Distribution change in South African frogs

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Abstract

Range change is a common species response to global change. Comparing historical species distribution data with recent biological surveys has the potential to quantify changes to species geographic ranges. However, the broad-scale sampling strategies typically employed to acquire primary species distribution data are prone to errors of omission. The aim of this study was to evaluate the *South African Frog Atlas Project* (*SAFAP*) as a means for detecting changes in amphibian species distributions and to relate observed range changes to extrinsic environmental factors and intrinsic species characteristics. The *SAFAP* provided historical (1905 – 1995) and recent (1996 – 2003) species distributions of the amphibians of South Africa. Geographic sampling bias in the dataset was assessed by relating collection density and species richness to hypothesised sources of bias. Several methods for managing differing sampling intensity were tested on hypothetical ranges. The best methods were applied to the South African species to investigate range dynamics. Changes to the size of species ranges and shifts in mean range centre were assessed. An Ecological Niche Factor Analysis provided comparative measures of climate and habitat niche breadth for each species. *SAFAP* sampling was concentrated around cities, roads and protected areas, resulting in relatively overestimated species richness and range sizes near to these features. Large parts of the arid northwestern regions were under-sampled. An increase in sampling intensity over time resulted in the false detection of range expansions. The most reliable method to correct for increased sampling was a mathematical correction factor, according to which, 60.2% of South African frog species have undergone range contractions. Upslope shifts of 47.6 m were found for South African species and species of the Bushveld region shifted towards an area of Savanna Biome resilience. While several of the observed changes to species ranges were consistent with global change predictions, southern hemisphere amphibians may show a differing response to global change to that which is commonly predicted. Small range size, habitat specialisation and climate specialisation were significant predictors of range contractions for all species. Contracting habitat specialists were concentrated within two areas of endemism that also had high levels of land transformation. The use of methods that correct for sampling variation has allowed the *SAFAP* to be valuable in investigating species range change.