**Estimating occupancy from autonomous recording unit data in the presence of misclassifications and detection heterogeneity**

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Figure S1 True and false detection probabilities across 29 simulation scenarios for a two-species false-positive N-mixture model. Within each scenario, detection probabilities vary among sites, as shown in figure. Scenarios organized by (1) mean animals per site ((a) to (e): Scenarios 1-5; μ=0.33, 1, 3, 9, 27); (2) overdispersion parameter ((f) to (j): Scenarios 6, 3, 7, 8, 9; *r*=0.125, 0.5, 2, 8, 32); (3) detections per animal ((k) to (o): Scenarios 10, 3, 11, 12, 13; λ=0.25, 1, 4, 16, 64), (4) false positive rate ((p) to (t): Scenarios 14, 15, 3, 16, 17; ω=0.02, 0.04, 0.09, 0.19, 0.47), (5) relative abundance ((u) to (y): Scenarios 1, 18, 19, 20, 21; μ*A*:μ*B*=1:1, 1:3, 1:9, 1:27, 1:81), (6) relative encounter rate ((z) to (dd): Scenarios 10, 22, 23, 24, 25; λ*A*:λ*B* =1:1, 1:4, 1:16, 1:64, 1:256), and (7) extra-Poisson variation in signal production ((ee) to (ii): Scenarios 3, 26, 27, 28, 29; Var(*μ*)*/μ* = 1.0, 4.0, 9.5, 25.7, 79.4).















Figure S2 Bias in abundance estimates across 29 simulation scenarios for a two-species false-positive N-mixture model. Scenarios organized by (a) mean animals per site, (b) overdispersion parameter (note, a high parameter indicates low variance), (c) detections per animal (note, scale differs from other panels), (d) false positive rate, (e) relative abundance (value indicates number of non-target animals per target animal), (f) relative encounter rate (value indicates ratio of signals produced per non-target animal to signals produced per target animal), and (g) extra-Poisson variation in signal production (value indicates factor by which variance in detections exceeds Poisson variance).



Table S1. Model convergence (Conv), bias, credible interval coverage (Cov), and root mean square error (RMSE) for estimates of occupancy for species *A* obtained from three occupancy models applied to simulated data. The models include a two-species false-positive occupancy model with Bernoulli detection (Bernoulli detection), a two-species false-positive occupancy model with Poisson detection (Poisson detection), and a two-species false-positive N-mixture model (N-mixture model), as described in the text. See Table 1 for details of the scenarios.

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  | Bernoulli detection | | | |  | Poisson detection | | | |  | N-mixture model | | | |
| Scenario |  | Conv (%) | Bias | Cov (%) | RMSE |  | Conv (%) | Bias | Cov (%) | RMSE |  | Conv (%) | Bias | Cov (%) | RMSE |
| 1 |  | 100 | 0.01 | 96.0 | 0.05 |  | 98.5 | 0.01 | 95.4 | 0.05 |  | 100 | 0.00 | 93.0 | 0.06 |
| 2 |  | 100 | 0.01 | 91.0 | 0.07 |  | 72.0 | -0.03 | 94.4 | 0.07 |  | 100 | -0.01 | 92.5 | 0.07 |
| 3 |  | 99.5 | 0.01 | 94.5 | 0.07 |  | 12.0 | -0.13 | 37.5 | 0.15 |  | 100 | 0.00 | 91.0 | 0.07 |
| 4 |  | 97.5 | 0.02 | 93.3 | 0.05 |  | 1.0 | -0.26 | 0.0 | 0.27 |  | 99.0 | -0.01 | 95.5 | 0.06 |
| 5 |  | 96.5 | -0.02 | 83.9 | 0.19 |  | 1.0 | -0.36 | 0.0 | 0.37 |  | 87.0 | -0.02 | 93.7 | 0.05 |
| 6 |  | 99.0 | 0.06 | 84.0 | 0.09 |  | 22.0 | -0.02 | 90.9 | 0.06 |  | 100 | 0.00 | 94.5 | 0.06 |
| 7 |  | 99.5 | -0.04 | 88.9 | 0.07 |  | 12.5 | -0.21 | 4.0 | 0.22 |  | 100 | -0.01 | 94.0 | 0.05 |
| 8 |  | 100 | -0.07 | 74.3 | 0.10 |  | 18.0 | -0.22 | 2.8 | 0.23 |  | 99.5 | -0.02 | 95.5 | 0.05 |
| 9 |  | 99.0 | -0.07 | 70.7 | 0.09 |  | 25.5 | -0.26 | 5.9 | 0.28 |  | 100 | -0.02 | 97.5 | 0.04 |
| 10 |  | 92.0 | -0.07 | 74.3 | 0.12 |  | 74.5 | -0.13 | 38.3 | 0.20 |  | 100 | -0.02 | 94.5 | 0.10 |
| 11 |  | 98.0 | 0.07 | 77.7 | 0.09 |  | 9.0 | -0.12 | 61.1 | 0.13 |  | 99.5 | 0.00 | 92.5 | 0.07 |
| 12 |  | 83.0 | -0.07 | 45.8 | .028 |  | 3.0 | -0.10 | 83.3 | 0.10 |  | 94.5 | 0.04 | 84.7 | 0.08 |
| 13 |  | 49.0 | -0.14 | 1.5 | 0.42 |  | 5.0 | -0.10 | 70.0 | 0.12 |  | 81.0 | 0.07 | 74.1 | 0.10 |
| 14 |  | 99.5 | -0.02 | 94.0 | 0.06 |  | 38.0 | -0.13 | 52.6 | 0.14 |  | 100 | -0.01 | 96.0 | 0.06 |
| 15 |  | 100 | -0.01 | 94.5 | 0.07 |  | 24.0 | -0.13 | 43.8 | 0.15 |  | 100 | -0.01 | 92.5 | 0.07 |
| 16 |  | 96.5 | 0.04 | 88.1 | 0.08 |  | 3.0 | -0.13 | 50.0 | 0.15 |  | 100 | 0.00 | 94.5 | 0.07 |
| 17 |  | 81.0 | -0.05 | 54.7 | 0.19 |  | 0.0 | -- | -- | -- |  | 96.0 | -0.03 | 93.8 | 0.09 |
| 18 |  | 100 | 0.03 | 95.0 | 0.06 |  | 86.5 | 0.04 | 91.3 | 0.07 |  | 100 | -0.01 | 96.5 | 0.05 |
| 19 |  | 99.0 | 0.12 | 53.4 | 0.14 |  | 39.0 | 0.11 | 50.0 | 0.12 |  | 100 | 0.00 | 95.5 | 0.06 |
| 20 |  | 97.5 | 0.25 | 4.7 | 0.26 |  | 18.5 | 0.10 | 54.1 | 0.12 |  | 99.5 | 0.00 | 95.5 | 0.06 |
| 21 |  | 96.5 | 0.39 | 0.0 | 0.40 |  | 20.5 | 0.03 | 85.4 | 0.07 |  | 99.0 | 0.00 | 93.9 | 0.08 |
| 22 |  | 95.5 | 0.00 | 93.7 | 0.07 |  | 25.0 | -0.06 | 72.0 | 0.12 |  | 100 | -0.02 | 95.0 | 0.09 |
| 23 |  | 97.0 | -0.07 | 64.9 | 0.14 |  | 13.5 | -0.15 | 29.6 | 0.16 |  | 100 | -0.02 | 93.0 | 0.10 |
| 24 |  | 99.0 | -0.27 | 2.0 | 0.28 |  | 26.0 | -0.19 | 11.5 | 0.20 |  | 99.5 | -0.02 | 95.0 | 0.09 |
| 25 |  | 97.5 | -0.36 | 0.0 | 0.38 |  | 25.0 | -0.18 | 14.0 | 0.19 |  | 100 | -0.01 | 94.5 | 0.10 |
| 26 |  | 97.0 | 0.02 | 92.8 | 0.07 |  | 9.5 | -0.12 | 47.4 | 0.13 |  | 100 | 0.00 | 95.0 | 0.06 |
| 27 |  | 97.0 | 0.02 | 96.4 | 0.07 |  | 9.0 | -0.13 | 38.9 | 0.14 |  | 100 | 0.00 | 97.5 | 0.06 |
| 28 |  | 98.0 | 0.01 | 94.9 | 0.07 |  | 10.0 | -0.13 | 40.0 | 0.15 |  | 100 | 0.00 | 94.5 | 0.06 |
| 29 |  | 94.0 | 0.01 | 93.6 | 0.07 |  | 11.0 | -0.12 | 54.5 | 0.13 |  | 99.0 | 0.00 | 94.4 | 0.06 |