Fossil-Augmented Species Distribution Models Reveal the Shifted Baselines of California Avifauna under Climate Change

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Climate change threatens to alter the distribution of numerous bird species globally. While predicting future distributional changes is critical in guiding management efforts, recent advances have shown that the present-day relationship between species occurrences and bioclimatic variables may be biased by prehistoric and historic anthropogenic influences; therefore, using solely present-day data can result in incorrect assessments of the species' climatic envelopes. To investigate the utility of fossil and historic occurrence data in producing more accurate long-term forecasts, the paleontological records available at the La Brea Tar Pits and other museum collections and deposits found more broadly across California were leveraged in combination with modern observations from citizen science platforms. Occurrences from the Late Pleistocene were used to make predictions for ranges under present-day climatic scenarios as a conservation counterfactual, and this counterfactual was compared with the actual present-day distributions, quantifying the effects of shifting baselines. When applied to the case of the California condor (Gymnogyps californianus), the Pleistocene model predicted current condor presence in Big Sur and Southern California to a high degree of accuracy. The model was then used to identify and map potential future areas of colonization and extinction and detect areas of habitat fragmentation. This research highlights opportunities for interdisciplinary collaboration and for the integration of datasets from the Pleistocene and Holocene to meet conservation challenges of the Anthropocene.

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