Unravelling Malta's unique Pleistocene evolution predicts 13% of future fossil discoveries will be new species

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Abstract

The current state of Malta and Sicily as distinct islands is atypical. For 2.5-million-years Europe has been dominated by recurrent glacial periods when vast amounts of water locked in polar ice drastically depleted Mediterranean Sea levels, joining both these islands together. During interglacial periods of island separation, ecological disruption had the potential to drive localised faunal extinctions. However, this would have had little influence on the long-term fossil record, given rapid recolonisation during glacial periods, when a land bridge between the two islands emerged. For these reasons, the Pleistocene faunas are widely assumed to be similar on both islands, with differences in the fossil records generally attributed to limited sampling, particularly on Malta where the discovery of new sites has been limited. Here, we apply a novel method which predicts the amount of new future discoveries, and tests if the fauna significantly differed between the islands. This approach incorporates prior assumptions of the relative frequencies of species, and leverages sample sets against each other. We show that the faunal composition of Malta and Sicily differed significantly, indicating long-term ecological and evolutionary differences between the two islands. We predict 5% – 20% (95% CI) of future Maltese recoveries from further excavations on Malta will yield as yet undiscovered species, with an efficiency of c.2.6%. Our approach provides a robust quantitative method of evaluation to complement and justify further fieldwork.

Keywords

Species frequency; missingness; presence data; mean likelihood estimator; MCMC; yield efficiency

Declarations

The authors declare no conflicts of interest.