Supplementary material

Appendix S1. OpenBUGS code for estimating adult annual survival probabilities, reproduction rates (number of independent young per female per year), and finite rates of increase for North Island robins in a pine plantation and native forest fragments.

```
Model
{

    # REPRODUCTION

    # Priors for reproduction parameters
    a.f ~ dnorm(0, 1.0E-6)              # intercept for log(f), where f = juveniles/female
    b.pine.f ~ dnorm(0, 1.0E-6)         # effect of pine vs native on log(f)
    b.gr.f ~  dnorm(0, 1.0E-6)          # effect of grazing on log(f)
    s.site.f ~ dunif(0,100)             # sd among sites in log(f)
    tau.site.f <- pow(s.site.f,-2)      # convert to precision
    s.fem ~ dunif(0,100)                # sd among females in log(f)
    tau.fem <- pow(s.fem,-2)            # convert to precision
    s.year.f ~ dunif(0,100)             # sd among years in log(f)
    tau.year.f <- pow(s.year.f,-2)      # convert to precision

    # Random effects for reproduction parameters
    for (i in 1:n.year.f)  {
        re.year.f[i] ~ dnorm(0,tau.year.f)# assign random effect to each year
    }
    for (i in 1:n.site) {
        re.site.f[i] ~ dnorm(0,tau.site.f)  # assign random effect to each site
    }
    for (i in 1:n.fem){
        re.fem[i] ~ dnorm(0,tau.fem)     # assign random effect to each female
    }

    # Sampling reproduction observations (no. independent young produced by each fem. each year)
    for (i in 1:n.obs.f)                # for each reproduction observation...
    {
        juvs[i] ~ dpois(mu.f[i])        # sample observed no. juvs from Poisson based on expected no.
        log(mu.f[i]) <- fixed.f[i]+random.f[i] # calculate expected number
        fixed.f[i] <- a.f+b.pine.f*pine[site.f[i]]+b.gr.f*gr[site.f[i]]
        random.f[i] <-re.year.f[year.f[i]]+re.site.f[site.f[i]]+re.fem[fem[i]]
    }

    # ADULT SURVIVAL

    # Adult survival and re-sighting priors
    a.phi ~ dnorm(0, 0.001)             # intercept for logit(sa), where sa = adult surv prob over 4 mo.
    b.pine.phi ~ dnorm(0, 0.001)        # effect of being in pine on on logit(sa)
    b.pine.sex.phi ~ dnorm(0, 0.001)    # interaction between pine and sex effect
    b.sj.phi ~ dnorm(0, 0.001)          # effect of season (Sep-Jan) on logit(sa)
    b.jm.phi ~ dnorm(0, 0.001)          # effect of season (Jan-Sep) on logit(sa)
    b.sex.sm.phi ~ dnorm(0, 0.001)      # effect of sex on on logit(sa) over breed.intervals (Sep-May)
    s.year.phi ~ dunif(0, 10)           # sd among years in logit(sa)
    tau.year.phi <- pow(s.year.phi, -2) # convert to precision
    s.site.phi ~ dunif(0, 100)          # sd among sites in logit(sa)
    tau.site.phi <- pow(s.site.phi, -2) # convert to precision
    a.p ~ dnorm(0, 0.001)               # mean logit (p), where p = re-sighting probability
    s.t.p ~ dunif(0, 10)                # sd among surveys in logit(p)
    tau.t.p <- pow(s.t.p, -2)           # convert to precision
```

```
# Random year effect for adult survival
for (j in 1:n.year.s) {
        re.year.phi[j] ~ dnorm(0, tau.year.phi)   # assign random time effect on survival probability
}
# Random survey effect for re-sighting
for (j in 1:n.surveys)    {
        re.t.p[j] ~ dnorm(0, tau.t.p)                # assign random time effect on re-sighting probability
}
# Random fragment effects for adult survival
for (k in 1:n.site)    {
        re.site.phi[k] ~ dnorm(0, tau.site.phi)    # assign random site effect
}
# Sampling encounter history for adult survival
for (i in 1:n.ind)          # for each individual (row)...
{
    alive[i, first[i]] <- 1                    # 1 = alive the first time observed as settled adult
    for (j in first[i]+1:n.surveys)            # for each subsequent survey....
    {
        # observation equation
        seen[i, j] ~ dbern(psight[i, j])     # whether individual was seen is sampled from Bernoulli
        psight[i, j] <- p[i,j]*alive[i, j]      # prob of being seen = re-sighting prob x whether it was alive
        logit(p[i,j]) <- a.p+re.t.p[j]      # re-sighting prob calculated for that survey

        # state equation
        alive[i, j] ~ dbern(palive[i, j])  # whether individual was alive is sampled from Bernoulli
        palive[i, j] <- phi.int[i, j]*alive[i, j-1] # prob alive = survival prob x whether alive last survey
        phi.int[i,j] <- pow(phi[i,j],int[j-1]) # adjust for interval length
        logit(phi[i, j]) <- fixed.phi[i,j]+random.phi[i,j] # calculate annual survival prob based
        fixed.phi[i,j] <- a.phi+b.sj.phi*sj[j-1]+b.jm.phi*jm[j-1]+b.sex.sm.phi*sex[i]*(1-ms[j-
        1])+b.pine.phi*pine[site.s[i]]+b.pine.sex.phi*pine[site.s[i]]*sex[i]*(1-ms[j-1])
        random.phi[i,j] <- re.year.phi[year[j-1]]+re.site.phi[site.s[i]]
    }
}

# JUVENILE SURVIVAL
logit.sjuv30 ~ dnorm(logit.sjuv30.mean, logit.sjuv30.tau)
logit.sjuv30.tau <- pow(logit.sjuv30.sd,-2)
logit(sjuv30) <- cut(logit.sjuv30)

# CALCULATING DERIVED PARAMETERS

log(mu.fenced) <- a.f           # mean reproduction rate in fenced native fragments
log(mu.grazed) <- a.f+b.gr.f  # mean reproduction rate in grazed native fragments
log(mu.pine) <- a.f+b.pine.f  # mean reproduction rate in pine plantation

logit(s.fem.sj.native) <- a.phi+b.sj.phi # prob female survives Sep-Jan native
logit(s.fem.jm.native) <- a.phi+b.jm.phi # prob female survives Jan-May native
logit(s.ms.native) <- a.phi                          # prob female survives May-Sep native
s.fem.annual.native <- s.fem.sj.native*s.fem.jm.native*s.ms.nativec

logit(s.fem.sj.pine) <- a.phi+b.pine.phi+b.sj.phi # prob female survives Sep-Jan pines
logit(s.fem.jm.pine) <- a.phi+b.pine.phi+b.jm.phi # prob female survives Jan-May pines
logit(s.ms.pine) <- a.phi+b.pine.phi # prob female survives May-Sep pines
s.fem.annual.pine <- s.fem.sj.pine*s.fem.jm.pine*s.ms.pine # mean annual female survival pines

# Prob of juvenile surviving to adulthood
s.juv.native <- sjuv30*pow(s.fem.jm.native,3/4)*s.ms.native     # juvenile survival native
s.juv.pine <- sjuv30*pow(s.fem.jm.pine,3/4)*s.ms.pine# juvenile survival pines
# Note: assumes 8 mo. from independence to adulthood, with first 30d at juvenile survival rate

# Finite rate of increase (lambda)
lambda.fenced <- s.fem.annual.native+0.5*mu.fenced*s.juv.native
lambda.grazed <- s.fem.annual.native+0.5*mu.grazed*s.juv.native
lambda.pine <- s.fem.annual.pine+0.5*mu.pine*s.juv.pine
```

```
    for (i in 1:n.site) {    # for each site calculate...

        # Site-specific estimates of reproduction rate (Fig. 2)
        log(mu[i]) <- a.f+b.pine.f*pine[i]+b.gr.f*gr[i]+re.site.f[i] # mean reproduction rate

        # Site-specific estimates of annual adult female survival probability (Fig. 2)
        logit(s.fem.sj[i]) <- a.phi+b.pine.phi*pine[i]+re.site.phi[i]+b.sj.phi # prob female survives Sep-Jan
        logit(s.fem.jm[i]) <- a.phi+b.pine.phi*pine[i]+re.site.phi[i]+b.jm.phi # prob fem. survives Jan-May
        logit(s.ms[i]) <- a.phi+b.pine.phi*pine[i]+re.site.phi[i] # prob female survives May-Sep
        s.fem.annual[i] <- s.fem.sj[i]*s.fem.jm[i]*s.ms[i] # prob female survives the whole year

        # Prob of juvenile surviving to adulthood
        s.juv[i] <- sjuv30*pow(s.fem.jm[i],3/4)*s.ms[i]
        # Note: assumes 8 mo. from independence to adulthood, with first 30d at juvenile survival rate

        # Site-specific estimates of finite rate of increase (Fig. 2)
        lambda[i] <- s.fem.annual[i]+0.5*mu[i]*s.juv[i]

    }

}
```

Appendix S2. OpenBUGS code for estimating nest survival probabilities for North Island robins in a pine plantation and native forest fragments.

```
Model
{

    # Priors
    a ~ dnorm(3, 2)                 # intercept for logit(DSR), where DSR = daily survival probability
    b.pine ~ dnorm(0, 1)            # effect of pine vs native on logit(DSR)
    b.gr ~  dnorm(0, 1)             # effect of grazing on logit(DSR)
    s.site ~ dunif(0,1)             # sd among sites
    tau.site <- pow(s.site,-2)      # convert to precision
    s.fem ~ dunif(0,1)              # sd among females
    tau.fem <- pow(s.fem,-2)        # convert to precision
    s.year ~ dunif(0,1)             # sd among years
    tau.year <- pow(s.year,-2)      # convert to precision

    # Random effects
    for (i in 1:n.year)    {
        re.year[i] ~ dnorm(0,tau.year)    # assign random effect to each year
    }
    for (i in 1:n.site) {
        re.site[i] ~ dnorm(0,tau.site)    # assign random effect to each site
    }
    for (i in 1:n.fem){
        re.fem[i] ~ dnorm(0,tau.fem)      # assign random effect to each female
    }

    # Sample nest success data
    for (i in 1:n.nests)  {                # for each nest...
        p.succ[i] <- pow(p.day[i],last.alive[i]-first[i]) # calculate pr. surviving interval observed active
        succ[i] ~ dbern(p.succ[i])                        # model success
        p.fail[i] <- 1-pow(p.day[i],last.check[i]-last.alive[i]) # calculate pr. failure over interval when failed
        fail[i] ~ dbern(p.fail[i])                        # model failure
        logit(p.day[i]) <- fixed[i]+random[i]             # calculate daily nest survival probability
        fixed[i] <- a+b.pine*pine[site[i]]+b.gr*gr[site[i]]
        random[i] <- re.year[year[i]]+re.site[site[i]]+re.fem[fem[i]]
    }

    # CALCULATING DERIVED PARAMETERS

    # Average nest survival rates for fenced, grazed, and pines (quoted in text)
    logit(p.day.site.fenced) <- a
    logit(p.day.site.grazed) <- a+b.gr
    logit(p.day.site.pine) <- a+b.pine
    p.40.site.fenced <- pow(p.day.site.fenced,40)
    p.40.site.grazed <- pow(p.day.site.grazed,40)
    p.40.site.pine <- pow(p.day.site.pine,40)

    for (i in 1:n.site) {   # for each site calculate...

        # Fragment-specific nest survival rates shown in Fig. 3
        logit(p.day.site[i]) <- a+b.pine*pine[i]+b.gr*gr[i]+re.site[i]
        p.40.site[i] <- pow(p.day.site[i],40)
    }

}
```

Appendix S3. OpenBUGS code for estimating rat tracking rates (probability that at least one rat passes through a baited tracking tunnel in 24 h) in a pine plantation and native forest fragments.

```
Model
{

    # Priors
    a ~ dnorm(0, 1.0E-6)                # intercept logit(p), where p = prob of tunnel being tracked
    b.pine ~ dnorm(0, 1.0E-6)           # effect of pine vs native on logit(p)
    b.gr ~ dnorm(0, 1.0E-6)             # effect of grazing on logit(p)
    s.grid ~ dunif(0,100)               # sd among grids in logit(p)
    tau.grid <- pow(s.grid,-2)          # convert to precision
    s.tun ~ dunif(0,100)                # sd among individual tracking tunnel sites
    tau.tun <- pow(s.tun,-2)            # convert to precision
    s.year ~ dunif(0,100)               # sd among years
    tau.year <- pow(s.year,-2)          # convert to precision
    s.time ~ dunif(0,100)               # sd among sampling occasions
    tau.time <- pow(s.time,-2)          # convert to precision

    # Assigning random effects
    for (i in 1:n.grid) {
        re.grid[i] ~ dnorm(0,tau.grid)      # grid effect on logit(p)
    }
    for (i in 1:n.tun) {
        re.tun[i] ~ dnorm(0,tau.tun)        # individual tunnel effect
    }
    for (i in 1:n.time) {
        re.time[i] ~ dnorm(0,tau.time)      # time effect (sampling occasion)
    }
    for (i in 1:n.year) {
        re.year[i] ~ dnorm(0,tau.year)      # year effect
    }

    # Sampling tracking data (either rat tracks or mouse tracks)
    for (i in 1:n.obs) {        # for each individual tracking tunnel on each sampling occasion...
        x[i] ~ dbern(p[i])      # whether tunnel was tracked is sampled from Bernoulli distribution
        logit(p[i]) <- fixed[i]+random[i] # calculate probability of it being tracked
        fixed[i] <- a+b.pine*pine[grid[i]]+b.gr*gr[grid[i]]
        random[i] <- re.grid[grid[i]]+re.tun[tun[i]]+re.year[year[i]]+re.time[time[i]]
    }

    # Calculating derived parameters
    for (i in 1:n.grid) {   # for each grid, calculate...
        logit(p.grid[i]) <- a+b.pine*pine[i]+b.gr*gr[i]+re.grid[i]          # mean tracking probability
    }

}
```

Appendix S4. Data used to estimate adult annual survival probabilities, reproduction rates (number of independent young per female per year), and finite rates of increase for North Island robins in a pine plantation and native forest fragments.

```
list(

n.site=23,        # no. sites, including 20 native fragments and 3 pine sites
# 1 Dennis, 2 DizzyG, 3 FattyG, 4 Flag, 5 Herekawe, 6 Jacks, 7 LTutu, 8 Lucky, 9 Mangapehi, 10 Mruhe1, 11 Mruhe2, 12 Skinny, 13 T38, 14 T74, 15 T91, 16 Teds, 17 TeHapeIti, 18 TeHapeNui, 19 TeHapeToru, 20 Tutu, 21 Longden Rd, 22 Moloney Rd, 23 Stub Rd

# whether each site is native or pine
pine=c(0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1),

# whether each fragment grazed by livestock (1=yes, 0=no)
gr=c(0, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0),

# REPRODUCTION DATA

n.year.f=9, # no. years of reproduction data

n.obs.f=274, # no. reproduction observations

n.fem=167, # no. individual females in reproduction data set

# year corresponding to each reproduction observation (2002/03 - 2010/11)
year.f=c(1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2,
2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4,
4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5, 5,
6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 7,
7, 7, 7, 7, 7, 7, 7, 7, 7, 7, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 8, 9, 9, 9, 9, 9, 9, 9, 9, 9, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3),

# female corresponding to each reproduction observation
fem=c(31, 1, 10, 37, 45, 114, 25, 27, 39, 49, 123, 13, 2, 136, 18, 66, 119, 127, 19, 36, 20, 105, 112, 21, 113, 40, 137, 31, 145, 1, 3, 14, 37,
138, 148, 27, 39, 47, 49, 116, 117, 124, 13, 48, 107, 18, 38, 66, 119, 147, 106, 129, 20, 105, 108, 115, 4, 32, 113, 40, 137, 134, 1, 3, 30, 37,
42, 138, 146, 43, 47, 49, 109, 124, 13, 29, 48, 107, 8, 110, 119, 130, 63, 106, 129, 20, 35, 111, 115, 4, 32, 40, 137, 134, 139, 143, 5, 65, 142,
7, 62, 141, 13, 29, 48, 69, 28, 64, 74, 73, 85, 26, 68, 129, 20, 35, 101, 102, 22, 95, 4, 32, 70, 15, 40, 126, 23, 103, 134, 50, 139, 44, 65, 104,
122, 141, 126, 46, 56, 60, 13, 48, 69, 71, 17, 51, 85, 26, 63, 68, 75, 129, 20, 35, 76, 77, 121, 125, 16, 4, 32, 78, 79, 80, 133, 15, 134, 81, 131,
58, 140, 44, 65, 61, 122, 141, 24, 126, 46, 56, 6, 69, 17, 22, 82, 83, 12, 57, 128, 26, 68, 75, 20, 35, 77, 87, 88, 125, 67, 16, 84, 4, 32, 59, 86,
80, 15, 33, 89, 134, 90, 120, 53, 141, 34, 46, 69, 91, 17, 82, 83, 92, 57, 72, 26, 68, 9, 35, 55, 88, 93, 125, 94, 90, 41, 46, 52, 135, 57, 9, 96, 97,
98, 99, 100, 118, 54, 58, 11, 56, 135, 69, 132, 57, 144, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165,
166, 167),

# site corresponding to each reproduction observation
site.f=c(1, 5, 5, 5, 5, 5, 9, 9, 9, 9, 9, 10, 11, 11, 13, 13, 13, 13, 14, 14, 15, 15, 15, 18, 18, 20, 20, 1, 1, 5, 5, 5, 5, 5, 5, 9, 9, 9, 9, 9, 9, 9, 10, 10,
11, 13, 13, 13, 13, 13, 14, 14, 15, 15, 15, 15, 18, 18, 18, 20, 20, 1, 5, 5, 5, 5, 5, 5, 7, 9, 9, 9, 9, 9, 10, 10, 10, 11, 13, 13, 13, 13, 14, 14, 14, 15,
15, 15, 15, 18, 18, 20, 20, 1, 2, 3, 4, 4, 4, 6, 6, 6, 10, 10, 10, 10, 11, 11, 11, 12, 12, 14, 14, 14, 15, 15, 15, 15, 16, 17, 18, 18, 18, 20, 20, 20, 1,
1, 1, 2, 2, 4, 4, 6, 6, 6, 7, 8, 8, 8, 10, 10, 10, 10, 11, 11, 12, 14, 14, 14, 14, 14, 15, 15, 15, 15, 15, 15, 17, 18, 18, 18, 19, 19, 19, 20, 1, 2, 2, 3, 3,
4, 4, 6, 6, 6, 7, 7, 8, 8, 10, 10, 11, 11, 11, 11, 12, 12, 12, 14, 14, 14, 15, 15, 15, 15, 15, 15, 16, 17, 17, 18, 18, 18, 18, 19, 20, 1, 1, 1, 2, 2, 6, 6,
8, 8, 10, 10, 11, 11, 11, 11, 12, 12, 14, 14, 15, 15, 15, 15, 15, 15, 18, 2, 8, 8, 8, 8, 12, 15, 15, 15, 15, 15, 15, 15, 2, 3, 8, 8, 8, 10, 11, 12, 12, 21,
21, 21, 21, 21, 21, 21, 22, 22, 22, 22, 22, 22, 23, 23, 23, 23, 23, 23),

# reproduction observations (no. independent young produced by each female each year)
juvs=c(0, 1, 2, 1, 1, 0, 0, 1, 1, 2, 0, 0, 0, 3, 2, 1, 3, 0, 1, 0, 4, 0, 0, 1, 2, 2, 0, 0, 0, 2, 0, 1, 1, 1, 2, 0, 0, 0, 2, 2, 0, 1, 0, 2, 1, 1, 0, 2, 2, 2, 0, 0, 2,
1, 0, 1, 2, 2, 1, 2, 0, 3, 0, 0, 2, 0, 0, 2, 0, 0, 3, 2, 0, 1, 2, 3, 1, 0, 0, 2, 2, 1, 2, 1, 2, 2, 3, 0, 2, 3, 2, 4, 2, 3, 2, 1, 3, 2, 4, 5, 1, 2, 2, 0, 2, 2, 2, 1, 0, 4,
3, 1, 0, 2, 7, 2, 2, 2, 3, 0, 3, 4, 2, 0, 1, 0, 0, 0, 2, 0, 0, 2, 3, 0, 4, 1, 2, 0, 2, 0, 2, 2, 2, 0, 2, 2, 2, 0, 0, 0, 0, 1, 0, 0, 2, 1, 3, 2, 1, 0, 2, 0, 2, 0, 0, 1,
0, 0, 2, 4, 0, 2, 0, 2, 0, 0, 0, 0, 2, 0, 1, 1, 4, 1, 0, 0, 2, 0, 3, 2, 2, 1, 2, 0, 5, 3, 2, 0, 1, 0, 3, 0, 2, 0, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 3, 0,
0, 0, 2, 2, 3, 0, 0, 0, 0, 0, 0, 0, 0, 2, 2, 2, 2, 0, 0, 0, 0, 0, 4, 0, 1, 0, 2, 0, 3, 2, 4, 0, 0, 0, 0, 0, 0, 0, 1, 0, 2, 0, 0, 3, 0, 0, 0, 0, 1, 2),

# ADULT SURVIVAL DATA

n.year.s=12,

n.ind=351, # no. rows in adult survival encounter history (330 individuals but some have > 1 row)

n.surveys=42, # no. surveys from Sep 2002 - Sep 2014

# time intervals between surveys, in years
int=c(1, 1, 1, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 0.5, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1),

# year of survey (1 = Sep02-Sep03,  2 = Sep03-Sep04,  .... 12 = Sep13-Sep14)
year=c(1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 4, 4, 4, 5, 5, 5, 6, 6, 6, 7, 7, 7, 8, 8, 8, 9, 9, 9, 10, 10, 10, 11, 11, 11, 12, 12, 12),
```

```
# seasons for each interval in encounter history (Sep-Jan, Jan-May, May-Sep)
sj=c(1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0),
jm=c(0, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0),
ms=c(0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1),

# first survey each individual is encountered
first=c(18, 1, 1, 24, 15, 19, 24, 18, 4, 12, 4, 21, 4, 15, 33, 18, 31, 18, 24, 25, 21, 24, 16, 34, 22, 27, 31, 34, 22, 27, 15, 18, 27, 22, 27, 15, 15,
18, 18, 27, 18, 17, 16, 15, 16, 16, 15, 15, 19, 1, 6, 1, 1, 6, 4, 10, 1, 10, 1, 1, 1, 1, 10, 1, 2, 1, 4, 6, 10, 1, 1, 1, 1, 1, 4, 4, 4, 2, 4, 15, 19, 15, 15,
18, 30, 31, 30, 30, 25, 25, 24, 21, 16, 15, 18, 30, 15, 30, 22, 18, 27, 27, 23, 27, 18, 10, 10, 31, 24, 22, 19, 28, 27, 18, 27, 27, 23, 18, 26, 21, 25,
28, 6, 2, 1, 1, 1, 1, 1, 1, 1, 1, 12, 8, 2, 10, 1, 4, 10, 2, 1, 1, 1, 10, 1, 21, 18, 15, 1, 1, 18, 1, 10, 24, 24, 4, 4, 15, 15, 18, 4, 1, 21, 19, 21, 21, 16, 1,
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2, 4, 10, 4, 18, 18, 2, 18, 1, 25, 1, 4, 16, 10, 16, 4, 1, 18, 19, 17, 6, 2, 18, 18, 17, 18, 2, 18, 6, 18, 24, 12, 1, 21, 25, 15, 27, 18, 4, 2, 21, 22, 1, 6,
16, 24, 15, 27, 27, 24, 15, 21, 24, 21, 24, 33, 18, 27, 24, 18, 4, 2, 15, 6, 1, 1, 27, 12, 22, 21, 15, 19, 2, 18, 26, 33, 33, 33, 18, 33, 18, 18, 1, 15,
1, 15, 27, 1, 16, 27, 1, 15, 1, 4, 10, 5, 5, 7, 6, 7, 11, 6, 7, 8, 7, 7, 8, 10, 7, 10, 10, 6, 6, 10, 5, 7, 6, 10, 8, 10, 10, 6, 7, 10, 7, 10, 7, 5, 13, 6, 5, 5,
6, 6, 7, 10, 10, 6, 11, 7),

# sex of each individual in encounter history (1=male, 0=female)
sex=c(0, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1,
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1, 0, 1, 1, 1, 1, 1, 1, 0, 0, 1, 1),

# site for each individual in encounter history
site.s=c(1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 3, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 4, 5, 5, 5, 5,
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23, 23),

# encounter history (whether each individual seen on each survey)
# rows = individuals, columns = surveys
seen=structure(.Data = c(
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),.Dim = c(351, 42)),

# JUVENILE SURVIVAL
# prob juv survives to 30d estimated to be 0.87 with sd 0.04 (Armstrong et al. 2014)
logit.sjuv30.mean=1.965,logit.sjuv30.sd=0.3883)
```

Appendix S5. Data for estimating nest survival probabilities for North Island robins in a pine plantation and native forest fragments.

```
list(

n.site=23,        # no. sites, including 20 native fragments and 3 pine sites
# 1 Dennis, 2 DizzyG, 3 FattyG, 4 Flag, 5 Herekawe, 6 Jacks, 7 LTutu, 8 Lucky, 9 Mangapehi, 10 Mruhe1, 11 Mruhe2, 12 Skinny, 13 T38, 14 T74, 15 T91, 16 Teds, 17 TeHapelti, 18 TeHapeNui, 19 TeHapeToru, 20 Tutu, 21 Longden Rd, 22 Moloney Rd, 23 Stub Rd

# whether each site is native or pine
pine=c(0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,1,1),

# whether each fragment grazed by livestock (1=yes, 0=no)
gr=c(0,1,1,1,0,0,0,1,0,0,0,0,0,1,0,0,1,0,1,0,0,0,0),

# NEST SUCCESS DATA

n.year=9,         # no. years of nest success data

n.nests=638,      # no. nests

n.fem=163,        # no. individual females in nests success data set

# year corresponding to each nest (2002/03 - 2010/11)
year=c(1, 1, 2, 7, 7, 7, 5, 7, 3, 3, 4, 4, 4, 4, 5, 5, 6, 6, 6, 7, 7, 2, 2, 5, 5, 5, 5, 9, 9, 7, 8, 8, 6, 4, 4, 4, 5, 5, 6, 6, 6, 9, 9, 6, 6, 4, 4, 4, 4, 4, 5, 5, 5,
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# female corresponding to each nest
fem=c(30, 30, 30, 32, 32, 32, 92, 106, 131, 131, 131, 131, 131, 131, 131, 131, 131, 131, 131, 132, 132, 143, 143, 49, 49, 49, 49, 53, 53, 107,
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day that nest last checked

last.check=c(17, 8, 16, 38, 80, 180, 66, 38, 40, 40, 26, 47, 93, 153, 69, 146, 39, 89, 146, 42, 130, 19, 40, 58, 95, 131, 159, 63, 135, 110, 43, 66, 41, 62, 121, 167, 39, 86, 66, 90, 136, 70, 104, 55, 152, 24, 62, 136, 26, 76, 24, 69, 120, 168, 70, 125, 159, 124, 56, 105, 145, 56, 120, 24, 64, 88, 134, 71, 128, 40, 40, 40, 20, 19, 16, 8, 28, 13, 40, 40, 40, 24, 37, 35, 22, 20, 14, 8, 9, 40, 29, 18, 40, 40, 19, 16, 40, 40, 96, 139, 89, 139, 42, 96, 36, 42, 81, 27, 56, 100, 153, 43, 104, 175, 38, 96, 133, 180, 48, 69, 104, 153, 96, 141, 58, 114, 32, 41, 96, 158, 41, 98, 119, 156, 14, 11, 64, 113, 155, 37, 52, 56, 99, 133, 50, 105, 134, 136, 65, 59, 65, 99, 49, 120, 48, 95, 150, 78, 42, 59, 65, 113, 64, 113, 37, 9, 40, 24, 29, 19, 13, 40, 16, 9, 31, 40, 38, 30, 40, 4, 40, 40, 40, 40, 15, 40, 28, 36, 40, 19, 19, 35, 12, 36, 8, 18, 40, 40, 14, 40, 40, 55, 66, 121, 143, 3, 8, 24, 19, 30, 26, 19, 40, 62, 109, 56, 118, 168, 40, 40, 40, 42, 81, 40, 40, 40, 40, 42, 76, 120, 41, 103, 153, 48, 97, 48, 92, 53, 126, 168, 46, 101, 144, 49, 94, 107, 66, 118, 147, 80, 14, 33, 75, 119, 82, 93, 143, 168, 47, 96, 151, 45, 87, 42, 65, 105, 63, 21, 33, 40, 20, 18, 19, 49, 59, 107, 38, 72, 119, 75, 121, 30, 80, 131, 43, 79, 103, 131, 162, 38, 105, 176, 40, 87, 61, 112, 150, 67, 128, 176, 55, 109, 50, 101, 141, 39, 62, 133, 57, 48, 103, 159, 40, 66, 70, 127, 38, 40, 40, 40, 6, 19, 34, 30, 57, 113, 150, 90, 135, 45, 58, 90, 137, 40, 40, 40, 40, 24, 40, 48, 68, 86, 121, 48, 106, 40, 40, 40, 40, 25, 3, 26, 40, 10, 38, 37, 40, 40, 11, 40, 64, 89, 134, 25, 70, 91, 133, 49, 116, 154, 10, 40, 40, 35, 82, 30, 46, 90, 106, 121, 68, 107, 68, 141, 45, 93, 39, 16, 36, 40, 49, 87, 154, 40, 18, 30, 40, 40, 12, 39, 66, 115, 151, 65, 116, 58, 100, 40, 15, 40, 40, 40, 38, 39, 46, 102, 143, 50, 72, 110, 54, 114, 40, 40, 38, 64, 116, 168, 44, 83, 110, 135, 153, 68, 114, 170, 53, 110, 162, 53, 113, 10, 25, 40, 11, 9, 20, 40, 40, 34, 40, 40, 36, 38, 77, 40, 102, 37, 57, 127, 81, 161, 49, 151, 40, 65, 53, 66, 58, 66, 133, 58, 32, 58, 66, 100, 49, 63, 120, 165, 91, 154, 40, 60, 48, 101, 133, 30, 77, 111, 48, 111, 140, 155, 61, 128, 45, 59, 37, 18, 40, 6, 40, 32, 53, 106, 139, 149, 54, 92, 129, 169, 59, 105, 144, 17, 40, 16, 19, 40, 19, 40, 22, 82, 143, 54, 65, 103, 139, 61, 138, 172, 48, 87, 144, 29, 99, 162, 40, 40, 27, 75, 79, 47, 54, 118, 54, 101, 149, 28, 119, 34, 67, 109, 151, 41, 57, 99, 146, 173, 73, 119, 165, 6, 40, 15, 11, 31, 40, 40, 40, 40, 167, 41, 60, 97, 19, 33, 39, 31, 40, 40, 21, 40, 45, 97, 109, 163, 20, 97, 132, 35, 57, 74, 100, 132, 166, 126, 125, 103, 20, 55, 97, 125, 166, 52, 100, 71, 97, 124, 59, 77, 144, 57, 113, 137, 53, 85, 124, 137, 37, 59, 106, 126, 68, 86, 138, 40, 86, 108, 159, 108, 57, 148, 55, 94, 127, 159)

this refers to the interval over which the nest survived, and is "1" for all observations

succ=c(1, 1),

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# whether the nest was observed to fail or not
fail=c(1, 1, 1, 1, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 1, 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1,
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1, 1, 1, 1, 1, 1, 1, 1, 0, 1, 0, 1, 1, 1)

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Appendix 6. Data for estimating rat tracking rates (probability that at least one rat passes through a baited tracking tunnel in 24 h) in a pine plantation and native forest fragments.

list(

n.obs=5507, # no. individual tracking observations
n.grid=23, # no. tracking grids
# 1 Dennis, 2 DizzyG, 3 FattyG, 4 Flag, 5 Herekawe, 6 Jacks, 7 LTutu, 8 Lucky, 9 Mangapehi, 10 Mruhe1, 11 Mruhe2, 12 Skinny, 13 T38, 14 T74, 15 T91, 16 Teds, 17 TeHapelti, 18 TeHapeNui, 19 TeHapeToru, 20 Tutu, 21 Longden Rd, 22 Moloney Rd, 23 Stub Rd

n.tun=320, # no. individual tracking tunnel sites
n.year=10, # no. years (2002/03-2011/12)
n.time=36, # no. sampling occasions

# whether each site is native or pine
pine=c(0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1),

# whether each fragment grazed by livestock (1=yes, 0=no)
gr=c(0, 1, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0),

# grid corresponding to each tracking observation
grid=c(1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
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rat tracking observations; whether each tunnel tracked by a rat (1) or not (0) on each sampling occasion

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