Appendix 3 – Results for Leach's storm-petrel when omitting Machias Seal Island

In our case study of Leach's storm-petrels, Machias Seal Island had substantially lower mean abundance than any other colony (mean count = 244 individuals; see Figure 2 in main text). Extremely small colonies can be subject to fundamentally different population dynamic processes than large colonies; thus, including Machias Seal Island may erode the ability of our model to share information on the shape of temporal trajectories among colonies. To examine this possibility, we re-fit the statistical model while omitting Machias Seal Island from the dataset. Fitted trajectories for each of the 12 storm-petrel colonies are shown in Figure S3.1.

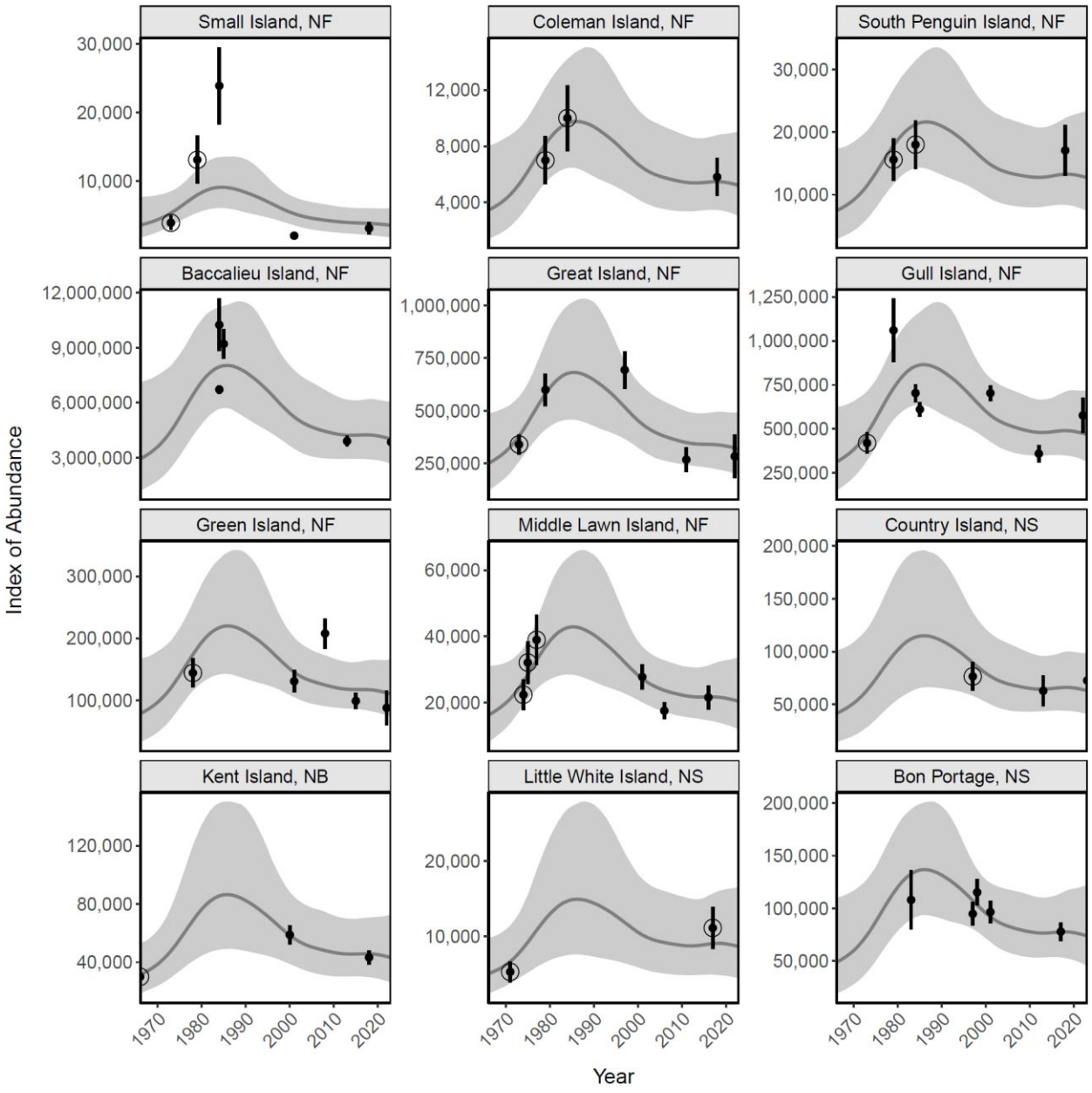

Figure S3.1. Colony-level trajectories for Leach's storm-petrel derived from the Bayesian hierarchical GAMM over the period 1966-2024 (ordered by latitude, 12 colony locations). Raw survey counts are shown as black points with standard error estimated by the GAMM (counts without raw estimated SE

are indicated by open circles). The solid gray line and ribbons depict colony-level trajectories as posterior median and 95% confidence interval.

The overall regional trajectory is shown in Figure S3.2. Compared to the estimate presented in the main text of the manuscript which included Machias Seal Island (Figure 4), this estimate implies a slightly higher degree of confidence that the regional population increased in the early portion of the time series (i.e., from 1970-1980).

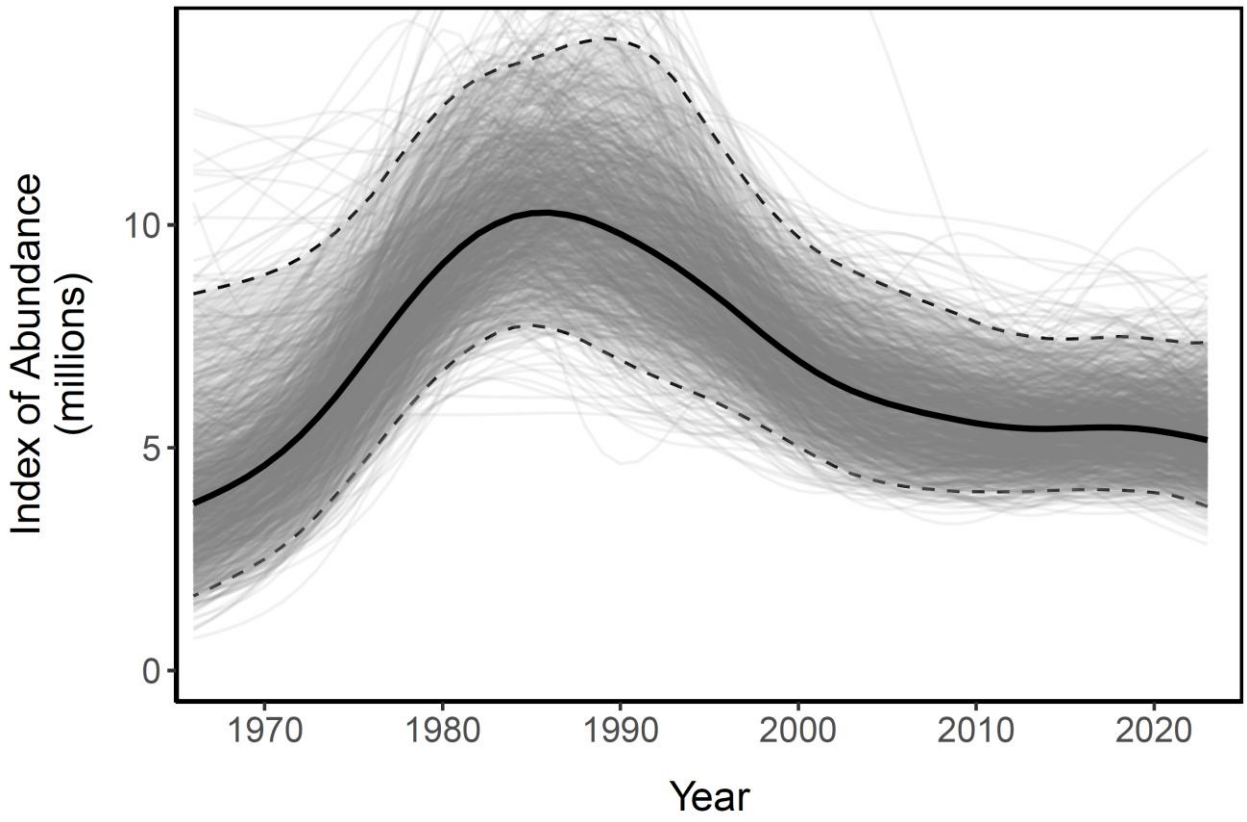

Figure S3.2. Regional-level trajectory for Leach's storm-petrel derived from the Bayesian hierarchical GAMM over the period 1966-2023, when omitting Machias Seal Island from the dataset.

The estimated trend from 1966 to 2023 when omitting Machias Seal Island from the analysis is -1.03% per year (95% CRI = -2.03 to -0.04), with a 98% chance the trend is negative (Figure S3.3). This estimate is similar to when Machias Seal Island was included in the model, despite the slightly increased confidence that the regional population increased in the early years of the time series.

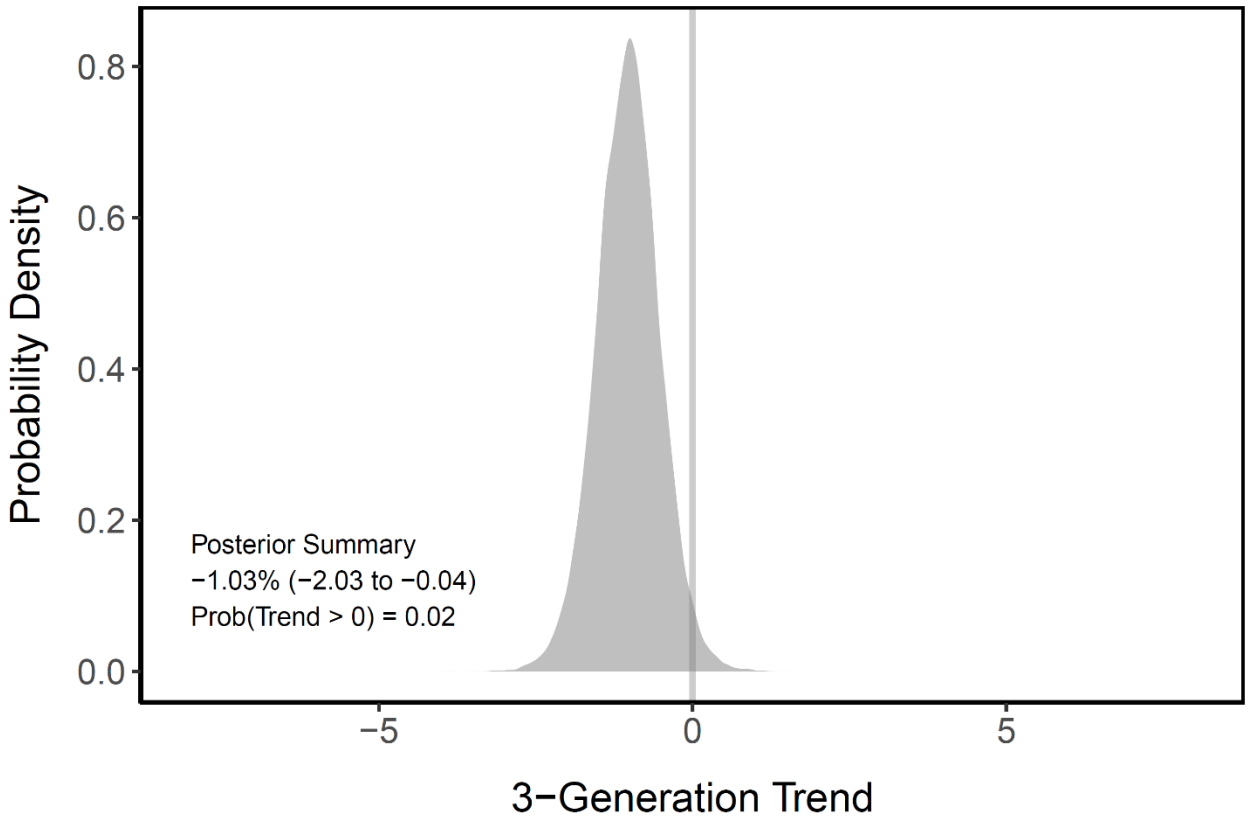

Figure S3.3. Regional 3-generation trend estimates for Leach's storm-petrel derived from the Bayesian hierarchical GAMM over the period 1966-2023, when omitting Machias Seal Island from the dataset (generation length was 14.8 years). Bayesian posteriors are presented as density plots with a vertical gray line at 0 indicating population stability. Posterior summaries describe the median estimate of the 3-generation trend with 95% credible intervals in parentheses.