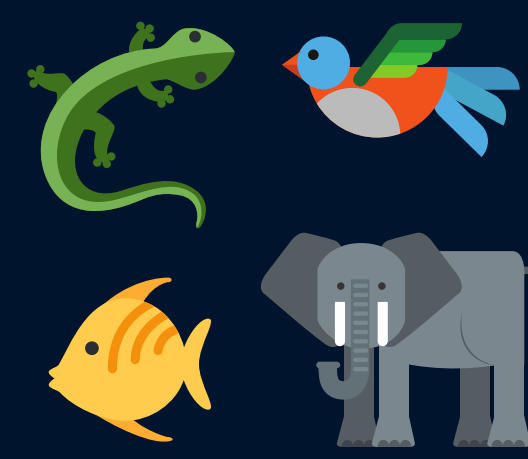


# A MORE PRECISE LIVING PLANET INDEX



Using the relationships between animal populations to strengthen certainty in our **measurement of biodiversity trends**.

The **Living Planet Index (LPI)** measures the **overall global trend in vertebrate abundances since 1970**, including terrestrial, freshwater, and marine systems. (WWF 2016; Loh *et al.* 2005)



The LPI has a **global-scale influence** on biodiversity management: it is an **Essential Biodiversity Variable (EBV)** used by the Convention on Biological Diversity to measure global progress towards **biodiversity targets**. (Kissling *et al.* 2018; CBD 2010)



## the issue of **precision**

- **Precision** is a measure of certainty in an estimated value (e.g. confidence limits).
- Every year, the LPI **accumulates uncertainty** and becomes **less precise**.
- Addressing the LPI's decreasing precision is **necessary** to ensure its **long-term reliability** for management & conservation.

## HOW CAN WE IMPROVE THE PRECISION OF ESTIMATED BIODIVERSITY TRENDS?



**ANIMAL POPULATIONS INTERACT** IN MANY WAYS, LINKING TOGETHER THEIR RESPONSES TO ENVIRONMENTAL CHANGE.

- Some populations **covary** through time as they respond to **shared stressors** or to their **interaction partners'** fluctuations.
- Unless accounted for, this covariation contributes to the **uncertainty** surrounding the LPI trend.
- If we can **explicitly** account for the covariation between populations in the LPI, we can potentially reduce the LPI's uncertainty, and thus **improve its precision**.



Figure 1. Example of interacting populations included in the LPI: Canada lynx (*Lynx canadensis*) hunting its prey, a snowshoe hare (*Lepus americanus*).

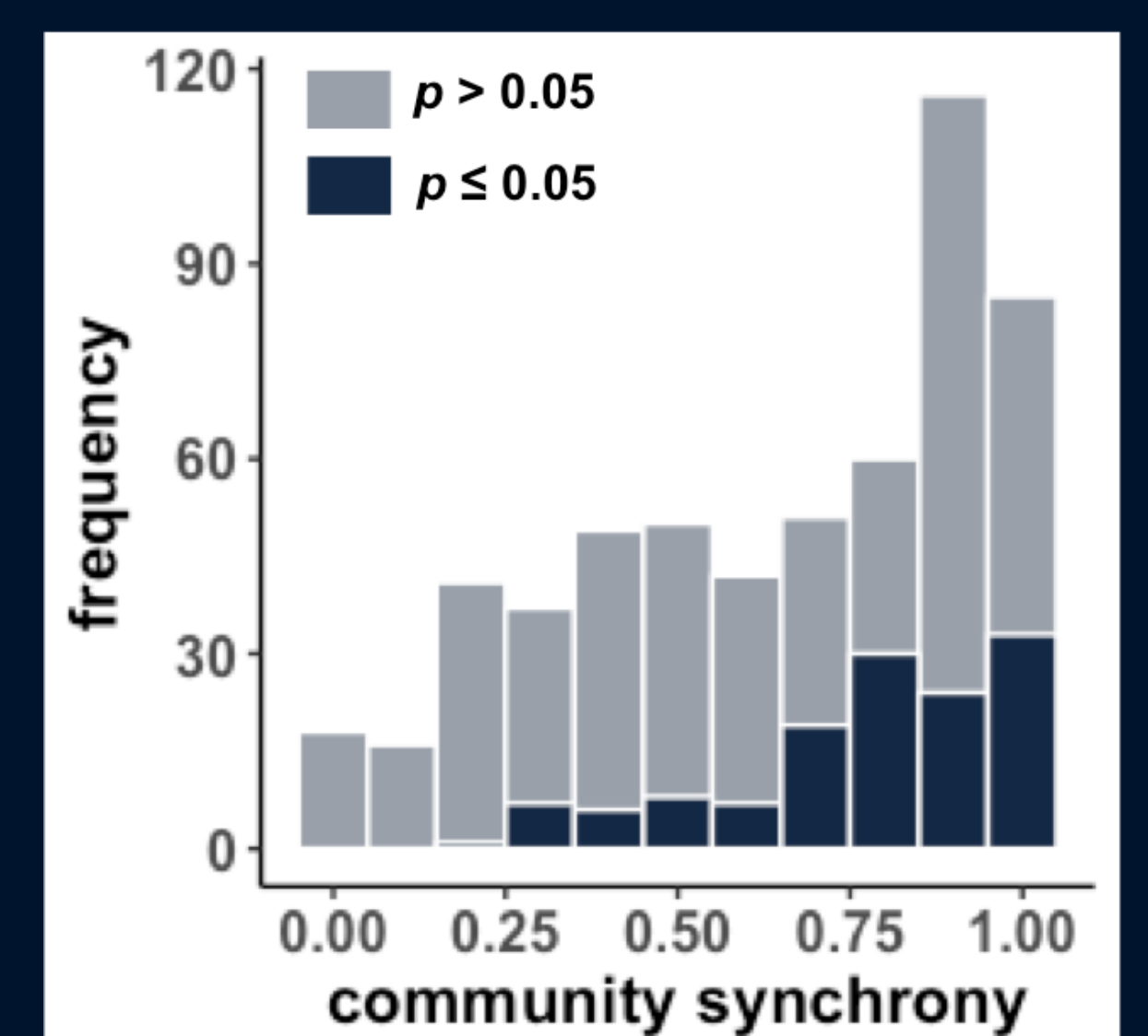
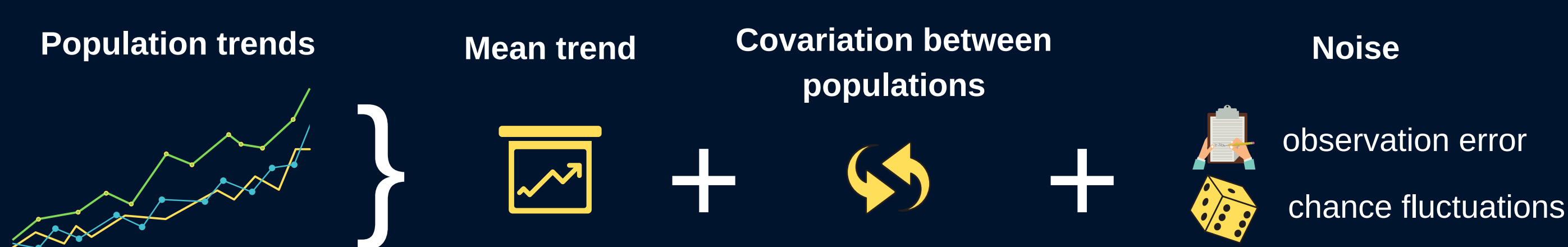


Figure 2. Covariation, measured as community synchrony, between all co-occurring populations in unique locations included in the publicly available subset of the 2016 Living Planet Database.

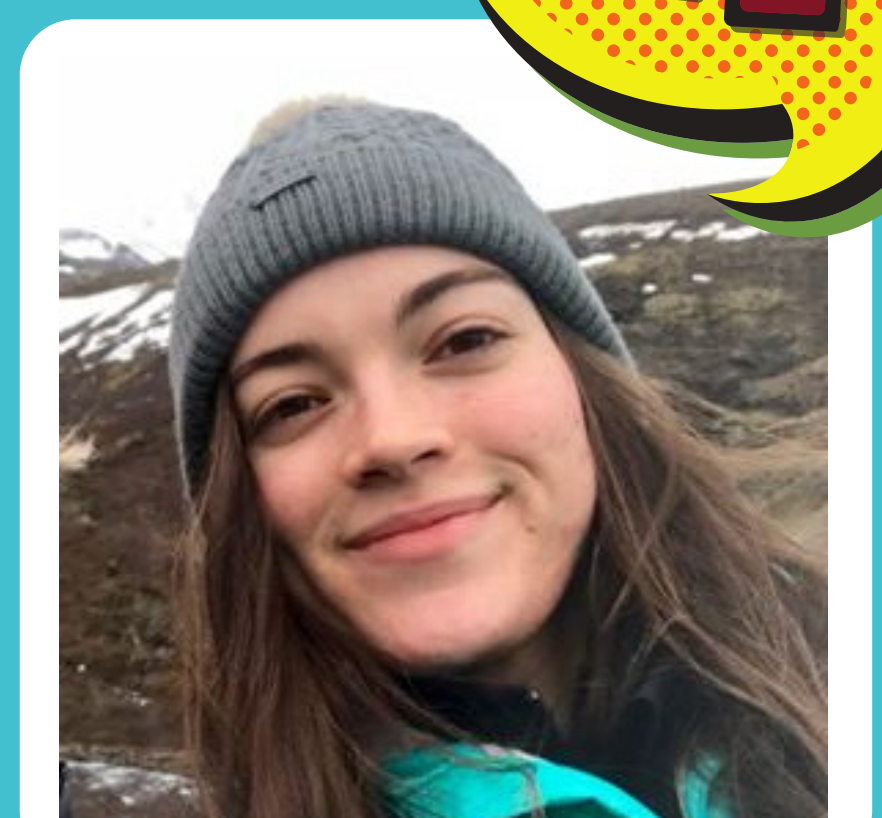
## the way forward: joint modelling

Rather than modelling each population independently, a joint modelling framework can be integrated into the LPI to estimate trends for all co-occurring populations together - and therefore explicitly account for covariation. (Warton *et al.* 2015)

This approach should reduce the uncertainty surrounding the LPI, ultimately providing a more precise estimate of global population-level trends. This, in turn, will allow for a more reliable metric of biodiversity change, which can be used with greater confidence to make decisions about biodiversity management and conservation.



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I will be present:  
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