COMMENTARIES

The Natural History Supplement: Furthering Natural History Amongst Ecologists and Evolutionary Biologists

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Abstract

Most ecologists and evolutionary biologists practice natural history, whether in the lab, field or greenhouse. This information generally does not get disseminated, especially in the short form journals that are increasing in popularity. We propose that papers include a natural history supplement to present data and observations which would otherwise remain in field notebooks, photographs or memory that have the potential to inform future investigations. The time for this small addition is upon us: we now have practically free publication space, statistical methods to integrate data across studies (meta-analyses), and tools to rigorously analyze media files. With a minimum expenditure of effort, we can archive and make available this useful information and perhaps, in a small way, incentivize natural history to present and future generations of ecologists.

Introduction

As many authors in the scientific (Dayton 2003, Greene 2004, Gardner et al. 2014, Middendorf and Pohlad 2014, Tewksbury et al. 2014) and popular press (Louv 2005) have noted, natural history seems to have been on a steady decline as a discipline for primary, secondary and university instruction and as published literature over the past several decades, if not longer. In that same time, ecology as a

discipline has become more experimental, larger-scale, and more statistically rigorous; all of which have greatly increased our understanding of the mechanisms and patterns of nature. The practice of natural history has not been eliminated; though the medium used to convey it has. Instead of articles in *Ecology*, *Science* and *American Naturalist* (among others) focusing on natural history observations and conclusions drawn from them; these are increasingly published in specialized journals (*International Journal of Odonatology*), on informative blogs, often written by observant amateurs (*Bug Tracks*) or in books (Eisemann and Charney 2010). Ecologists and other academic biologists are pressured to publish concise and hypothesis-driven science at every stage of their career; these scientists often have thousands of hours spent observing and gathering data on their study organisms and notebooks full of observations and data sets that are never published because of the focus on "the paper."

Herein lies the paradox; in this age of cheap—practically free—publishing space on the Internet, ecologists publish shorter papers with less natural history included. We suggest a small step toward a revival in publishing natural history study in a way that will be easy to implement and foster the development of future ecological and evolutionary sciences. Our idea is to encourage the addition of a natural history supplement to papers, whether these papers concern studies conducted in the field or lab, or purely theoretical and whether these studies focus on molecular, organismic or ecosystem-wide phenomena. Will this answer many of the problems that studies have identified? No, but it will provide an easy outlet for natural history information on systems which have genetic, population, physiological or ecological data or experimentation on them and could provide useful information for generations of future scientists and interested laypeople (especially in the age of open access).

The natural history supplement

What to include in a natural history supplement should be open-ended; after all, the investigators have more experience with the specific organisms in the study than and referee or reader. The list below should serve as a general guide of topics appropriate to this supplement.

1) Observational data on life-history

Classic natural history described the life-history of organisms, including their behavior, trophic interactions, growth patterns, phenology and distributions. Much of this data is gathered by field and lab workers in an informal or formal fashion. We record the flowering times of study populations of various plants in an effort to better plan out subsequent field seasons; this same data, gathered by Henry David Thoreau in the 1850s served as a baseline for an informative study of phenological changes due to climate change (Miller-Rushing and Primack 2008, Willis et al. 2008). Interesting, but rarely, behaviors may be of use for investigators of those phenomena (e.g., intraguild predation, courtship displays, etc.), though within your study the behavior was observed but incidentally.

2) Photos, sound recordings and videos

Many journals encourage the practice of supplemental media materials at the present time; these media allow the reader a more illustrative look at a behavior, ontogenetic change or other phenomenon than a simple description, though we encourage detailed description accompanying any media material. These media can further be analyzed for biomechanics, acoustics or other research; while these materi-

als may not be thought of traditionally as "data" in the right hands they can be quite valuable data and archiving these can allow analyses far outside the scope of gathered quantitative "data."

3) Citations, summaries and quotes from older or foreign literature

A great deal of natural history is buried in older literature. Several projects, including the Biodiversity Heritage Library, have allowed access to these valuable books and articles, though many remain obscure. Including citations, summaries, and quotes from these works allow present and future scholars to find them more easily; in our experiences, these references often escape attention for long periods of time and are usually found in a serendipitous fashion. Additionally, wonderful natural history was and continues to be published in journals around the world, many not in English. If these are of importance, even tangential, to the system in question, summarizing the important findings and relevance to the investigation at hand is a great service to many who might otherwise look past that article.

4) Motivations for the current paper; pilot study results

The current paper structure and necessity of tying in broader themes to increase appeal of a paper often obscures the rationale behind the paper in the first place. Reading the works of Jean Henri Fabre or Darwin, experiments usually logically follow observations, and this is still how much of ecological science is conducted. Nowadays, these initial observations leading to a hypothesis are usually left out in favor of an introduction framing why the question at hand is interesting (which is justified). The motivations and observations, including pilot study results, leading to a paper are often important for devising alternate hypotheses and building upon the study (in the same or other systems) and merit inclusion in a natural history supplement.

5) More information on "pers. obs." or "unpublished data"

References to personal observation or unpublished data come up commonly in ecology papers, often for natural history observations or simple life-history data. Many of these personal observations would benefit from a more thorough explanation, and much of the unpublished data would be useful for select readers of the study (if not destined for a future manuscript).

6) What did not work

We, and many others, have done meticulously and not-so-meticulously planned experiments that did not work for one reason or another, often related to the natural history of one or more organisms. These failures are useful! If all your transplants in March were eaten by slugs, but not in May, that information would save the next person doing a similar experiment the headache that you experienced. In an ongoing study with predatory bugs on sticky plants, I found that in open serpentine barrens, several of the predators are somewhat crepuscular and midday sampling was rather useless, as they hide in basal rosettes and on the ground. This valuable piece of natural history data allowed me to tweak my methodology, but will likely not make it into a methods section; we suggest it belongs in the supplement.

7) Anything else of potential interest to future workers

Benefits of a natural history supplement

The authors believe natural history is a worthwhile pursuit in its own right, but it also has tangible benefits to the science of ecology in general, several of which we will detail below.

1) The archiving of data for future examination

Meta-analyses are an extremely informative tool in distilling patterns from multiple systems. Archiving the natural history—phenology, morphological (size, reproductive output, biomass, etc.)—data from many systems allows for more powerful tests of theory. Molecular tools are becoming more common as well, and informative integration of natural history with molecular data is becoming more common (e.g., in comparative approaches) and will certainly continue to do so in the future. Further, while many researchers' notebooks eventually get archived in university libraries where they are technically "accessible," as the researcher yourself, presenting the data and observations that are most interesting in a way that will be archived and accessible is a worthy endeavor. Archiving data and observations thus can directly assist quantitative investigations as well as save future researchers time in tracking down data that is "available."

2) The incentivizing of natural history

Citations and papers are the "currency" of academia. Natural history papers published in small journals and even if extremely well-written, accurate and interesting, these do not get cited as often as studies in higher profile journals and may be passed over in job searches, etc. Further, many of the higher profile journals are space restricted and impose word or page limits restricting the amount of natural history possible in a given paper. For these reasons, the practice of publishing otherwise interesting observations and data is disincentivized, especially for grad students, post-docs and non-tenured professors (though even tenured professors need high profile publications to bring in grants). Including these as a natural history supplement, which can be cited either in conjunction with the paper or separately with its own DOI (especially good when simply citing data from the supplement). We are convinced, from both our own experiences and discussions with others, that this would not require much additional work, as the observations and data exist simply from conducting the field work, lab experiment or otherwise, penciled into margins, etched into memory or captured on photograph.

Surmountable problems with this new model

We can think of two potential drawbacks that including this extra supplement would entail. We believe both are surmountable and not a death knell to the idea.

1) Additional editorial work/peer review

Any additional writing would necessarily entail additional editing and potentially review, by a subject editor, copy editor, and reviewers. As most of these jobs are unpaid jobs done outside of other obligations by academics, additional work might negate any marginal benefit of an additional supplement. We believe that this would not be the case. In our experience, supplementary information is not scrutinized as closely to begin with, and natural history information would not need the same sort of careful scrutiny as statistical, methodological or molecular material often included in supplements. The natural history

supplement could be passed on to reviewers on a case-by-case basis by editors; if it simply contained useful data and observations which passed an editor's approval, reviewers could be given it voluntarily. Additionally, separate natural history reviewers or editors could handle these sections. The job of these editors would not be to make acceptance decisions or editorial oversight over the content of papers, but instead to gently probe additional useful information out of the authors (who, of course, have a great deal of knowledge about the system). Many supplemental materials are not peer reviewed or are skimmed by reviewers and editors and not vetted with the same scrutiny as the manuscript itself. While science is generally bettered by peer review, we believe traditional peer review is unnecessary for a natural history supplement. This comes with the implicit caveat that unlike a traditional supplement, especially one for materials and methods, the natural history supplement *should not be used to support a major point in the paper*. Natural history is still published in papers when essential and if it is an integral part of a point or assumption, it belongs in the main text. It is everything else—observations, unused data, etc.—that belongs in the natural history supplement.

2) Archival and dissemination

We, like many other scientists whom we have discussed this with, only occasionally read supplementary material. Therefore, one could argue that the writing of the natural history supplement is an exercise in futility. However, we believe with proper archiving and dissemination, this supplement would be a worthwhile contribution. A variety of keywords—taxa names, region, ecosystem, behavior, system, prior researchers, etc.—would allow an easier search for this information. Additionally, if many future papers include these supplements, a researcher looking for data on members of a phylogeny or phenological data on a specific phenomenon would have a ready place to look for such data (does this paper have a natural history supplement?). While uniting disparate publishers and societies might not be possible, we suggest journals should encourage these supplements and highlight them in some way (e.g., making the supplements open access).

3) Model systems

How much more can be written about the natural history of *Arabidopsis* or *Drosophila*? Lots, we believe (new lines and new experiments are being created constantly). The use of model systems has permitted many integrative investigations that were unthinkable decades ago, given the amount of knowledge we now possess about certain species. However, research continues into these species as we do not know everything and given the number of labs working on many model organisms, even small observations that may seem unimportant to a given investigation will have a large potential audience of other researchers on those systems for which this observation could be topical. Obviously, in nonmodel systems, available natural history information may be minimal; any information would be extremely useful for future researchers in the same or similar systems.

Conclusion

We believe that the time is right for the inclusion of natural history supplements in ecological and evolutionary papers. The benefits of disseminating these data and observations far outweigh the costs now that journal space, in the virtual world, is practically free. While the exact form and direction this might take remains to be seen (and ought to vary greatly as natural history in the past has), the

authors plan to include these supplements in their papers and encourage other authors at any stage in their careers to do the same and editors and reviewers to suggest the inclusion of these information in manuscripts they read.

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