Background:

We are facing a biodiversity crisis that is unprecedented in human history, caused by myriad human impacts including habitat loss and fragmentation, invasive species, pollution, unsustainable harvesting, and climate change (Barnosky et al. 2011). For example, the 2018 World Wildlife Fund Living Planet Index (WWF 2018) suggests that we have lost approximately 70% of global diversity since 1970 – a period of marked human population growth and dramatic increases in industrialization and economic growth in many countries. The UN Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) estimates that there are one million species at risk of extinction in the next decades (IPBES 2019). Conservation action (e.g. national and international treaties, species legal protections, reserve design and designation) requires detailed quantitative data on temporal trends in population sizes (e.g. Bonebrake et al. 2010), shifts in species ecology (e.g. breeding phenology; Adams 2010), and changes to species distributions (e.g. Sekercioglu et al. 2008; Marini et al. 2009). The need for continuous monitoring and demographic data is particularly important for migratory species, especially in the Northern Hemisphere, that require breeding grounds, stop-over sites during seasonal migrations, and wintering grounds that may encompass many countries (e.g. Amano et al. 2010; Wang et al. 2017). Birds also serve as important bioindicators of ecosystem health surveys of waterbird diversity in particular can provide insights into ecosystem health (Zhang and Ma 2011).

One of the most important migratory stop-over sites in eastern Asia is the Chongming Dongtan Nature Reserve, located on the eastern edge of Chongming Island, the largest estuarine alluvial island in the world and part of the Yangtze River Delta (MacKinnon et al. 2012). Reflecting its global ecological importance, the Dongtan Reserve is designated as National Nature Reserve in China and a Ramsar Wetland of International Importance (MacKinnon et al. 2012). Dongtan wetlands are critical for over 100 migratory waterbirds, including the critically endangered spoon-billed sandpiper (*Eurynorhynchus pygmeus*), the endangered black-faced spoonbill (*Platalea minor*) and the vulnerable hooded crane (*Grus monacha*) (MacKinnon et al. 2012).

There are many means to monitor population numbers for individual species or groups of species that include visual monitoring by human observers, automated audio recorders with song recognition, and environmental DNA surveys. This study will be part of a larger collaborative project to compare different methods for surveying avian diversity and the environments upon which they depend including invertebrate diversity and water chemistry.

Objectives

Traditional approaches to quantifying spatial and temporal trends in avian diversity relied on expert observers using standardized methods for conducting visual surveys (either point counts or transects) (Bibby et al. 1993). The role in this team effort is to undertake these visual surveys at multiple locales to provide baseline data for comparison to data derived from auditory monitoring and from

eDNA surveys. However, it will also explore the use of high-resolution photography using unmanned aerial vehicles and from shore in Dongtan Reserve over a period of significant bird migration (Chabot and Francis 2016). The hypotheses relates to comparisons to two other means of surveying (visual point counts and eDNA) and to the use of new approaches for visual surveys: 1. That visual surveys will provide the most complete data on avian species richness and abundance over the migration period that we will sample. 2. That high-resolution photography will yield additional insights on individual species abundance, and location within multi-species assemblages, and may yield additional species not apparent using traditional visual survey methods or either acoustic or eDNA methods.

Significance of the project

Humans have never had greater impacts on global environments than now. This is a consequence of burgeoning human populations and increasing industrialization in emerging economies like those in many Asian countries resulting in unprecedented rates of habitat loss and conversion, pollution, and ultimately global climate change. This is all having profound and potentially irrevocable consequences for the natural world. This study contributes to understanding avian patterns at one of the most important stop-over sites in Asia for shorebirds and waterfowl, and tests the efficacy of visual monitoring relative to other methods, and the advantages of high-resolution imagery. More broadly, and in conjunction with other members of the MITACS research team, this study will help us to better monitor aquatic ecosystem health using a suite of tools moving us to more comprehensive methods for monitoring the Yangtze River and other major riverine and lake systems.

Timeline

TBD

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