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Need for longitudinal studies of Asian wildlife in the face of crises

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HIGHLIGHTS

- Longitudinal studies of wildlife are not as prevalent in Asia as elsewhere.
- Regulatory frameworks lack adequate data for protecting species.
- Examples of longitudinal assessments show their utility for conservation.
- Researchers should try to publish datasets & results in journals or repositories.
- Funders should diversify support and opportunities for longitudinal research.

GRAPHICAL ABSTRACT

Clockwise from top: *Hippocampus sindonis*, Shiho's seahorse (Photo: Honutomo, cc-by nc 4.0); *Otis tarda*, Asian Great Bustard (Photo: Martin Gilbert, all rights reserved); *Elephas maximus*, Asian elephant (Photo: Shermin de Silva, cc-by nc 4.0)

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ABSTRACT

Conservation biology is conceived as a discipline that must balance the short-term aim of gathering data on pressing conservation issues with the long-term vision of protecting populations, species, and functional ecosystems. Asian wildlife face imminent threats ranging from hunting to loss of critical habitats, but there are few examples of detailed longitudinal wildlife research in the region. Longitudinal research is essential for protecting populations especially in light of the high volumes of legal and illegal trade, understanding basic population dynamics, notably with respect to long-lived species, as well as accommodating the spatial needs of animals. It is also critical for evaluating the success of conservation or management interventions and adaptively improving outcomes. Such studies, particularly when requiring sustained field work, are impeded

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by mismatches between needs on the ground vs. the priorities of different stakeholders, the ephemeral and inefficient nature of funding mechanisms, and by the logistics of maintaining sites and personnel. Yet we cannot adequately protect biodiversity in Asia unless the magnitude of human impacts on its species is quantitatively understood and used to inform management.

"Although crisis oriented, conservation biology is concerned with the long-term viability of whole systems".

– Soulé (1985), *BioScience*, "What is conservation biology?"

"At times we seem to be documenting paths to extinction, telling ourselves that we need to do more research, developing theoretical models with insufficient consideration of their practical application, and giving each other advice on what others should be doing. If that is the limit of our expectations then conservation biology is succeeding as a field. But if we are intent on holding back the forces driving extinction, then we are failing in a major way".

– Whitten et al. (2001), *Conservation Biology*, "Conservation Biology: A Displacement Behavior for Academia?"

1. Definition and utility of longitudinal studies

Since its inception, conservation biology was characterized as a "crisis discipline" with the mission of providing the scientific basis for conservation decisions, responsive to immediate needs but with an eye toward the distant future (Soulé, 1985). In many regions, this ideal is overshadowed by the grim reality that data are often still inadequate, or worse, ignored (James et al., 1999; Rabinowitz, 1995; Sodhi et al., 2004). Confronted with the leading edge of Anthropocene mass extinction, conservation efforts often resemble attempts to plug the proverbial broken dam, which springs new leaks as soon as one is fixed. Conservation research as well as management decisions tend to occur in reaction to imminent threat. However, a longer perspective is required if our collective aim is to facilitate the persistence of species, including our own.

Currently conservation and ecological research published in leading journals is biased toward study sites based in wealthy and temperate countries (Martin et al., 2012). Yet in Asia, home to both the largest human populations and some of the most threatened ecosystems, the rapid pace of environmental change is most pronounced (Laurance, 2004a,b) and has been termed an "impending disaster" with respect to the loss of biodiversity through both deforestation and defaunation (Harrison, 2011; Jepson et al., 2010; Kurten, 2013; Laurance, 1999; Sodhi et al., 2004). Here I discuss reasons why we need greater investments in longitudinal research efforts on Asian fauna and the current challenges for doing so, with examples based on experience and literature.

Longitudinal research constitutes efforts to study a particular system in a repeatable and systematic way that are spread out over two or more time points, as opposed to one-time investments. By this I do not mean multiple independent studies but systematic, sustained efforts to understand the behavior of a system using a specific protocol. Some monitoring programs may constitute longitudinal research, if they are conducted in a consistent and scientifically justifiable way. The importance of longitudinal ecological studies is well-understood, especially with regard to understanding the long-term dynamics of ecosystems (Condit, 1995; Kim, 2006). The 50-acre plots which form the network of forests monitored through the Center for Tropical Forest Science and Forest Global Earth Observatories (CTFS-ForestGEO) are classic examples of long-term monitoring efforts. In Asia there are already a number of International Long Term Ecological Research (ILTER) sites. More generally, understanding the basic biology of long-lived species, especially if they reproduce slowly, requires great time investment (Condon et al., 1994). This is no less true of wildlife populations than for the ecosystems they are part of. Clutton-Brock and Sheldon (2010) identified at least six benefits of long-term individual-based research on wildlife: the ability to analyze age structure, link life history stages, link generations, quantify social structure, derive lifetime fitness measures and replicate estimates of selection. By individual-based I mean studies tracking the life histories of identified individuals in the population. At least the first three are directly relevant to conservation, and the others necessary for basic understanding of wildlife populations and their life histories. While long-term, individual-based studies may be considered a gold standard, longitudinal studies need not necessarily be long-term to be of value, so long as they are *of sufficient duration to capture a process of interest*. Ideally, this will entail multi-year timescales that adequately reflect the time needed for biological processes to occur or for the impacts of disturbance or management to manifest and be evaluated (Chapman et al., 2000; Yamaura et al., 2009). Longer studies are not always better than shorter ones, given that resources are limited. Where sufficient data are available, conservation funding and effort would be better invested in transferring available expertise to policy makers law enforcement, and ultimately into action (Knight et al., 2010, 2008). Studies also need not be based on known individuals, e.g. studies based simply on counts or occupancy, which can nevertheless provide important data on population trends.

Longitudinal studies are requisite for understanding population trends. North American hunting and fisheries records inform harvest quotas, a paradigm example of the practical application of longitudinal research in managing wildlife. There