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The value and necessity of natural history studies of waterbirds

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The Nature of Natural History

Natural history is the study of organisms in their environments, and has an historic role as the foundation for ecological and biological sciences (e.g., Jerdon 1874). The centrality of natural history was emphasized by Elton (1927) who defined ecology as "scientific natural history." As an accounting of the "history" of nature, natural history studies entail personal involvement; indeed, even the etymology of "history" suggests seeing, knowing, and accounting of one's inquiries and knowledge (www.etymonline.com). In this paper, we trace the use and the scientific and social values of natural history studies, provide cautions on overreliance on technologies at the cost of personal experience of nature, suggest the potential role of natural history studies to address issues of social inequities, and conclude with support for natural history studies particularly of waterbirds to significantly contribute to community involvement and advance scientific inquiry.

Natural history observations provide insight into natural phenomena and processes not necessarily requiring deep methodological scopes, intricate quantitative measurement, and statistical analysis, but still consisting of more than just a mere collection of incidental or anecdotal observations. Natural history studies require scientific rigor and must lend to repeatability, as replication is a hallmark of science, and to validation by the scientific community, and can further serve as a basis for generating hypotheses for more rigorous testing. Working at its best, natural history observation can open the door to new perspectives and relationships previously unreported and unsuspected (Ricklefs 2012).

Sources of Natural History Contributions

An important element of natural history in the 21st century is its accessibility to a broad audience who may not have considered participating in the scientific enterprise. Notable activities include: reporting incidental observations of bird species (ebird.org), bird–feeder watch programs (feederwatch.org), posting recordings of bird vocalizations and other wildlife sounds (macaulaylibrary.org), providing a community forum for discussions and species identifications (inaturalist.org), working with local and traditional knowledge (ewatlas.net), recording citizens' bird counts (audubon.org/conservation/

science), providing results of aquatic bird censuses (lac.wetlands.org), and more. Electronic resources used as a vehicle for citizens to convey natural history observations to scientists and others, have been transformational in the number of non–scientists that are engaged and in the broad geographic and temporal scales over which data are collected, with attention and concern over scientific rigor (Callaghan and Gawlik 2015, Dunn *et al.* 2022). Natural history studies, including those of waterbirds, also are accessible to amateur ecologists and to those conducting interdisciplinary work.

Involving community members to participate in natural history observations can yield dividends for science and society alike. Ecotourism and local involvement in conservation has blossomed as a means for providing citizens with natural experiences. An excellent example comes from the brackish Central Chaco Lagoons in the Great Chaco in Paraguay, South America, that led to the area being formally declared as a Ramsar Wetland. There, the visits of researchers, local people and birdwatchers have provided identification of species of waterbirds and contributed to understanding the timing and occurrence of various species. The popularity of this region and the local support for such visitation have highlighted this unique location and ecosystem in Paraguay, its role as serving for congregations of aquatic birds, the importance of how these habitats have developed, and the importance of these interconnected lagoons. The few scientific publications available on the area suggest that more can be produced. Another example from Paraguay is the *ad libitum* collection of citizen observations on biodiversity (mainly birds) on a sand bank site in the capital city of Asunción. This effort led to a citizen movement for the area to be declared an ecological reserve in 2005, and with the Parliament promoting its international recognition as a designated Western Hemisphere Shorebird Reserve Network, with further, pending designation as a Ramsar Wetland and a World Heritage Site. However, it must be noted that unchecked ecotourism comes with its own perils including habitat destruction and sociocultural ill-effects (Das and Chatterjee 2015).

Natural history observations often have historical continuity, such as color bands used on waterbirds the same way across multiple human generations. The first waterbirds that were banded likely for careful observation in south Asia were Sarus Cranes (*Antigone antigone*). One of the more famous stories around the Mughal Emperor Jahangir (1605–1627) regards his fondness for the pair of semi-captive Sarus Cranes he owned, and he placed gold bands on their legs to allow their recognition. His observations of the Sarus Cranes constitute the earliest information on the species' habits including their incubation period (Ali 1927). When one of us (KSGS) began work on this species in 1998, reliable information on incubation period for this species was known from five nests – two of which were from Jahangir's notes! Connecting observations made so long ago with those made today makes for stories that are both instructive (e.g., has the incubation period changed?) and attractive to a much larger set of people. It is safe to say that natural history observations of waterbirds in historic travel journals can still contribute to current knowledge.

Natural history anecdotes are often straightforward and simple relative to more complex quantitative studies, thereby making for much better stories to connect with the larger public whose participation can be crucial for conservation and for research funding (Fernández–Llamazares and Cabeza 2018). An example is with the story of storks migrating from Russian wetlands, through environments of the "Stans" (i.e., Afghanistan, Kyrgyzstan, Turkmenistan, etc.), to reach their favored wetland in central India. The story is both easy to tell for the scientist and greatly inspiring for the listener and reader. It may catch much less general, public attention if the story was heavy on scientific jargon and emphasizing climate variables, physiological measurements, wind patterns, and so on. The lesson here is that natural history stories are usually the ones that politicians act on in most countries because the more detailed sciences are

not easy to comprehend and are seldom well told to non–science audiences. Such stories often can be based on relatively simple observational studies not requiring expensive technology (e.g. satellite transmitters) but rather with using simpler tools such as plastic numbered tags, and also can be based on citizens contributing to observations. For example, natural history knowledge collected from anecdotes of traditional and indigenous people of Paraguay is contributing to IUCN's Nature–based Solutions (iucn.org/theme/nature–based–solutions) under the Nationally determined Contributions (NDCs) commitments of ratifying countries of the Paris Agreement on Climate Change.

Despite this, there is a general dearth of natural history taught to students in academic programs (Tewksbury *et al.* 2014), with greater emphasis on data analysis and modeling over fundamentals such as species identifications. Students' lack of natural history experiences in the field and the accompanying joy of first–hand natural history discoveries may be reducing their passion for pursuing conservation–related fields of study.

Technology Supplements, But Cannot Substitute, Direct Experience

A recent trend in natural history studies conducted by students and researchers is the increased reliance on technology such as environmental DNA (eDNA) and on the use of audio recorders, trail cameras, and other sensing devices, that remove the researcher from the immediacy of the environment (Tosa *et al.* 2021). The use of geotechnologies (e.g., satellite imagery, drones, GIS) is replacing field experience as a goal. Whereas we applaud the advances that these technologies make possible, and acknowledge that some technologies such as use of remote sensing do not require people to be removed from the immediacy of the environment, we are concerned at how these tools can shape the questions that are asked, particularly if they are the main or the only interaction that the researcher has with the environment under study. The greater the physical removal of the observer from the observed environment the harder it may be for the researchers to acquire an inherent understanding of natural phenomena and activities.

For example, the shared space and experiences of directly observing the natural history of any species can entice the participation of local residents. Residents can contribute a wealth of collective information particularly indigenous knowledge and traditional ecological knowledge, to weave a comprehensive narrative on the natural history of a species (Prado *et al.* 2020, Jessen *et al.* 2022). For instance, they can provide historic information regarding behavior and ecology that is not readily available in academic texts, or which would otherwise require years of observation.

As demonstrated by the successful conservation program for the IUCN–listed endangered Greater Adjutant (*Leptoptilos dubius*) in Assam, India, the researcher gains from the experiences of residents, and the residents gain a new perspective into the value of the biodiversity in their backyards. In this example, local residents initially regarded the Greater Adjutant as 'unclean' and were unaware of its endangered status. Hence, conservation measures were integrated with the local cultural and religious stories and events, particularly including women and villagers. This led to a growing sense of pride and ownership amongst the locals and potentially a threefold increase in the number of successful nests over a period of 10 years (Barman *et al.* 2020). Although there may be some uncertainty as to the specific contribution of this program to the conservation of the species, given how some of the locals at least initially regarded the stork as "unclean" when they were unaware of its endangered status, this case may nonetheless highlight the advantage of promoting conservation through environmental education, cultural ownership, and linking with local traditions.

It is important to stress the dual importance of technology-heavy (and often lab-based) science with far less-expensive and less-complex activities of natural history observation. Consider, for example, how an

entire class could benefit from encouraging their personal involvement with nature by simply providing them with binoculars, pens, and notebooks. Also important is to consider where natural history observations generally occur, such as in an individual's "home space" (which can be, for instance, bird feeders literally in the back yard), as contrasted with the far more complex sampling designs and environments of quantitative science. Few people grow up in a laboratory. Natural history, by its essence, lends to the incorporation of traditional ecological knowledge that can draw on extensive histories of the dwellers on the land.

What is needed is a greater degree of complementarity between complex analytic studies and more qualitative and immersive natural history studies. However, experiencing natural history through various media, such as television series and online videos, can serve a most important purpose to make nature more accessible especially to children in urban environments. Such engagement provides a major benefit by providing some exposure, albeit indirect, to a nature experience, and promoting some appreciation for nature and the need for conservation.

On Citizens and Science

One major caveat is that, to ensure scientific rigor, all such citizen science activities must include rigorous oversight, and citizen–reported observations be vetted, by trained researchers or reviewers (Dickinson *et al.* 2010, Johnston *et al.* 2021). Further, citizen–generated observations should be used with appropriate caution for scientific research, acknowledging and, if possible, correcting for potential biases associated with untrained observers (Johnston *et al.* 2022). In this document, "citizen" is equivalent to the concept of the "global citizen," which includes any person potentially interested in contributing to science. It does not refer to the concept of "national citizenship."

We advocate for taking great caution in using such terms as "citizen science" and "citizen scientist" as this misleads the general public as to the stringent academic requirements for becoming a scientist and as to the key role of peer review in producing reliable scientific information. Further, there may be some elitist connotations associated with such terms (Cooper *et al.* 2021), although it is firmly embedded in the literature. Nonetheless, public involvement in making and reporting observations is a wonderful vehicle for engaging people in appreciating natural phenomena and participating in one step in a scientific process (perhaps to be thought of as "citizen naturalists"), and we fully herald that engagement, particularly if it opens doors to learning for any and all.

A Means of Bridging Social Divides

Can the experience and study of natural history help bridge the gap between the haves and the have–nots? Countries of the "Global South" seldom have resources for in–country scientists to undertake expensive ecological work, although the situation has changed considerably in some countries (e.g., China, India). The absence of such resources puts students and scientists in these countries at a disadvantage, in that researchers in poorer countries are unable to conduct work that is as robust (and publishable) as work done by ecologists from richer countries.

Natural history is perhaps the great balancer in such situations in that scientists can contribute to knowledge about the species and ecosystems immediately around them and be considered important components of the global assemblage of scientists. For instance, we still lack basic information on occurrence, life history, and other aspects of the ecologies of most waterbird species in Asia and Africa. As an example, the incubation period of the Indian Skimmer (*Rynchops albicollis*) was documented just a few years ago (Rajguru 2017). Highlighting the role of basic natural history observation for students and scientists also can help reduce events of "parachute-ecologists" where researchers from richer countries visit developing countries without transfer of resources or training (Asase *et al.* 2022).

Reliance on technology potentially can be useful to bridge the gaps among people, communities, and societies varying greatly in their economic and educational status, although it does increase costs for people already struggling for resources. On the other hand, low–tech natural history observations can help discover novel relationships among species, such as an unexpected commensalism between storks and owls (Sundar *et al.* 2022) and unique behaviours of some species such as the formation of trios in Sarus cranes (Roy *et al.* 2022).

Further, can the study of natural history help solve the gender conundrum? Studies and publications of ecology and conservation, including those of waterbirds, are still dominated by male scientists (e.g., Corbera *et al.* 2021, Pettorelli *et al.* 2013) although the Waterbird Society is a great example of increasing the diversity of its membership, leadership, and academic outputs to be led by many remarkable women. The role and imbalance of gender is fairly well–studied in the sciences, and emerging trend of women facing biases is likely to be true in the community that works on waterbirds. Natural history is potentially a great way, especially for women colleagues living in areas with poorly-studied species, to become known and make a significant contribution to the understanding of the requirements of waterbird species. Women in many developing countries face the challenge of domestic responsibilities very early on in their careers and lives, and have fewer opportunities relative to men to follow a career, including in waterbird ecology and conservation. Natural history, with its relative ease to conduct observations, along with its increasing visibility in natural history sections of major journals such as *Ecology* and *Biotropica*, can potentially help continue to propel women scientists into an academic career.

Consider further how Western academic thinking can be alien to many countries as a mode of enquiry and of answering questions. The many statistics-based approaches, such as hypothetico–deductive testing and multi–model inferences, as emphasized in academic study and ecological research, effectively keep many participants out of the scientific community at the level they ought to be. Natural history at its essence is structured story-telling, a phenomenon common to most if not all cultures. To help convey such stories often demands proficiency in communicating and writing in the English language. Promoting that skill can likely help non–Western participation in "global" science.

A World to Share

Studying and reporting the natural history of waterbirds provide major contributions to science and conservation. Waterbirds are charismatic and, indeed, many are edible, making these species matter in ways that may not be immediately obvious in other taxonomic groups. Humans have been observing waterbirds for a very long time and have actively manipulated large areas of habitat to encourage their presence, such as Keoladeo Ghana National Park, a wetland bird sanctuary in India, which was initially created by a local ruler in the 18th century and subsequently used by Maharajas for hunting. Waterbirds can potentially be great ambassadors for conservation given their fascinating natural history.

Our purpose here is to spur thinking, discussion, conversation, and work on the natural history of waterbirds and their habitats and ecosystems, and beyond, for considerations of social equity. Here at *Waterbirds*, we advocate for, and encourage, the use of natural history observation and reporting that adheres to the means of scientific rigor, that encourages greater student involvement, and that can help amend gender and social inequities, and that provides contributions of surprising new insights sparking curiosity and further study of the natural world around us.

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EDITOR'S NOTE

The opinions and views represented in the Opinions section are the authors' own and do not necessarily reflect the opinions and views of the Waterbirds Editorial Staff.

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