Assessing abundance-suitability models to prioritize conservation areas for the dwarf caimans in South America

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Abstract

Species-environment relationships have been extensively explored through species distribution models (SDM) and species abundance models (SAM), which have become key components to understand the spatial ecology and population dynamics directed at biodiversity conservation. Nonetheless, within the internal structure of species' ranges, habitat suitability and species abundance do not always show similar patterns, and using information derived from either SDM or SAM could be incomplete and mislead conservation efforts. We gauged support for the abundance-suitability relationship and used the combined information to prioritize the conservation of South American dwarf caimans (*Paleosuchus palpebrosus* and *P. trigonatus*). We used 7 environmental predictor sets (surface water, human impact, topography, precipitation, temperature, dynamic habitat indices, soil temperature), 2 regressions methods (Generalized Linear Models - GLM, Generalized Additive Models - GAM), and 4 parametric distributions (Binomial, Poisson, Negative binomial, Gamma) to develop distribution and abundance models. We used the best predictive models to define 4 categories (low, medium, high, very high) to plan species conservation. The best distribution and abundance models for both *Paleosuchus* species included a combination of all predictor sets, except for the best abundance model for *P. trigonatus* which incorporated only temperature, precipitation, surface water, human impact, and topography. We found non-consistent and low explanatory power of environmental suitability to predict abundance which aligns with previous studies relating SDM-SAM. We extracted the most relevant information from each optimal SDM and SAM and created a consensus model (2,790,583 km2) that we categorized as low (39.6%), medium (42.7%), high (14.9%), and very high (2.8%) conservation priorities. We identified 279,338 km2 where conservation must be critically prioritized and only 29% of these areas are under protection. We concluded that optimal models from correlative methods can be used to provide a systematic prioritization scheme to promote conservation and as surrogates to generate insights for quantifying ecological patterns.

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