**Supporting information: S1**

Estimating species occupancy across multiple sampling seasons with temporal autologistic occupancy models via the autoOcc R package

<Author information has been removed for the review process, it will be added in the event the manuscript is accepted for publication>

## The autologistic occupancy model is a simplification of the dynamic occupancy model

The autologistic occupancy model is a special case of the dynamic occupancy model. To show this I will begin explaining the standard formulation of the dynamic model and then show the assumptions that must be made to reduce the dynamic model to an autologistic. Thus, for *i* in 1,…,*I* sites and *t* in 1,…,*T* primary sampling periods (hereafter seasons), let *zi,t*be the latent binary occupancy status of a species at site *i* and time *t*. During the first season we have no knowledge of the occupancy status before. Thus, we estimate occupancy in the first time step, which we refer to as the initial occupancy probability *ψ*.

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|  | *,* | Eq. S1 |

Following the first season we condition the occupancy status, *zi,t,*on the occupancy status in the previous season, *zi,t-1*. Doing so allows us to separately estimate local colonization (γi) and extinction (εi) probabilities. Thus, for *t>1*, the latent state model is

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|  | *,* | Eq. S2 |

Thus, the occupancy status in the previous timestep serves as an indicator variable. If the species is present in the previous timestep then the probability in Eq. S2 simplifies to , which is also known as the persistence probability, φi. Conversely, if the species is not present, then Eq. S2 simplifies to estimating local colonization, γi.

If we define