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Opinion

Professionalizing European Pollinator Monitoring: A Strategic Imperative

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Introduction

The European Commission, alarmed by the decline of pollinators [1-3] acknowledges a chronic lack of scientific data essential for taking necessary actions to protect them. In response to this shortage, the European Commission is gearing up to organize an ambitious pollinator surveillance program, involving all 27 European Union Member States. Alongside the program's stated objective of monitoring population trends and species distributions (decline, stability, expansion), other goals of the monitoring scheme, in line with the European Pollinator Initiative (EPI, 2018), include:

a) Enhancing knowledge of the biology, ecology, and taxonomy of pollinating species

b) Increasing awareness of the importance of pollinators for the planet's life

c) Acquiring targeted knowledge on what is needed for their protection and integrating such knowledge into the legislation of member states.

Particularly, to achieve the goal of raising awareness and also in view of addressing this immense commitment sustainably in terms of costs, it has been proposed to rely heavily on volunteerism, within the framework of the so-called Citizen Science. While the goals are clear, many practical aspects of basing most of the survey on volunteers are not, as only a few countries in central, northern, and western Europe have so far conducted comprehensive, national-scale monitoring like what is being proposed. To prepare the ambitious mandatory pollinator surveillance program in all member states, the European Commission [4] has issued a call for a group of experts to prepare a proposal outlining a comprehensive monitoring design for the whole of Europe as fully as possible [5]. A few weeks after the report was published, given the complexity of the machinery to be built, the European Commission wisely planned to build a test project based on the principle of trying out the entire complex mechanism in all member states but on a smaller scale, equal to 10%. In practice, this meant implementing a pilot project on 10% of the estimated sampling sites. The minimum number of sites necessary for the extracted data to have statistically significant value sufficient to detect a possible 30% population decline over 10 years for the entire Europe was calculated through a Power Analysis and it was found that at least 2000 sampling sites are needed for the entire Europe. Starting from this sampling dimensioning, the entire spring pilot project (https://pollinator-monitoring.net/) was implemented. The approximately 200 sites were distributed among the various countries based on their surface area, as envisaged in the proposal, and the project partners implemented all the necessary actions knowing that what they were facing was nothing more than a tenth of what awaits them in the future. The larger and more numerous the sampling site network, the greater the number of volunteers recruited and placed in a position to maintain their commitment throughout the sampling season. The main purpose of the Pilot project was to provide insights and data especially on any issues that might arise

in order to limit errors and unexpected events as much as possible when it comes time to implement the program in its entirety, presumably starting from 2026. From my perspective, having first participated in the expert group that drafted the Proposal and subsequently managed the activities as Coordinator for the Central Mediterranean Region in the spring project, regarding one of the cornerstones of the Scheme, which foresees extensive use of Citizen Science.

EuPoMS involves many practical aspects to be addressed, falling into three broad categories:

Network

Network recruiting and keeping alive a network of volunteers. They will be tasked with collecting data in the field, preparing the material to be identified by experts once they return home, sending the material to the experts, and uploading the identification results and sampling data to an online platform.

Training

Training and instructing such a network of volunteers by organizing training courses lasting 2-4 days and providing for two or more levels of increasing competence, beginners, intermediates, advanced. The knowledge to be imparted concerns two distinct skills, on the one hand, the ability to identify species, and on the other hand, learning the complex set of field and laboratory techniques and methodologies for capturing or counting specimens in the field, and preparing them to be identified by experts.

Data production

Data production from detecting a data in the field to obtaining the processed data, there is a long chain of production comprising, so to speak, a "hardware" part such as choosing the sampling sites and their installation, supplying the surveyors with materials, traps, entomological nets, detergents, entomological pins, and preparation plans, identifying official laboratories for material identification, and a "software" part such as managing the survey teams, sampling dates ranging from four to eight a year depending on latitude, managing volunteer expense reimbursements, ensuring progress in the preparation of collected material, sending it to identification laboratories, uploading data to the platform once identification results are obtained, and finally obtaining data processing stored in the platform. Knowing that Europe does not have enough professional staff to manage such a workload, it was planned to carry out these activities largely relying on volunteering, assisted by experts and properly trained. This, also thanks to the growing favor with which scientists on one side and citizens on the other have been embracing the phenomenon of citizen science in recent years [6,7]. Many European biodiversity researchers have a considerable number of successful experiences in using citizen science for data collection. However, analyzing a sample of successful projects reveals that most of them consist of surveys limited in space, such as a river, a lagoon, a stretch of sea, or the citizen scientist's contribution is characterized by opportunistic collections without precise constraints regarding the number of samplings, the frequency of samplings, following complex protocols with detailed instructions. It is about reporting a sighting during a vacation or on the way to work or reading from a device. In general, the most successful projects involve a small number of species and easily identifiable after brief training.

However, the framework within which the European Pollinator Monitoring is designed is the opposite of those that ensure the success of many citizen science-based projects, especially, as seen, due to the repetitiveness of the required commitment, the duration over time, the request to observe protocols, the variety of tasks required in the field and subsequently at home or in the laboratories of a scientific institute concerning the preparation of the material, at least partial identification, and data entry. These are tasks normally performed by undergraduate students for their thesis, if not by postgraduates in Life Sciences. Although I initially approached the goal no. 1 building a network with a positive attitude and initially received good feedback on our recruitment campaign through social media, in the end, I had to rethink it, for several reasons that try to list below. Regarding the willingness of populations in the various member states to participate in research on natural science topics as volunteers, talking about heterogeneity in the territories of the Union is an understatement. While in some countries in central-northern Europe, a good predisposition has been consolidating for some years and in Western Europe, the response received is very promising, in countries of southern and eastern Europe, a rather contradictory, poor, or nonexistent response has been received. In some places, the proposal to work as a volunteer is seen as a joke or an insult, given the chronic shortage of work.

There is a marked disparity in the European Union regarding the territorial dimensions among the member states. The territorial extension of a country plays an important role in organizing national monitoring with a capillary and evenly distributed network of sampling sites, for at least two reasons:

a) The high number of sampling sites, beyond a certain threshold, coordination becomes difficult, both due to the number of sampling events and the distance, by a single coordination unit, and it is therefore advisable to compartmentalize coordination at the geographical level (for example, central-north-south or central-east-west).

b) The distance of the sampling site from the surveyor's starting point, the sustainable distance is the one that allows a round trip in a day, because an overnight stay would involve disproportionate costs compared to the cost of sampling itself.

Roughly, we could consider a maximum area of 100,000km^2 for a member state, as one that allows a single coordination unit sufficient to follow all sampling events in an orderly manner, in addition to managing the flow of collected and sampled material and data. At the same time, the maximum road distance to be covered from one end of such a country to the other would hardly exceed 500km or 250km from an ideal central coordination headquarters. 17 out of 27 member states have an area of less than 100,000km^2. It is hardly possible to ask a citizen scientist to go once a month to sample at a site more than 30km away from their home. It would therefore be necessary to place the sampling sites close to the major

population centers and along the main communication routes, hoping to intercept a greater number of volunteers. But in turn, this would contrast with the need for these sites to be representative of the territory's habitat diversity. Conversely, a network almost exclusively of professionals would have less difficulty covering distances up to a radius of 100km. In the central Mediterranean area, following the promotion and recruitment campaign carried out at the beginning of the project, 235 citizen scientists were recorded, a number higher than expected, although the geographic distribution of volunteers was heavily biased towards the regions (NUTS 2 level) of the north and left some regions of southern Italy uncovered. Of this promising initial group, however, only 60 (25%) of them actually came to carry out the activities. As the activities were carried out over the course of two seasons, a relevant figure to observe is the turnover. Of the 35 volunteers active in the first year, less than half continued in the second year. Fortunately, in the second year, the number of reinforcements was approximately equal to the number of dropouts. If the trend were confirmed in the coming years, it could be argued that the rate of new admissions required each year is around 50%. It would be necessary to study the possible causes for abandonment because before basing everything on citizen science, it is worth understanding whether it is possible to mitigate the loss of volunteers or if it is a component inherent in the type of volunteer, difficult to overcome. In my experience, those who decide to join these biodiversity surveys are generally young students or working people who decide to spend their free time, attracted by love for nature, eager to grasp as many aspects as possible of the vast and complex environment that surrounds us and to help pursue a better planet to live on. They focus on many possible organisms, not necessarily only on pollinators. Furthermore, they hope one day to work in this sector, earning a living by doing what they love, i.e., living in contact with animals and nature, and for this reason, it is natural that they try to expand their curriculum vitae and their skills by gaining multiple experiences. Once the defining elements about the world of pollinators are understood, it is not strange that they want to direct their thirst for knowledge towards other organisms. There is so much to discover about lichens, bats, whales, raptors, not to mention mammals, and there is a citizen science program for everything. We lose someone else because, hopefully, they will have found a fellowship, a research grant, or a contract. If this hypothesis were proven, it would be hardly possible to reduce the dropout rate.

The motivation of saving funds so far appears to be the most powerful driving force for the decision to base the vast EuPoMS project on surveys carried out by volunteers. But are we sure that things are really like that? Just as a costing has been calculated for the sampling instruments, the processing of collected specimens, specimen identification, uploading data to the online platform, transportation costs, etc., [8] a costing should also be calculated for the maintenance of a volunteer network that looks very much like a Penelope's shroud, woven by day and partially undone by night. In fact, maintaining a network counting a minimum number of 2000 European volunteers who partially need to be renewed every year presupposes the maintenance of a professional staff ensuring the efficient performance of activities, also covering foreseeable gaps, as well as a team of experts providing training for a new batch of volunteers every year. Reimbursements for food and transport cannot be avoided, unless we want to transfer them to the citizen scientists themselves, with predictable dissatisfaction and disincentivization of new volunteer arrivals.

Conclusion

While citizen scientists play a valuable role in many research endeavors, the intensive and extensive nature of pollinator monitoring necessitates a different approach, one that is implemented comprehensively on a European scale. Therefore, the question arises: why not allocate funds towards remunerating a professional staff, ensuring greater efficiency and effectiveness? After all, if the knowledge deficit that currently requires substantial funding for pollinator monitoring arose from a historical lack of investment in professional training in the XX century, it's imperative to invest in training a new generation of European professionals to address this challenge effectively. However, it's vital to recognize that while professionals are essential for meticulous data collection and analysis, a predominantly professional-driven system with a substantial, albeit non-dominant, contribution from citizen scientists might represent the optimal solution. Moreover, volunteers can serve as a crucial link between scientists and the public, while also providing a pool of talent to supplement the workforce as professionals phase into retirement.

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