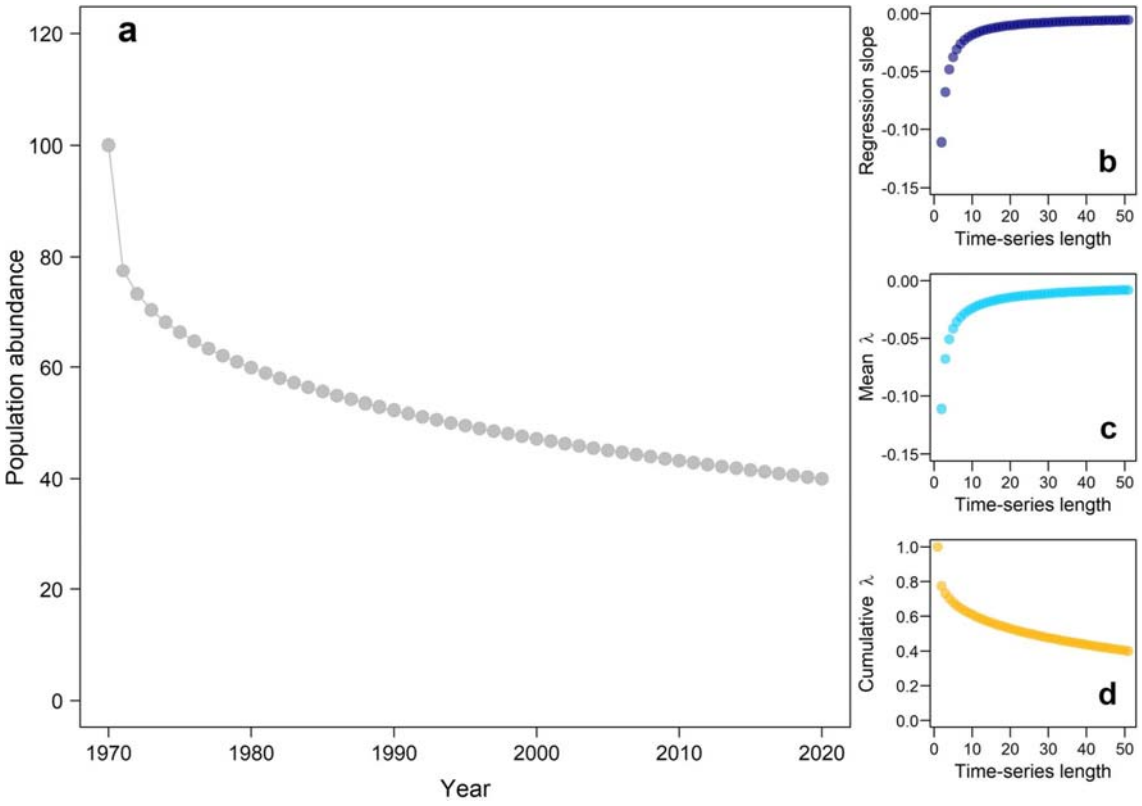
Extended Data Fig. 9: Cumulative population changes represent empirical trajectories more accurately than average changes as time series lengths increase.

From: Random population fluctuations bias the Living Planet Index



a, The trajectory of a hypothetical population that decreases nonlinearly from 100 individuals in 1970 to 60 individuals by 1980 and steadily settles to a new equilibrium of 40 individuals by 2020. **b**, If population changes were quantified as the slope of a linear regression on $\log_{10}$-transformed population data, declines are high when the time series is short, but tend to zero as new data is added to the time series. **c**, The same observation holds for mean year-on-year population changes, $\lambda = \log_{10} (N_{t+1}/N_t)$, where declines are dramatic at first and steadily tend to zero as the length of the time series increases. d, By contrast, cumulative year-on-year population changes, $\lambda = \log_{10} (N_{t+1}/N_t)$, accurately capture the hypothetical population trajectory because the population change in each subsequent year is added to the change from preceding years. Thus, measuring cumulative population change is more representative when population trajectories settle into alternative equilibria nonlinearly.