau out in the near future. This is the main reason for this analysis being conducted – I need to ascertain the best way to minimise this and continue to find new species.

Best Sites by Number of Species

The first data I examined was the best sites for overall number of species recorded. The chart shows the species count in orange and the number of visits (checklists) I have made in blue, see Fig. 1.

Carisbrooke Drive (my garden) was top. This is partly because of the sheer amount of time I spend in it and partly because it is the only place where I do regular moth trapping. If I were to exclude moths the number of species there shrinks to 270, putting it in 2nd place.

Noticeably, several sites have made it into the top 10 whilst having less than 5 visits there. Minsmere and Carlton Marshes are nature reserves in Suffolk, whilst Bowers Marsh is a nature reserve in Essex. In fact 6 of the top 10 are nature reserves, though the three mentioned before are standouts. This is unsurprising, but highlights the importance of choosing good sites when it comes to searching for high biodiversity.*


Fig. 1 - Top 10 Sites by Species Showing Number of Visits
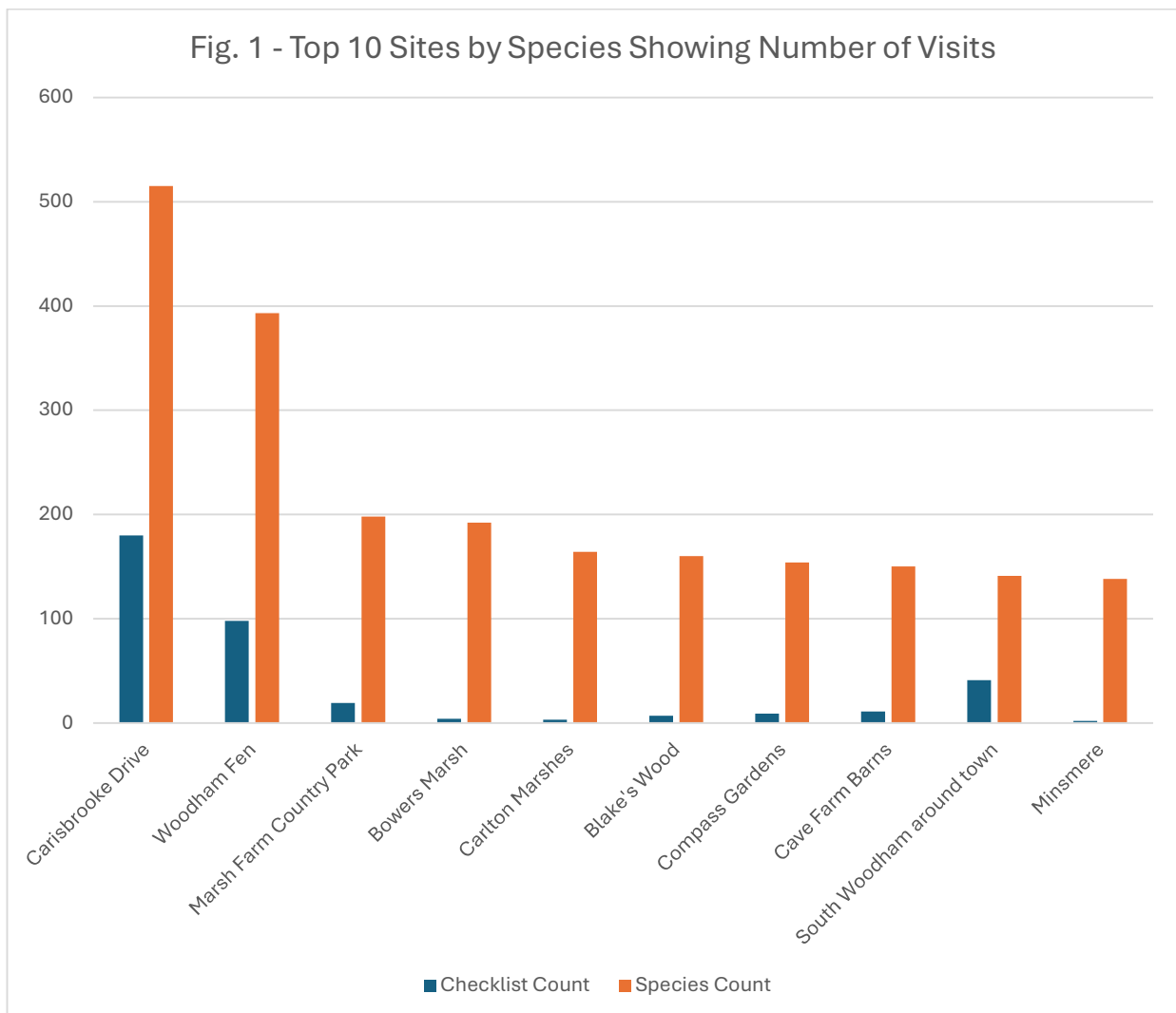
I devised a simple measure of biodiversity by taking species count divided by checklist count and found that the top 10 were all nature reserves. This supports the conclusion.

Unique Species by Site

A key indicator of how important the site is to my efforts is the unique species that are found in that site. These are the species that would not be in my data at all if I had not been to that particular site and are therefore an indicator of how my species list would suffer if I had not been there.

With this in mind, I examined the top 10 and once again found that Carisbrooke Drive (my garden) was heading the list with a whopping 288 unique species. However, 198 of these were moths, as mentioned before, so in the below chart I have excluded moths from this site. The site still topped the list.

Fig. 2 - Unique Species by Site
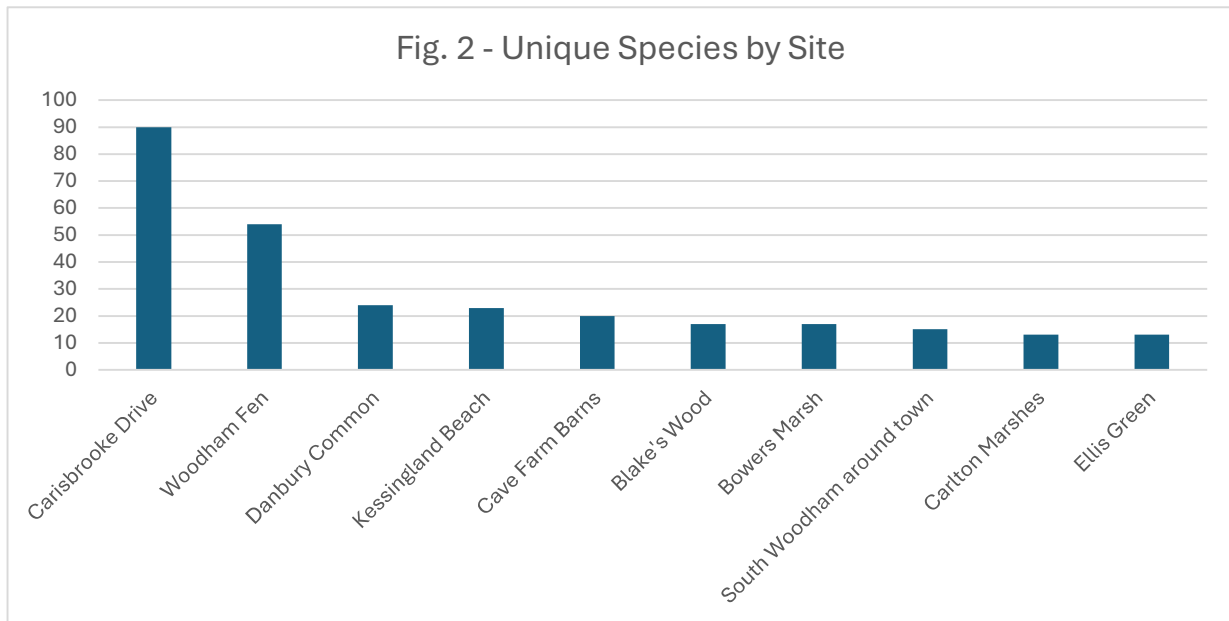
Examining this chart shows me several things – noticeably that both of my trips with the Essex Field Club show up (Danbury Common and Ellis Green) despite not appearing in Fig. 1. This indicates that although the actual number of species observed was not high, the species found were of particular interest.

Cave Farm Barns was the site I examined during my trip to the Ely area. Kessingland Beach and Carlton Marshes are both sites that I visit when I go to Suffolk. The beach has shot up into 4th place from not appearing in Fig. 1 at all.

Marsh Farm Country Park has disappeared from the list entirely, indicating that although there are a good number of species found there, they are not particularly unusual species. The site was in fact in joint 14th place with 10 unique species.

I was surprised that South Woodham is on the list, as it is a generic site for anything that I see round the suburban areas of my home town.

However, most surprisingly of all, not a single site from my trip to Scotland appeared. I certainly remember seeing a large number of new species on that trip. The reason for this appears to be many of the species that I saw there were present at multiple of the sites I went to there, so were cut out from the data I am examining above. This led me to examine the unique species in a different way for my next perspective on the data.
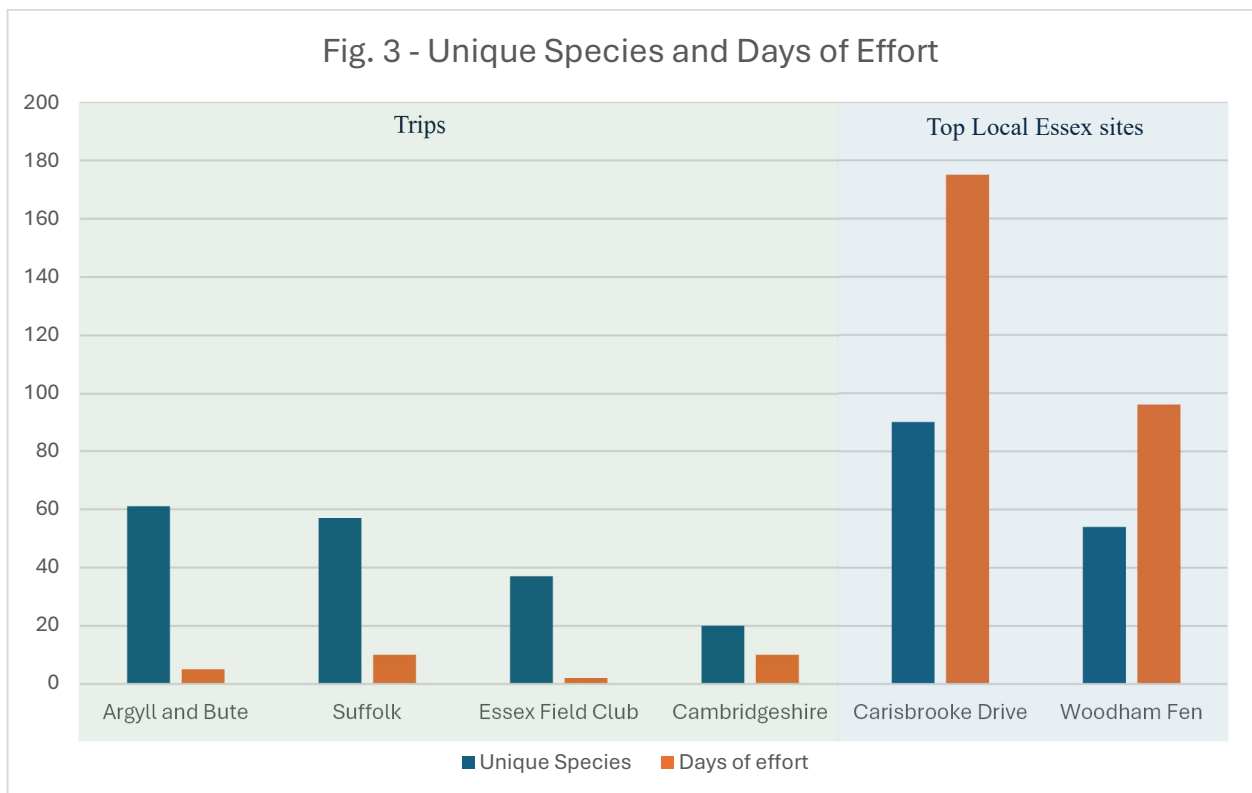
Unique Species from Trips

To really understand a trip or a method's impact on my data, I realised that I have to examine the unique species generated by the trip or method as a whole, since otherwise I lose out on species that were only added because of the trip, but were seen at multiple sites on the trip.

The areas I have recorded are:
- Suffolk – Near my parents there are extensive coastal and saltmarsh habitats and several nature reserves, including some heathland. I go frequently, but record nature less frequently
- Cambridgeshire – My extended family have a yearly gathering for a long weekend North of Ely. The surrounding area is very rich in insects, but my time is severely limited here. I have once conducted a moth-trapping session here.
- Argyll and Bute – My trip here was to climb some mountains with a friend, but with five days in the mountains, I was able to record many interesting species
- Essex – The habitats I visit in Essex vary hugely from suburban, to coastal, to grassland and woodland. I also spend far more time here than anywhere else. I have made a couple of trips with the Essex Field Club.

To analyse this I have compared days of effort against unique species for my trips, I have included the top two sites in Essex for comparison.

Fig. 3 - Unique Species and Days of Effort

There are some clear points to highlight here – notably that the better trips (Suffolk and Argyll) generate more unique species than any site other than Carisbrooke Drive and with far less effort. Whilst the local sites do generate unique species to add to the data, the amount of effort put in in is significantly larger.

My belief about this, confirmation of which would require data that I do not possess, is that the key factor here is one of habitat. In Argyll, I visited mountainous bogland, which is very different from

the lowland habitats that I frequent in Essex, leading to over 60 new species in less than a week. In Suffolk, the habitat is more similar to the habitats of Essex, though different enough to find a good number of different species. However, more effort is required to obtain the same numbers.

My trips with the Essex Field Club are unique among the trips that I have conducted, since they are with others that are more knowledgeable than I. Being around these experts generates good numbers of unique species for comparatively low effort, since they can identify things that I can't and frequently teach me new species I did not know. This also leads to a small boost in the number of species I can record elsewhere (a fact not represented in the data).

Species Examined by Group

I record various groups that I have the capability to identify (see Appendix 1.1), but I wanted to know how my efforts in these various areas are paying off. Thus I looked at the species counts for the various groups.

Fig. 4 - Ratios of Species by Group
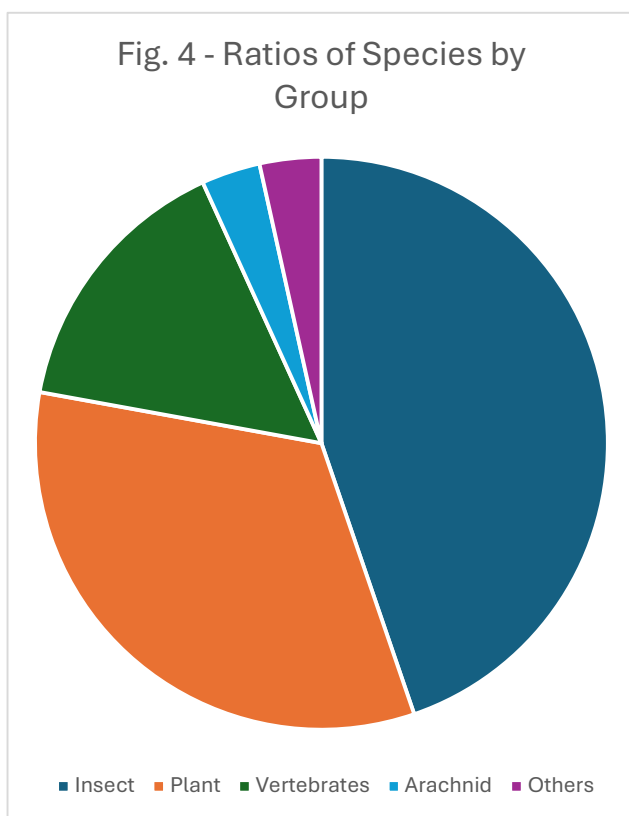
Insect Plant Vertebrates Arachnid Others

Fig. 4 clearly shows that not all groups are equal – there is a plethora of insect and plant species recorded, with vertebrates also constituting a significant number. However, other groups are a very small number when compared to the data as a whole, though arachnids still takes a noticeable slice.

Partly, this is a reflection of the number of species in each group (for example, there are far more insect species than arachnid species). Also, this is partly a reflection of my expertise – there is a huge variety of fungus species, but most of them require expert microscopic examination and identification material is not as easily accessible.

Before I proceeded with looking at group distributions across sites and species uniqueness categorised by group, I decided to split the groups down further to really understand the species distribution. This gave some further insights, which helped to guide my analysis going forwards.

Fig. 5 - Species Count by Subgroup

Fig. 5 highlights once again how different groups are represented differently in species numbers in the data, and indicates where efforts could be concentrated.

Unsurprisingly, birds dominated the vertebrates – there are more species and they are by far the easiest to see.

Similarly, flowers dominated the plants by virtue of their species diversity and ease of identification. Grasses are more limited in diversity and bryophytes often require expert knowledge, leading to a lower representation here.

Insects are a more diverse group and will require more thought further along in the analysis, as there are several strong contenders for sheer number of species, although expert knowledge is a limiter again. Lepidoptera have high numbers due to my moth-trapping efforts, and are often easier to identify then other groups, and thus will likely remain in the lead. However, if my efforts with the Field Club continue to bear fruit, then this lead may well reduce.

The next stage is to integrate this data with the site uniqueness concept that was examined earlier in the report.

Unique Species by Larger Group

The final graphic that I produced is the most helpful of all in showing the patterns that are underlying the data.

I considered the trips that I have made alongside the most productive sites I regularly attend in Essex and look for unique species separated by group. I chose not to separate by subgroup as that would make the chart far more complex and harder to read, and the breakdown by subgroup is covered already in Fig. 5.

Fig. 6 - Unique Species by Group Across Trips and Top Sites
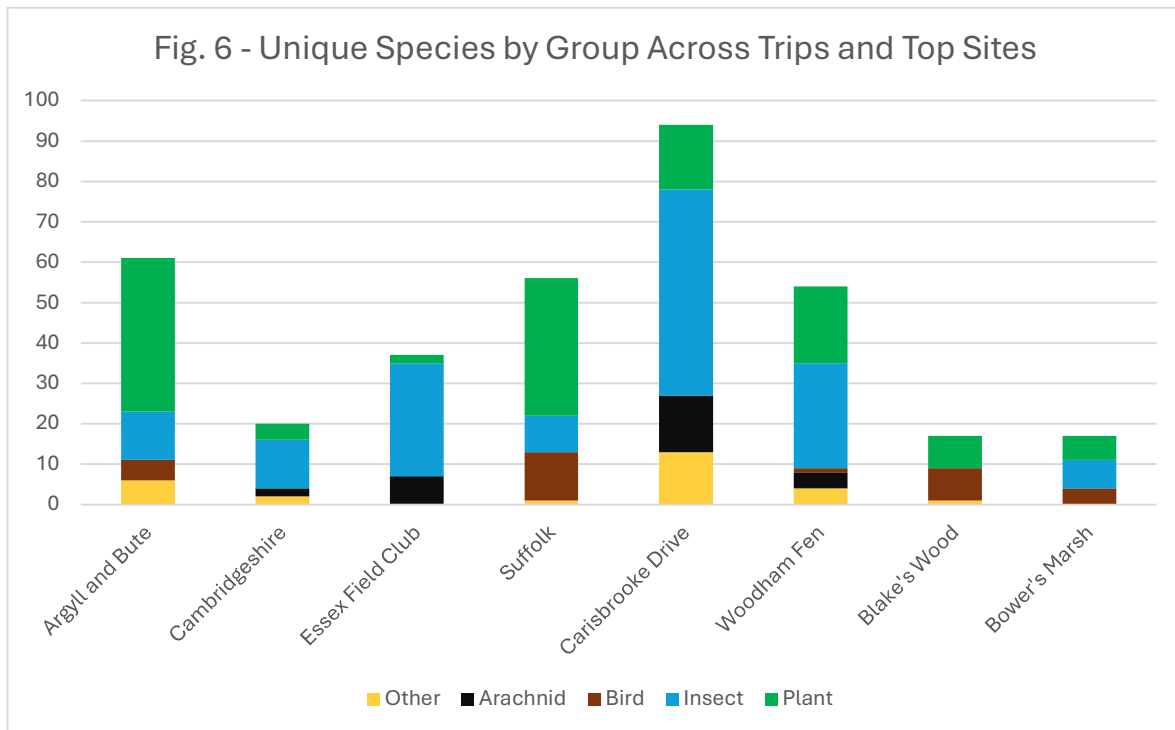
I also removed moths from Carisbrooke Drive (again) as this would take unique insects alone to nearly 250 at this site.

There is no surprise that the trips with the Essex Field Club are skewed towards insects and arachnids, as these are the focus of the excursions. The trips to Scotland and Suffolk clearly are skewed towards plants, which was surprising to myself. Perhaps an explanation is that they are more easily visible and identifiable than some of the other groups. In any case, this is an indicator of where efforts can be focussed more productively in the future. Cambridgeshire has a larger proportion of insects (most likely because of the one time that I ran a moth-trap there).

The four Essex sites show a fairly consistent spread, although Blake's Wood is clearly good for birds! Insects are the most frequent group here in my frequent sites as well, even without the records from the moth-trap.

Conclusions

1. The most productive method when measuring both overall number of species and number of unique species is certainly the day-to-day recording in local sites. However, it has to be acknowledged that the amount of new species when compared to the amount of effort put into it is much lower. Thus supplementing this with trips to other parts of the country and other habitats is a very sensible strategy.
2. When on trips, it appears that the greatest number of new species is found in the plant life, rather than any other group, so a focus on this is recommended
3. One key method which has been highly under-utilised is moth-trapping. This is due to the difficulty of performing this due to time constraints and permissions from land-owners. However, if this can be utilised in other places, then this is expected to contribute significantly to the goals.
4. Further trips with the Essex Field Club (and other experts if available) is recommended due to the species count produced from comparatively low effort. The expertise gained from such trips will be useful in all future trips from that point on.

Further Analysis

I believe that the best course of action to maximise the effectiveness of this analysis is to wait another year before any further analysis whilst actioning the above. At that time, I can re-evaluate any new trips and how the day-to-day recording is contributing to the species total compared to right now, having had a full cycle of seasons.

One possible concern is that the unique species identified by day-to-day recording is slowing down due to a limit in the local biodiversity, but the rate of this is not known. This will be particularly obvious in the next year, since it seems that I am unlikely to adopt any new groups for study, as I have exhausted the easily available resources. In this case, the best course of action will likely change.

Appendix 1 – Limits on My Methods

A 1.1 - My resources

The keen observer may notice that various groups make appearances in the data at various times. This is due to my increasing resources and knowledge of the group at hand. In particular, I have gradually been purchasing the field guides to various groups, and adding them to my repertoire of species to identify.

For example, you will find one record of a bee before Spring 2024 (I obtained the book November 2023 and bees do not appear until spring). You will also find no references to bryophytes until September 2024 when I purchased the guide. Thus my data around these (and some other) groups will be significantly skewed.

The result of this is that some early trips will have less of an impact on my species list than if I had gone on the same trip later on. Based on this, I consider the most recent trips I have made to be the most indicative of potential species list increases.

Most groups that I study have species within them that I cannot identify. Generally, I consider a group easy if 90% can be identified and with practice over 75% can be identified without detailed examination. Some examples would be birds, wild flowers, ladybirds and mammals (excluding bats).

It is also worth noting that there are various groups which I completely ignore due to their complexity, such as almost all wasps and many fly families. Also, I generally ignore anything smaller than 5mm.

A1.2 - My Equipment
Many groups, particularly insects such as beetles and flies require examination under a microscope, which is a piece of equipment I do not possess. A smaller, but still significant number of species (including some moths), require dissection to identify, which is a skill I do not possess.

Later in 2023, I purchased a good macro camera, which was recommended to me by various people who I have seen high quality photographs from. This has been a huge help in identifying smaller creatures and has vastly improved my ability to identify insects, as well as the quality of photograph I can send off to experts for help with.

A 1.3 - My Time
Firstly, I have a full time job (not nature related), a wife and two small children. My boys (aged 1 and 2) are of an age where they are more likely to eat insects than help me identify them, meaning that they have very limited usefulness as field assistants. Indeed, when I go walking with them, I generally can't identify much at all!
The limited time available limits how often I can get out to identify things and also how much time I have at home to put into the more difficult groups, which require careful photography and consultation with experts.

Secondly, many of my trips away are not for the primary purpose of nature. In particular my trips to Cambridgeshire are for family gatherings, so less time is spent on nature. A comparison of this trip with my time in Scotland (where 5 out of 6 days were spent in nature) is likely to be skewed.

Another factor to be aware of is that my effort in various groups varies with the seasons. Insects and wild flowers have to be studied in the summer as they are dormant in the winter. Bryophytes can be studied at any time of year, but I have far more time for them in the winter since I am less busy with other groups (which is reflected in my recording).