**Supplementary Material**

Bird population trends on Aguiguan (Goat Island), Mariana Islands

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Appendix S1. Detection function parameters used to derive population densities for each species on Aguiguan by data set (USFWS — 1982, 1995, 2008 surveys; DFW — 2000, 2002 surveys).

Appendix S2. Repeated measures analysis of variance difference of least squares means. A Tukey’s adjustment was used to control experiment-wise alpha = 0.05 for multiple-comparison procedures, and significant differences are marked in bold. Species abbreviations were: Island Collared-dove – ISCD, White-throated Ground-dove – WTGD, Mariana Fruit-dove – MAFD, Collared Kingfisher – COKI, Micronesian Myzomela – MIMY, Rufous Fantail – RUFA, Golden White-eye – GOWE, Bridled White-eye – BRWE, and Micronesian Starling – MIST.Appendix S1. Detection function parameters used to derive population densities for each species on Aguiguan by data set (USFWS — 1982, 1995, 2008 surveys; DFW — 2000, 2002 surveys).

USFWS

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Truncation | Key Model | Adjustment Terms | Covariates |
| Island Collared-sove | 70.0 | Hazard rate | None | None |
| White-throated Ground-dove | 59.0 | Half normal | None | None |
| Mariana Fruit-dove | 191.0 | Hazard rate | Cosine (2) | Observer |
| Collared Kingfisher | 193.0 | Hazard rate | None | Observer |
| Micronesian Myzomela | 85.0 | Hazard rate | None | Observer |
| Rufous Fantail | 44.0 | Hazard rate | None | Detection type |
| Golden White-eye | 65.3 | Hazard rate | None | Detection type |
| Bridled White-eye | 37.0 | Hazard rate | None | Detection type |
| Micronesian Starling | 75.9 | Hazard rate | None | Observer |
|  |  |  |  |  |

DFW

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Species | Truncation | Key Model | Adjustment Terms | Covariates |
| Island Collared-dove | — | — | — | — |
| White-throated Ground-dove | 62.9 | Half normal | None | None |
| Mariana Fruit-dove | 97.0 | Hazard rate | None | Island, Year |
| Collared Kingfisher | 99.0 | Half normal | None | Island |
| Micronesian Myzomela | 65.0 | Hazard rate | None | Island |
| Rufous Fantail | 29.0 | Hazard rate | None | Year |
| Golden White-eye | 33.5 | Hazard rate | None | None |
| Bridled White-eye | 29.9 | Hazard rate | None | None |
| Micronesian Starling | 58.1 | Hazard rate | None | Island, Year |
|  |  |  |  |  |

Appendix S2. Repeated measures analysis of variance difference of least squares means. A Tukey’s adjustment was used to control experiment-wise alpha = 0.05 for multiple-comparison procedures, and significant differences were marked in bold. Species abbreviations were Island Collared-dove – ISCD, White-throated Ground-dove – WTGD, Mariana Fruit-dove – MAFD, Collared Kingfisher – COKI, Micronesian Myzomela – MIMY, Rufous Fantail – RUFA, Golden White-eye – GOWE, Bridled White-eye – BRWE, and Micronesian Starling – MIST.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Species | Year | Year | Estimate | SE | DF | *t-*Value | Adj*P* |
| ISCD | 1982 | 1995 | -0.004 | 0.031 | 161 | -0.11 | 0.993 |
|  | **1982** | **2008** | **-0.168** | **0.031** | **174** | **-5.45** | **<0.001** |
|  | **1995** | **2008** | **-0.165** | **0.036** | **171** | **-4.61** | **<0.001** |
| WTGD | **1982** | **1995** | **-0.315** | **0.079** | **319** | **-3.97** | **0.001** |
|  | 1982 | 2000 | -0.172 | 0.081 | 323 | -2.13 | 0.209 |
|  | 1982 | 2002 | -0.122 | 0.081 | 323 | -1.51 | 0.555 |
|  | **1982** | **2008** | **-0.393** | **0.075** | **336** | **-5.26** | **<0.001** |
|  | 1995 | 2000 | 0.143 | 0.093 | 322 | 1.54 | 0.537 |
|  | 1995 | 2002 | 0.193 | 0.093 | 322 | 2.08 | 0.232 |
|  | 1995 | 2008 | -0.078 | 0.088 | 331 | -0.89 | 0.900 |
|  | 2000 | 2002 | 0.050 | 0.094 | 319 | 0.53 | 0.984 |
|  | 2000 | 2008 | -0.221 | 0.089 | 334 | -2.49 | 0.095 |
|  | **2002** | **2008** | **-0.271** | **0.089** | **334** | **-3.05** | **0.021** |
| MAFD | 1982 | 1995 | 0.055 | 0.043 | 325 | 1.27 | 0.709 |
|  | **1982** | **2000** | **0.221** | **0.044** | **327** | **5.02** | **<0.001** |
|  | **1982** | **2002** | **0.304** | **0.044** | **327** | **6.90** | **<0.001** |
|  | 1982 | 2008 | -0.112 | 0.041 | 349 | -2.69 | 0.057 |
|  | **1995** | **2000** | **0.166** | **0.051** | **326** | **3.28** | **0.010** |
|  | **1995** | **2002** | **0.249** | **0.051** | **326** | **4.92** | **<0.001** |
|  | **1995** | **2008** | **-0.167** | **0.048** | **343** | **-3.44** | **0.006** |
|  | 2000 | 2002 | 0.083 | 0.051 | 325 | 1.62 | 0.484 |
|  | **2000** | **2008** | **-0.332** | **0.049** | **344** | **-6.77** | **<0.001** |
|  | **2002** | **2008** | **-0.415** | **0.049** | **344** | **-8.46** | **<0.001** |
| COLK | **1982** | **1995** | **-0.325** | **0.056** | **329** | **-5.84** | **<0.001** |
|  | **1982** | **2000** | **-0.329** | **0.057** | **332** | **-5.82** | **<0.001** |
|  | 1982 | 2002 | -0.111 | 0.057 | 332 | -1.96 | 0.288 |
|  | **1982** | **2008** | **-0.312** | **0.052** | **346** | **-5.95** | **<0.001** |
|  | 1995 | 2000 | -0.004 | 0.065 | 331 | -0.06 | 1.000 |
|  | **1995** | **2002** | **0.214** | **0.065** | **331** | **3.29** | **0.010** |
|  | 1995 | 2008 | 0.013 | 0.061 | 341 | 0.21 | 1.000 |
|  | **2000** | **2002** | **0.218** | **0.066** | **329** | **3.32** | **0.009** |
|  | 2000 | 2008 | 0.017 | 0.062 | 344 | 0.27 | 0.999 |
|  | **2002** | **2008** | **-0.201** | **0.062** | **344** | **-3.23** | **0.012** |
| MIMY | 1982 | 1995 | -0.183 | 0.094 | 330 | -1.95 | 0.295 |
|  | 1982 | 2000 | -0.094 | 0.095 | 333 | -0.99 | 0.862 |
|  | 1982 | 2002 | -0.173 | 0.095 | 333 | -1.81 | 0.369 |
|  | 1982 | 2008 | 0.122 | 0.088 | 346 | 1.38 | 0.640 |
|  | 1995 | 2000 | 0.089 | 0.110 | 333 | 0.81 | 0.928 |
|  | 1995 | 2002 | 0.010 | 0.110 | 333 | 0.09 | 1.000 |
|  | **1995** | **2008** | **0.305** | **0.104** | **342** | **2.94** | **0.029** |
|  | 2000 | 2002 | -0.079 | 0.111 | 330 | -0.71 | 0.954 |
|  | 2000 | 2008 | 0.216 | 0.105 | 344 | 2.06 | 0.242 |
|  | **2002** | **2008** | **0.295** | **0.105** | **344** | **2.81** | **0.042** |
| RUFA | **1982** | **1995** | **-0.968** | **0.130** | **326** | **-7.47** | **<0.001** |
|  | **1982** | **2000** | **-1.099** | **0.132** | **328** | **-8.33** | **<0.001** |
|  | **1982** | **2002** | **-1.305** | **0.132** | **328** | **-9.90** | **<0.001** |
|  | **1982** | **2008** | **-1.084** | **0.124** | **350** | **-8.76** | **<0.001** |
|  | 1995 | 2000 | -0.130 | 0.152 | 328 | -0.86 | 0.912 |
|  | 1995 | 2002 | -0.337 | 0.152 | 328 | -2.22 | 0.174 |
|  | 1995 | 2008 | -0.116 | 0.145 | 344 | -0.80 | 0.931 |
|  | 2000 | 2002 | -0.207 | 0.153 | 326 | -1.35 | 0.659 |
|  | 2000 | 2008 | 0.014 | 0.147 | 345 | 0.10 | 1.000 |
|  | 2002 | 2008 | 0.221 | 0.147 | 345 | 1.51 | 0.557 |
| GOWE | 1982 | 1995 | -0.413 | 0.175 | 329 | -2.36 | 0.129 |
|  | 1982 | 2000 | 0.002 | 0.178 | 332 | 0.01 | 1.000 |
|  | 1982 | 2002 | -0.039 | 0.178 | 332 | -0.22 | 1.000 |
|  | **1982** | **2008** | **-0.832** | **0.166** | **349** | **-5.02** | **<0.001** |
|  | 1995 | 2000 | 0.415 | 0.205 | 331 | 2.03 | 0.256 |
|  | 1995 | 2002 | 0.374 | 0.205 | 331 | 1.83 | 0.360 |
|  | 1995 | 2008 | -0.419 | 0.194 | 343 | -2.16 | 0.199 |
|  | 2000 | 2002 | -0.041 | 0.207 | 329 | -0.20 | 1.000 |
|  | **2000** | **2008** | **-0.834** | **0.197** | **345** | **-4.23** | **<0.001** |
|  | **2002** | **2008** | **-0.793** | **0.197** | **345** | **-4.03** | **0.001** |
| BRWE | **1982** | **1995** | **-0.468** | **0.164** | **334** | **-2.85** | **0.037** |
|  | 1982 | 2000 | 0.084 | 0.167 | 337 | 0.50 | 0.987 |
|  | 1982 | 2002 | -0.095 | 0.167 | 337 | -0.57 | 0.979 |
|  | **1982** | **2008** | **-1.432** | **0.154** | **347** | **-9.29** | **<0.001** |
|  | **1995** | **2000** | **0.552** | **0.192** | **336** | **2.88** | **0.034** |
|  | 1995 | 2002 | 0.373 | 0.192 | 336 | 1.94 | 0.296 |
|  | **1995** | **2008** | **-0.964** | **0.181** | **343** | **-5.32** | **<0.001** |
|  | 2000 | 2002 | -0.179 | 0.194 | 334 | -0.92 | 0.888 |
|  | **2000** | **2008** | **-1.516** | **0.183** | **346** | **-8.27** | **<0.001** |
|  | **2002** | **2008** | **-1.337** | **0.183** | **346** | **-7.29** | **<0.001** |
| MIST | **1982** | **1995** | **-0.723** | **0.161** | **334** | **-4.50** | **<0.001** |
|  | **1982** | **2000** | **-0.897** | **0.163** | **337** | **-5.49** | **<0.001** |
|  | 1982 | 2002 | -0.406 | 0.163 | 337 | -2.48 | 0.097 |
|  | **1982** | **2008** | **-1.303** | **0.151** | **350** | **-8.60** | **<0.001** |
|  | 1995 | 2000 | -0.174 | 0.188 | 336 | -0.93 | 0.886 |
|  | 1995 | 2002 | 0.317 | 0.188 | 336 | 1.69 | 0.442 |
|  | **1995** | **2008** | **-0.580** | **0.178** | **346** | **-3.27** | **0.011** |
|  | 2000 | 2002 | 0.491 | 0.190 | 334 | 2.59 | 0.075 |
|  | 2000 | 2008 | -0.406 | 0.180 | 348 | -2.25 | 0.163 |
|  | **2002** | **2008** | **-0.897** | **0.180** | **348** | **-4.98** | **<0.001** |
|  |  |  |  |  |  |  |  |