SAVING BUMBLE BEES
THE GARDEN JUNGLE; HOW WE CAN ALL HELP SAVE OUR INSECTS

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In 2017, a paper was published by the Krefeld Society, a group of entomologists who had been trapping flying insects in Malaise traps on 63 nature reserves scattered across Germany since the late 1980s [Hallmann et al. 2017]. Malaise traps are tent-like structures that passively trap any flying insects unlucky enough to bump into them (Figure 1). The German entomologists amassed insects from nearly 17,000 days of trapping, a total of 53 kg. They found that the overall biomass of insects caught in their traps fell by 75% in the 26 year period from 1989 to 2014. The study was reported around the world and has been much discussed. Some argue that the data set is not robust as some of the 63 sites were sampled only in one year. Nonetheless the pattern is very strong [figure 1], and it is hard to avoid the conclusion that there has been a major decline in insect biomass. We should also bear in mind that the impacts of mankind on the planet were at play long before 1989, which was 27 years after the publication of Rachel Carson's "Silent Spring". It seems probable that this 75% drop is just the tail end of a much larger fall. We will never know how many insects there were, say, 100 years ago, before the advent of pesticides and industrial farming.

There has been much debate as to whether similar declines in insect abundance are occurring in the UK, or whether something peculiar is going on in German nature reserves, but hard data are largely lacking. Only butterflies and moths have been monitored extensively in the UK, and they show pervasive patterns of decline, though not as dramatic as that found in Germany. Overall abundance of larger moths in Britain fell by 28% in the period from 1968 to 2007, with the decline more marked in southern Britain where the overall count fell by 40% [Fox et al. 2013]. More than one third of species (37%) declined by more than 50% during the period. Perhaps the best-studied insect populations in the world are the UK's butterflies, which are counted along more than 2,500 transect walks each year as part of the Butterfly Monitoring Scheme. Butterflies of the "wider countryside" fell in abundance by 46% between 1976 and 2017, while habitat specialists fell by 77%, despite concerted conservation efforts directed at many of them.

Although the bulk of insect species, the flies, beetles, grasshoppers, wasps, caddis flies, froghoppers and so on are not systematically monitored at all, we often have good data on population trends for birds that depend on insects for food, and these are mostly in decline. For example populations of aerial insectivorous birds have fallen by more than any other bird group in North America, by about 40% between 1966 and 2013 [Michel et al. 2015; Stanton et al. 2018]. In the UK, populations of the spotted flycatcher fell by 93% between 1967 and 2016 [Woodward et al. 2018]. Other once-common insectivores have suffered similarly, including the grey partridge (-92%), nightingale, (-93%) and cuckoo (-77%) [Woodward et al. 2018]. The red- backed shrike, a specialist predator of large insects became extinct in the UK in the 1990s.

An interesting aspect of these declines of insects and their predators is that most of us have not noticed it. Amongst scientists it is now recognised that we all suffer from shifting-baseline syndrome, whereby we

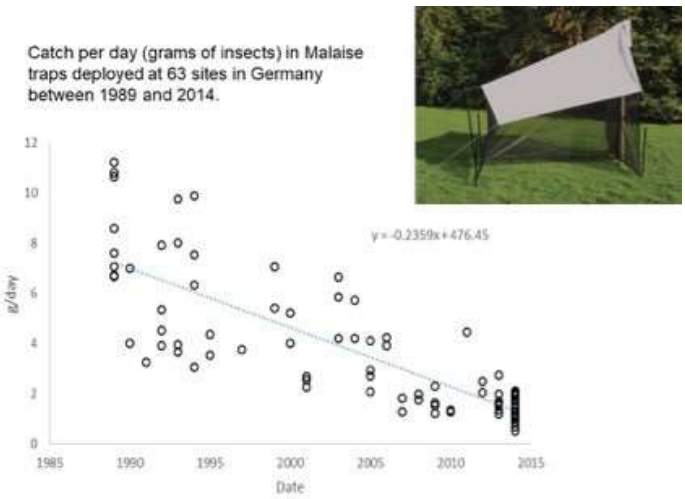

Figure1 Declines in daily catch of insect biomass on German nature reserves (Hallmann et al. 2017):

accept the world we grow up in as normal, although it might be quite different from the world our parents grew up in. A fascinating study of photographs of trophy fisherman returning to Key West, Florida with their catches from 1950 to 2007 estimated that the average size of the fish fell from 19.9 to just 2.3 kg, but the smiles on the fisherman's faces are not any smaller. The only aspect of insect declines that has impinged on the consciousness of significant numbers of people has become known as the "windshield phenomenon". Anecdotally, almost everybody over the age of about 50 years old can remember a time when any long-distance drive in summer resulted in a windscreen so splattered with dead insects that it was necessary to stop occasionally to scrub them off. Driving country lanes at night in high summer would reveal a blizzard of moths in the headlights. Today drivers in Western Europe and North America are freed from the chore of washing their windscreens. It seems unlikely that this can be entirely explained by the improved aerodynamics of modern vehicles.

Causes of insect declines

What might be driving the landscape-scale disappearance of insects? Causes of the decline of wild bees have been discussed more than those of other insects, and although there is still debate, most scientists believe that it is the result of a combination of man-made stresses, including massive loss of habitat, chronic exposure to complex mixtures of pesticides, the spread of non-native insect diseases with commercial bee nests, and the beginnings of the impacts of climate change [Goulson et al. 2015].

The disease issue primarily affects only bees, but the others are problems that all insects face in the modern world.

Why should we care?

Understandably few people bemoan the lack of squashed insects on their cars. For many people the idea of fewer insects seems attractive, for insects are often associated with annoyance, bites, stings and the spread of disease. When recently asked about the seriousness of global insect declines on national UK radio, medical doctor, professor and well-known TV presenter Lord Robert Winston replied "*There are quite a lot of insects we don't really need on the planet*". This response likely typifies the attitude of many.

I am deeply concerned that we scientists have done such a poor job of explaining the vital importance of insects to the general public. Insects make up the bulk of known species, and are intimately involved in all terrestrial and freshwater food webs. Without insects, a multitude of birds, bats, reptiles, amphibians, small mammals and fish would disappear. Eighty seven percent of all plant species require animal pollination, most of it delivered by insects [Ollerton et al. 2011]. Approximately three quarters of the crop types grown by humans require pollination by insects, a service estimated to be worth between $235 and $577 billion per year worldwide [Lautenbach et al. 2012]. Financial aspects aside, we could not feed the growing global human population without pollinators; billions of people would starve. In addition to pollination, insects are important biocontrol agents (often controlling other insect pests). They are intimately involved in the break-down of organic matter such as leaves, timber, animal faeces and carcasses to recycle the nutrients therein. They help to aerate the soil, disperse seeds, and provide products such as silk and honey [Noriega et al. 2018].

For many insects we simply do not know what they do. We have not even given a name to possibly 4/5ths of the perhaps 5 million insect species that are thought to exist, let alone studied what ecological roles they might perform. As Aldo Leopold said "*The first rule of intelligent tinkering is to keep all the parts*". We are nowhere near understanding the multitude of interactions that occur between the thousands of organisms that comprise most ecological communities and so we cannot say which insects we 'need' and which ones we do not.

How can we help?

There is some good news. Insect populations can recover, and much more quickly than those of large animals such as tigers or pandas. In the UK not many have actually become extinct. They just need some habitat and a respite from the barrage of pesticides.

Gardens cover half a million hectares of the UK, and if managed in a way that is sympathetic for wildlife they could form a vast patchwork of tiny nature reserves. Add in better management of parks, road verges and roundabouts, and we could create a network of wildlife habitat across the UK.

It is easy to make your own miniature rewilding project. A few suggestions are below:

- Grow plants that provide nectar and pollen for insects such as bees, butterflies and hoverflies (recommendations can be found here: **http://www.sussex.ac.uk/lifesci/goulsonlab/resources/flowers**)
- Grow food-plants for butterflies and moths, nettles, bird's foot trefoil, lady's smock, ivy and holly are all good.
- Make or buy a bee hotel – for example simply drill some horizontal 8mm holes in a block of wood and hang it in a sunny place.
- Dig a pond; even a tiny one in a bucket will support insect life.
- Create your own miniature wildflower meadow; leave a patch of lawn to grow, or sow with a wildflower mix, and cut just once per year in late summer.
- Reduce your mowing – allow the dandelions, buttercups, daisies and clovers in your lawn to flower.
- Avoid using any pesticides; you do not need them in a garden.
- Plant a fruit tree – available in dwarf sizes suitable for tiny gardens, you will provide blossom for pollinators and produce your own zero-food miles, pesticide-free fruit.
- Leave a corner for nature – do nothing!
- Provide a brash pile or log pile
- Build a compost heap and recycle kitchen scraps and weeds; compost heaps teem with insect life

More detailed advice on how to turn your garden into a haven for insects and other mini-beasts can be found in my new book, *The Garden Jungle*.

FURTHER READING

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