What is natural history? *Root Gorelick, Carleton U.*

Regarding defining *natural history*, "I shall not today attempt further to define the kinds of material I understand to be embraced within that shorthand description; and perhaps I could never succeed in intelligibly doing so. But I know it when I see it…" (*Jacobellis v. Ohio* 378 U.S. 184 (1964) Potter Stewart, concurring opinion). Is natural history the input data for science or at least the thing that generates sufficient curiosity to construct hypotheses? Is natural history merely a pattern-recognition exercise (Fleishner 2011), something at which most humans excel? Is there 'history' in 'natural history'? Does this make natural history not just descriptive, but also predictive? Or is natural history merely more geographically local than other aspects of ecology and evolution? For me, the 'history' means that natural history must contain some good story telling.

Instead of a definition, maybe there are a few properties that natural history possesses. Natural history is usually a solitary or nearly solitary activity. Ever try observing birds or mammals while surrounded by a crowd of thirty noisy people? Even observing plants can be difficult, as plants get trampled and people are invariably distracted by social conversations. Natural history is a lonely and almost anarchic activity. It is why I canoe to work most days, gliding past turtles, otters, muskrats, and beavers. Furthermore, "I like to sit outside when I write, partly because there are bugs and birds and rocks around that suggest an idea." (Watterson 1995: 19).

Natural history focuses on individual organisms, comprised of many little observations and explorations that are not guided (at least not initially) by hypotheses. Just as many small observations can accumulate into maps of genomes and phylogenies that we accept as critical

infrastructure, so can many small organismal observations of interactions in ecology and evolution accumulate into a critical infrastructure. For example, natural history provides crucial input to biodiversity research. "Question-oriented researchers aren't enough…we also need researchers who focus their work on an organism or group of organisms, regardless of what questions those organisms might lead them to ask" (Maddison 1996: 60). The comparative method requires natural history observations as inputs (Harvey & Pagel 1991). Collectively, natural history observations describe the diversity of taxa, their behaviours, ecological strategies, life histories, as well as a rich network of interactions among them. Much of natural history is "the art of the commonplace" (Wirzba 2002).

"The traditional Gaussian way of looking at the world begins by focusing on the ordinary, and then deals with exceptions or so-called outliers as ancillaries. But there is a second way, which takes the exceptional as a starting point and treats ordinary as subordinate." (Taleb 2010: 236). Does natural history, especially of so-called 'black swans,' debunk the aphorism that "the plural of anecdote is data" (Polsby quoting Wolfinger (1984: 779))? Black swans are rare events that are harder to study than statistical means or taxonomists' type specimens, but that can be much more informative than common occurrences (Nuñez & Logares 2012**)**. "Darwin admonished us not to ignore the 'oddities and peculiarities' of life as we see it today. It is by the analysis of such oddities that evolutionary history can be reconstructed" (Margulis & Sagan 1988). This boils down to studying means versus variances (Anderson 2011), which is a false dichotomy because we need the mean in order to compute variance.

An important facet of natural history is the role of art, including drawing, painting, photography, and poetry. Art was a routine part of natural history in the 18th and 19th centuries, especially before photography and computer graphics. The spatial visualization that occurs in map-making or drawing is critical for solving scientific problems, such as cause of the London cholera epidemic and plate tectonics (Rieber, 1995). Art, especially drawing, with its emphasis on seeing what is there, rather than what we expect, forces the eye and eventually the brain, to recognize the exception, the outlier. The synergistic role of text and images is especially apparent in field journals (Greene, 2011). One reason we value biological illustrations is that, although when initially published they may have included many details not relevant to any hypotheses, these details may unexpectedly become relevant later. We need (boring) statistics to formalize our publications, but pictures are what usually persuade us.

Another useful form of art is comedy. The most impressive scientific talks are usually self-effacing and humorous. These do not contain bad cartoons and jokes, but ones that capture the essence of the science. Paulos (1980) described humor as a semi-stable state, where the information presented contains sufficient ambiguity to allow for multiple conclusions. While we may gravitate towards one conclusion, punch-lines and scientific paradigm shifts rely on shifting away from orthodoxy to heterodoxy. A good scientific story is akin to a good joke, where the listener is lulled into believing something mundane and then is logically jolted into believing some quietly lurking antithetical notion. I am more persuaded by a fascinating, rich, and subtle cartoon or joke than by reams of statistics.

How can we instill natural history in students? We could push for more native landscaping, thereby transforming university campuses into living classrooms. We could include creative components in ecology and evolution courses, such as drawing and writing. Many natural history courses have become glorified trivial pursuit exercises. While this can be important – e.g. distinguishing edible from poisonous sister taxa – there is much more. To determine when to tap sugar maples, I do not look at the calendar nor weather report, but

rather for squirrels chewing on maple buds and licking the exuding sap. Students should be able to earn BSc, MSc and PhD minors or degrees in natural history. For many, natural history is the initial door into studying ecology and evolution, so we should foster this in our students and ourselves.

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