|  |  |  |
| --- | --- | --- |
| Table S1: List of tree species used in this study, seed size, and native or introduced status. | | |
| Species | Seed mass (g) | Status |
| Aglaia marianensis | 0.62 | Native |
| Aidia cochichinensis | 0.0014 | Native |
| Eugenia palumbis | 0.40 | Native |
| Eugenia reinwardtiana | 0.55 | Native |
| Ficus prolixa | 0.00036 | Native |
| Ficus tinctoria | 0.00036 | Native |
| Meiogyne cylindrocarpa | 0.27 | Native |
| Melanolepis multiglandulosa | 0.031 | Native |
| Morinda citrifolia | 0.012 | Native |
| Carica papaya | 0.012 | Introduced |
| Pipturus argenteus | 0.00013 | Native |
| Premna serratifolia | 0.0093 | Native |
| Psychotria mariana | 0.025 | Native |
| Planchonella obovata | 0.039 | Native |
| Triphasia trifolia | 0.081 | Introduced |

|  |  |  |  |
| --- | --- | --- | --- |
| Table S2: Weight and gape width of wild-caught birds that were used in gut passage time trials. Gape width was not collected for Golden White-eye for birds in captivity but mean gape width of wild birds was 7.8 ± 0.8 mm (E. Rehm unpublished data). | | | |
| Species | Weight (g) | Gape width (mm) |
| Bridled White-eye | 8.1 | 5.4 |
| Bridled White-eye | 7.5 | 5.7 |
| Bridled White-eye | 6.2 | 5.2 |
| Golden White-eye | 18.4 | No data |
| Golden White-eye | 17.3 | No data |
| Golden White-eye | 21.8 | No data |
| Golden White-eye | 19.8 | No data |
| Mariana Fruit dove | 80.4 | 9.1 |
| Mariana Fruit dove | 72.2 | 9.5 |
| Mariana Fruit dove | 88.7 | 9.6 |
| Mariana Fruit dove | 81.1 | 10.1 |
| Mariana Fruit dove | 77.3 | 9.6 |
| Mariana Fruit dove | 84.7 | 9.5 |
| Micronesian Starling | 81.2 | 14.6 |
| Micronesian Starling | 78.8 | 15.8 |
| Micronesian Starling | 71.3 | 15.2 |
| Micronesian Starling | 76.7 | 15.9 |
| Micronesian Starling | 77.4 | 15.9 |
| White-throated Ground dove | 127.4 | 9.2 |
| White-throated Ground dove | 132.1 | 9.4 |

Table S3: The individual bird identifier, number of seeds passed and total number of gut passage trials conducted for each tree and bird species combination

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Tree Species | Bird Species | Individual | Number of seeds passed | Number of gut passage trials |
| Aglaia marianensis | Micronesian Starling | 1 | 136 | 2 |
| Aglaia marianensis | Micronesian Starling | 4 | 4 | 1 |
| Aglaia marianensis | Micronesian Starling | 5 | 8 | 1 |
| Aidia cochinchinensis | Bridled White-eye | 1 | 78 | 2 |
| Aidia cochinchinensis | Bridled White-eye | 2 | 269 | 7 |
| Aidia cochinchinensis | Bridled White-eye | 3 | 288 | 5 |
| Aidia cochinchinensis | Golden White-eye | 3 | 362 | 9 |
| Aidia cochinchinensis | Golden White-eye | 4 | 401 | 10 |
| Aidia cochinchinensis | Mariana Fruit Dove | 3 | 234 | 7 |
| Aidia cochinchinensis | Mariana Fruit Dove | 4 | 239 | 8 |
| Aidia cochinchinensis | Mariana Fruit Dove | 5 | 230 | 11 |
| Aidia cochinchinensis | Micronesian Starling | 1 | 133 | 5 |
| Aidia cochinchinensis | Micronesian Starling | 3 | 272 | 13 |
| Aidia cochinchinensis | Micronesian Starling | 5 | 580 | 15 |
| Carica papaya | Golden White-eye | 3 | 140 | 2 |
| Carica papaya | Golden White-eye | 4 | 92 | 2 |
| Carica papaya | Mariana Fruit Dove | 3 | 44 | 2 |
| Carica papaya | Mariana Fruit Dove | 4 | 208 | 2 |
| Carica papaya | Mariana Fruit Dove | 5 | 272 | 3 |
| Carica papaya | Mariana Fruit Dove | 6 | 304 | 2 |
| Carica papaya | Micronesian Starling | 3 | 4 | 1 |
| Eugenia palumbis | Mariana Fruit Dove | 4 | 80 | 2 |
| Eugenia palumbis | Mariana Fruit Dove | 5 | 60 | 2 |
| Eugenia palumbis | Mariana Fruit Dove | 6 | 80 | 2 |
| Eugenia palumbis | Micronesian Starling | 3 | 100 | 2 |
| Eugenia palumbis | Micronesian Starling | 5 | 68 | 1 |
| Eugenia reinwardtiana | Micronesian Starling | 3 | 128 | 2 |
| Ficus prolixa | Golden White-eye | 1 | 178 | 7 |
| Ficus prolixa | Golden White-eye | 2 | 210 | 7 |
| Ficus prolixa | Golden White-eye | 4 | 212 | 6 |
| Ficus prolixa | Mariana Fruit Dove | 2 | 7 | 2 |
| Ficus prolixa | Mariana Fruit Dove | 4 | 654 | 21 |
| Ficus prolixa | Mariana Fruit Dove | 5 | 96 | 5 |
| Ficus prolixa | Micronesian Starling | 3 | 275 | 10 |
| Ficus prolixa | Micronesian Starling | 5 | 418 | 11 |
| Ficus tinctoria | Golden White-eye | 1 | 246 | 5 |
| Ficus tinctoria | Golden White-eye | 2 | 134 | 5 |
| Ficus tinctoria | Golden White-eye | 3 | 379 | 7 |
| Ficus tinctoria | Mariana Fruit Dove | 3 | 384 | 13 |
| Ficus tinctoria | Mariana Fruit Dove | 4 | 193 | 8 |
| Ficus tinctoria | Micronesian Starling | 1 | 706 | 16 |
| Ficus tinctoria | Micronesian Starling | 5 | 299 | 8 |
| Ficus tinctoria | White-throated Ground Dove | 1 | 21 | 3 |
| Ficus tinctoria | White-throated Ground Dove | 2 | 18 | 2 |
| Meiogyne cylindrocarpa | Mariana Fruit Dove | 3 | 8 | 1 |
| Meiogyne cylindrocarpa | Micronesian Starling | 1 | 4 | 1 |
| Melanolepis multiglandulosa | Golden White-eye | 1 | 108 | 2 |
| Melanolepis multiglandulosa | Golden White-eye | 2 | 128 | 2 |
| Melanolepis multiglandulosa | Golden White-eye | 3 | 204 | 2 |
| Melanolepis multiglandulosa | Mariana Fruit Dove | 3 | 73 | 2 |
| Melanolepis multiglandulosa | Mariana Fruit Dove | 4 | 666 | 5 |
| Melanolepis multiglandulosa | Mariana Fruit Dove | 5 | 372 | 1 |
| Melanolepis multiglandulosa | Mariana Fruit Dove | 6 | 924 | 3 |
| Melanolepis multiglandulosa | Micronesian Starling | 3 | 277 | 3 |
| Melanolepis multiglandulosa | Micronesian Starling | 4 | 28 | 1 |
| Morinda citrifolia | Micronesian Starling | 1 | 214 | 3 |
| Morinda citrifolia | Micronesian Starling | 3 | 332 | 2 |
| Pipturus argenteus | Bridled White-eye | 2 | 93 | 5 |
| Pipturus argenteus | Bridled White-eye | 3 | 401 | 11 |
| Pipturus argenteus | Golden White-eye | 1 | 242 | 6 |
| Pipturus argenteus | Golden White-eye | 2 | 204 | 5 |
| Pipturus argenteus | Golden White-eye | 3 | 202 | 8 |
| Pipturus argenteus | Golden White-eye | 4 | 153 | 7 |
| Pipturus argenteus | Mariana Fruit Dove | 2 | 115 | 4 |
| Pipturus argenteus | Mariana Fruit Dove | 3 | 218 | 9 |
| Pipturus argenteus | Mariana Fruit Dove | 4 | 159 | 6 |
| Pipturus argenteus | Mariana Fruit Dove | 5 | 209 | 6 |
| Pipturus argenteus | Mariana Fruit Dove | 6 | 87 | 5 |
| Pipturus argenteus | Micronesian Starling | 1 | 83 | 5 |
| Pipturus argenteus | Micronesian Starling | 2 | 108 | 5 |
| Pipturus argenteus | Micronesian Starling | 3 | 270 | 7 |
| Pipturus argenteus | Micronesian Starling | 5 | 264 | 7 |
| Planchonella obovata | Golden White-eye | 2 | 232 | 2 |
| Planchonella obovata | Golden White-eye | 3 | 165 | 3 |
| Planchonella obovata | Mariana Fruit Dove | 4 | 240 | 3 |
| Planchonella obovata | Mariana Fruit Dove | 5 | 188 | 3 |
| Planchonella obovata | Micronesian Starling | 3 | 137 | 3 |
| Planchonella obovata | Micronesian Starling | 5 | 112 | 2 |
| Premna serratifolia | Golden White-eye | 3 | 92 | 2 |
| Premna serratifolia | Golden White-eye | 4 | 165 | 3 |
| Premna serratifolia | Mariana Fruit Dove | 2 | 597 | 4 |
| Premna serratifolia | Mariana Fruit Dove | 5 | 188 | 2 |
| Premna serratifolia | Mariana Fruit Dove | 6 | 500 | 3 |
| Premna serratifolia | Micronesian Starling | 3 | 369 | 3 |
| Premna serratifolia | Micronesian Starling | 4 | 80 | 2 |
| Premna serratifolia | Micronesian Starling | 5 | 40 | 1 |
| Psychotria mariana | Golden White-eye | 3 | 304 | 2 |
| Psychotria mariana | Golden White-eye | 4 | 52 | 2 |
| Psychotria mariana | Mariana Fruit Dove | 1 | 28 | 1 |
| Psychotria mariana | Mariana Fruit Dove | 3 | 408 | 3 |
| Psychotria mariana | Mariana Fruit Dove | 4 | 304 | 2 |
| Psychotria mariana | Mariana Fruit Dove | 5 | 304 | 2 |
| Psychotria mariana | Micronesian Starling | 1 | 128 | 2 |
| Psychotria mariana | Micronesian Starling | 3 | 260 | 2 |
| Triphasia trifolia | Mariana Fruit Dove | 4 | 220 | 2 |
| Triphasia trifolia | Mariana Fruit Dove | 5 | 196 | 2 |
| Triphasia trifolia | Mariana Fruit Dove | 6 | 221 | 3 |
| Triphasia trifolia | Micronesian Starling | 3 | 76 | 2 |
| Triphasia trifolia | Micronesian Starling | 4 | 88 | 2 |
| Triphasia trifolia | Micronesian Starling | 5 | 108 | 2 |

Table S4: Number of tracking sessions, start date of tracking, end date of tracking, and the number of days over which individuals were tracked for every individual of all species

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Species | Individual | Number of tracking sessions | Start Date | End Date | Number of days tracked |
| Bridled White-eye | 1 | 1 | 6/12/15 | 6/12/15 | 1 |
| Bridled White-eye | 2 | 1 | 7/15/15 | 7/15/15 | 1 |
| Bridled White-eye | 3 | 2 | 7/16/15 | 7/21/15 | 6 |
| Bridled White-eye | 4 | 5 | 10/12/15 | 10/28/15 | 17 |
| Bridled White-eye | 5 | 5 | 11/12/15 | 12/1/15 | 20 |
| Bridled White-eye | 6 | 5 | 11/30/15 | 12/16/15 | 17 |
| Bridled White-eye | 7 | 3 | 4/9/16 | 4/14/16 | 6 |
| Bridled White-eye | 8 | 6 | 4/11/16 | 4/25/16 | 15 |
| Bridled White-eye | 9 | 9 | 5/5/16 | 5/31/16 | 27 |
| Bridled White-eye | 10 | 5 | 5/5/16 | 5/16/16 | 12 |
| Golden White-eye | 1 | 7 | 6/2/16 | 7/1/16 | 30 |
| Golden White-eye | 2 | 8 | 6/2/16 | 7/11/16 | 40 |
| Golden White-eye | 3 | 5 | 6/23/16 | 7/8/16 | 16 |
| Golden White-eye | 4 | 4 | 6/23/16 | 7/8/16 | 16 |
| Golden White-eye | 5 | 7 | 7/13/16 | 8/8/16 | 27 |
| Golden White-eye | 6 | 3 | 7/21/16 | 7/25/16 | 5 |
| Golden White-eye | 7 | 1 | 7/21/16 | 7/21/16 | 1 |
| Golden White-eye | 8 | 3 | 7/22/16 | 7/27/16 | 6 |
| Golden White-eye | 9 | 7 | 8/9/16 | 9/6/16 | 29 |
| Golden White-eye | 10 | 2 | 9/9/16 | 9/13/16 | 5 |
| Golden White-eye | 11 | 8 | 9/9/16 | 10/6/16 | 28 |
| Golden White-eye | 12 | 7 | 9/12/16 | 10/6/16 | 25 |
| Golden White-eye | 13 | 7 | 9/12/16 | 10/5/16 | 24 |
| Golden White-eye | 14 | 5 | 9/26/16 | 10/7/16 | 12 |
| Mariana Fruit Dove | 1 | 4 | 5/29/15 | 9/16/15 | 111 |
| Mariana Fruit Dove | 2 | 1 | 6/23/15 | 6/23/15 | 1 |
| Mariana Fruit Dove | 3 | 2 | 9/21/15 | 10/7/15 | 17 |
| Mariana Fruit Dove | 4 | 7 | 9/23/15 | 12/4/15 | 73 |
| Mariana Fruit Dove | 5 | 2 | 10/5/15 | 10/23/15 | 19 |
| Mariana Fruit Dove | 6 | 7 | 11/13/15 | 12/22/15 | 40 |
| Mariana Fruit Dove | 7 | 9 | 3/9/16 | 6/15/16 | 99 |
| Mariana Fruit Dove | 8 | 8 | 3/10/16 | 5/26/16 | 78 |
| Mariana Fruit Dove | 9 | 9 | 3/11/16 | 7/6/16 | 118 |
| Mariana Fruit Dove | 10 | 9 | 5/19/16 | 8/26/16 | 100 |
| Mariana Fruit Dove | 11 | 9 | 7/8/16 | 10/7/16 | 92 |
| Mariana Fruit Dove | 12 | 9 | 7/29/16 | 9/30/16 | 64 |
| Micronesian Starling | 1 | 3 | 5/29/15 | 6/26/15 | 29 |
| Micronesian Starling | 2 | 2 | 6/24/15 | 6/30/15 | 7 |
| Micronesian Starling | 3 | 5 | 9/28/15 | 11/17/15 | 51 |
| Micronesian Starling | 4 | 4 | 10/2/15 | 11/17/15 | 47 |
| Micronesian Starling | 5 | 1 | 11/12/15 | 11/12/15 | 1 |
| Micronesian Starling | 6 | 4 | 12/3/15 | 12/17/15 | 15 |
| Micronesian Starling | 7 | 3 | 3/11/16 | 3/17/16 | 7 |
| Micronesian Starling | 8 | 5 | 3/23/16 | 4/4/16 | 13 |
| Micronesian Starling | 9 | 7 | 4/20/16 | 5/25/16 | 36 |
| Micronesian Starling | 10 | 3 | 4/20/16 | 4/26/16 | 7 |
| Micronesian Starling | 11 | 12 | 5/5/16 | 7/15/16 | 72 |
| Micronesian Starling | 12 | 10 | 6/30/16 | 9/27/16 | 90 |
| Micronesian Starling | 13 | 6 | 8/11/16 | 8/30/16 | 20 |
| Micronesian Starling | 14 | 8 | 8/11/16 | 10/5/16 | 56 |
| Micronesian Starling | 15 | 9 | 8/11/16 | 9/29/16 | 50 |
| White-throated Ground Dove | 1 | 2 | 6/23/15 | 6/29/15 | 7 |
| White-throated Ground Dove | 2 | 1 | 7/11/15 | 7/11/15 | 1 |
| White-throated Ground Dove | 3 | 1 | 9/21/15 | 9/21/15 | 1 |
| White-throated Ground Dove | 4 | 5 | 9/23/15 | 11/18/15 | 57 |
| White-throated Ground Dove | 5 | 5 | 10/2/15 | 11/2/15 | 32 |
| White-throated Ground Dove | 6 | 4 | 12/7/15 | 12/22/15 | 16 |
| White-throated Ground Dove | 7 | 2 | 3/30/16 | 4/1/16 | 3 |
| White-throated Ground Dove | 8 | 2 | 3/31/16 | 4/1/16 | 2 |
| White-throated Ground Dove | 9 | 12 | 4/12/16 | 7/14/16 | 94 |
| White-throated Ground Dove | 10 | 7 | 5/19/16 | 6/21/16 | 34 |

**Hierarchical Bayesian model of gut passage times**

We modeled mean log-transformed gut passage time (μtime,jbp) as a linear model with an intercept (β0) representing a reference species combination, effects of bird (βbird,b) and plant (βplant,p) species, their interaction (βinter,bp), and a bird individual effect (βindiv,jb):

log(timeijbp) ~ N(μtime,jbp, σ2time,bp)

μtime,jbp = β0 + βbird,b + βplant,p + βinter,bp + βindiv,jb

The bird, plant, and interaction terms (βbird,b, βplant,p, and βinter,bp, respectively) were each normally distributed around zero, with terms representing reference values set to zero.

βbird,b ~ Normal(0, σ2βbird)

βplant,p ~ Normal(0, σ2βplant)

βinter,bp ~ Normal(0, σ2βinter)

The bird individual effects were centered at zero with species-specific variance terms that were given folded-non-central-*t* priors following Gelman (2006).

βindivid,jb ~ Normal(0, σ2βindivid,b)

For each of the other standard deviation terms (σ), we used Uniform (0,10) priors. We ran three chains, sampling every 200 iterations for 20000 iterations following a 20000 iteration burn in. We determined that chains converged and mixed using visual inspection and Rhat values.

Hierarchical Bayesian model of gut passage times

We modeled observations of displacement (disp.obsijb) of bird individual *j* of bird species *b* from their position at the beginning of each tracking session. Error in measurement of was displacement was Rayleigh distributed based on beacon tests to determine displacement error. Expected dispersal distances over time were fit following a two parameter (γ1, γ2) asymptotic function.

disp.obsijb = disp.expijb + rijb

abs(rijb) ~ Rayleigh(σ)

disp.expijb = γ1jb \* t / (1 + γ1jb \* t / γ2jb)

The individual level γ1jb and γ2jb terms were gamma distributed with species-levels shape (α) and rate (β) parameters.

γ1jb ~ Gamma(α1b, β1b)

γ2jb ~ Gamma(α2b, β2b)

After reparameterizing the gamma distributions by mode and standard deviation, we used folded-non-central-t priors for the species level γ1b and γ2b mode and standard deviation (Gelman 2006), with Uniform(0, 100) hyperpriors for the global mode and sd of γ1b and Uniform(0, 2000) for the global mode and standard deviation of γ2b. We ran three chains, sampling every 100 iterations for 10000 iterations following a 10000 iteration burn in. We determined that chains converged and mixed using visual inspection and Rhat values.

References

Gelman A. 2006 Prior distributions for variance parameters in hierarchical models. *Bayesian Analysis* **1**, 515-533.