Test of garden hunting hypothesis for mammals in La Gran Sabana, Venezuela using occupancy models

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Methods

Model definition

Covariates of probability of detection

dras: distance to animal tracks and trails

sfrz: sampling effort (nr. of days camera was active)

date: date of sampling

Covariates of probability of occupancy - frecuency of use

buf.fragmen: 1 km buffer of forest cover derived from LandSat time series (Hansen et al. 2013)

dcon: distance to nearest conuco

Results

Goodness of fit

MacKenzie and Bailey Goodness-of-fit Test for Royle-Nichols Occupancy Models.

Symptoms of lack of fit for most species: Five models with extreme p-value or c-hat values, 18 models with large coeficients or standard errors.

```
##
##         FALSE TRUE
##   FALSE     8   16
##   TRUE      2    3
```

These species show one or more signs of lack of fit, probably due to the low number of detections:

```
##             spp n.detect chi.square p.value c.hat.est large.coefs   large.SE
## 1   C.unicinctus        2  295.66416  0.0098 8.8945594    7.071380  5.0081054
## 2 H.hydrochaeris        2   16.68571  0.0432 5.2421961    3.842652  2.9204259
## 3  O.virginianus        4   64.51162  0.0412 5.3132298   44.046622 25.7977704
## 4       P.tajacu        2   45.69512  0.0319 6.7631083   66.723836 87.1356459
## 5        T.major       18  379.96563  0.8813 0.2182564    1.695395  0.9525662
```

These species appear to have a good fit but might have problems with large coeficients and standard errors

```
##            spp n.detect  chi.square p.value c.hat.est large.coefs  large.SE
## 1   M.americana       17  215.572252  0.7627 0.3019883    7.134577  2.482872
```

```
## 2   T.tetradactyla       6   72.663508  0.6188 0.3192818     5.164098    2.001775
## 3        P.maximus        6   67.571706  0.6804 0.3317900     7.036178    1.892043
## 4      D.imperfecta      11  266.209138  0.5067 0.3424823     4.818468    1.605697
## 5      T.terrestris       8  158.477133  0.5396 0.3944222     5.657397    2.467836
## 6        E.barbara       16  388.534946  0.5121 0.5430994     5.554579    1.242093
## 7        D.kappleri      25  852.546578  0.5714 0.5441481     4.209479    1.388482
## 8        P.jacquacu       6   70.739383  0.6249 0.5701230    37.082142   28.925759
## 9          N.nasua        5  105.869507  0.4305 0.6420629     6.842468    2.795994
## 10   M.gouazoubira      33 1145.057388  0.5295 0.6614825     4.034886    1.093072
## 11   D.marsupialis        2    9.581695  0.4112 0.7769455    55.283025   58.253299
## 12        T.pecari        2    8.499666  0.3444 0.9616432    23.011694   21.260222
## 13    M.tridactyla       13  561.147367  0.1622 1.2244398     6.143464    4.591714
## 14     C.olivaceus        7  157.744947  0.1895 1.2393072    10.142120    2.518607
## 15        L.wiedii        2   27.875366  0.2523 1.4828106    18.158086   27.246292
## 16       P.concolor       9  189.250421  0.1141 1.6100295   153.976386  347.696038
```

For this species, the over-dispersion might be accounted for by using quasi-AICc

```
##               spp n.detect chi.square p.value c.hat.est large.coefs large.SE
## 1 D.novemcinctus       18   843.9364  0.1746  1.046054    2.941325 1.150269
```

These species seem to have a good fit and no signs of over-dispersion:

```
##            spp n.detect chi.square p.value c.hat.est large.coefs  large.SE
## 1 L.rufaxilla       33   649.5666  0.6100 0.3576340    3.599487 1.0750818
## 2      C.paca       71  1005.9241  0.7933 0.4707363    2.314499 0.5961605
## 3  D.leporina       66  1015.8078  0.8586 0.4810738    2.596495 0.5920658
## 4      P.onca       12   796.9177  0.6285 0.4888525    1.865236 1.1192002
## 5  L.pardalis       15   932.5476  0.2917 0.8229451    2.270754 0.9688629
## 6   C.alector       31  1768.9078  0.3694 0.8719773    3.439504 0.8856976
## 7     C.thous       24  1354.9744  0.3197 0.9879003    1.749595 1.0504025
```

Model averaging

Variable importance

```
## [1] "D.leporina"
##                      lam(buf.fragmen) p(sfrz) p(dras) p(date) lam(dcon)
## Sum of weights:      1.00                0.98    0.41    0.36    0.35
## N containing models:   16                  16      16      16      16
## [1] "L.pardalis"
##                      lam(buf.fragmen) lam(dcon) p(dras) p(date) p(sfrz)
## Sum of weights:      0.49                0.31      0.24    0.24    0.24
## N containing models:   32                  24        24      24      24
##                      lam(I(buf.fragmen^2))
## Sum of weights:      0.14
## N containing models:   16
## [1] "C.alector"
##                      lam(buf.fragmen) p(sfrz) p(dras) lam(dcon) p(date)
## Sum of weights:      0.99                0.73    0.59    0.53      0.24
## N containing models:   16                  16      16      16        16
## [1] "C.thous"
##                      lam(buf.fragmen) p(sfrz) p(dras) lam(dcon) p(date)
## Sum of weights:      0.92                0.49    0.27    0.27      0.24
## N containing models:   16                  16      16      16        16
## [1] "P.onca"
##                      lam(buf.fragmen) lam(dcon) p(dras) p(date) p(sfrz)
```

```
## Sum of weights:      0.87             0.29      0.28   0.25   0.24
## N containing models:  16               16        16     16     16
## [1] "D.novemcinctus"
##                      p(date) lam(buf.fragmen) p(dras) lam(dcon) p(sfrz)
## Sum of weights:      0.96    0.30             0.23    0.23      0.23
## N containing models:  24      32               24      24        24
##                      lam(I(buf.fragmen^2))
## Sum of weights:      0.07
## N containing models:  16
## [1] "M.gouazoubira"
##                      lam(buf.fragmen) p(sfrz) lam(dcon) p(date) p(dras)
## Sum of weights:      0.98             0.95    0.49      0.23    0.23
## N containing models:  16               16      16        16      16
## [1] "D.kappleri"
##                      lam(buf.fragmen) p(sfrz) lam(dcon) p(dras) p(date)
## Sum of weights:      0.99             0.68    0.43      0.42    0.34
## N containing models:  16               16      16        16      16
## [1] "C.paca"
##                      p(sfrz) p(dras) lam(dcon) lam(buf.fragmen)
## Sum of weights:      0.97    0.90    0.89      0.47
## N containing models:  24      24      24        32
##                      lam(I(buf.fragmen^2)) p(date)
## Sum of weights:      0.30                  0.26
## N containing models:  16                    24
## [1] "L.rufaxilla"
##                      p(sfrz) lam(buf.fragmen) lam(I(buf.fragmen^2)) lam(dcon)
## Sum of weights:      1.00    0.67             0.53                  0.48
## N containing models:  24      32               16                    24
##                      p(date) p(dras)
## Sum of weights:      0.32    0.23
## N containing models:  24      24
```
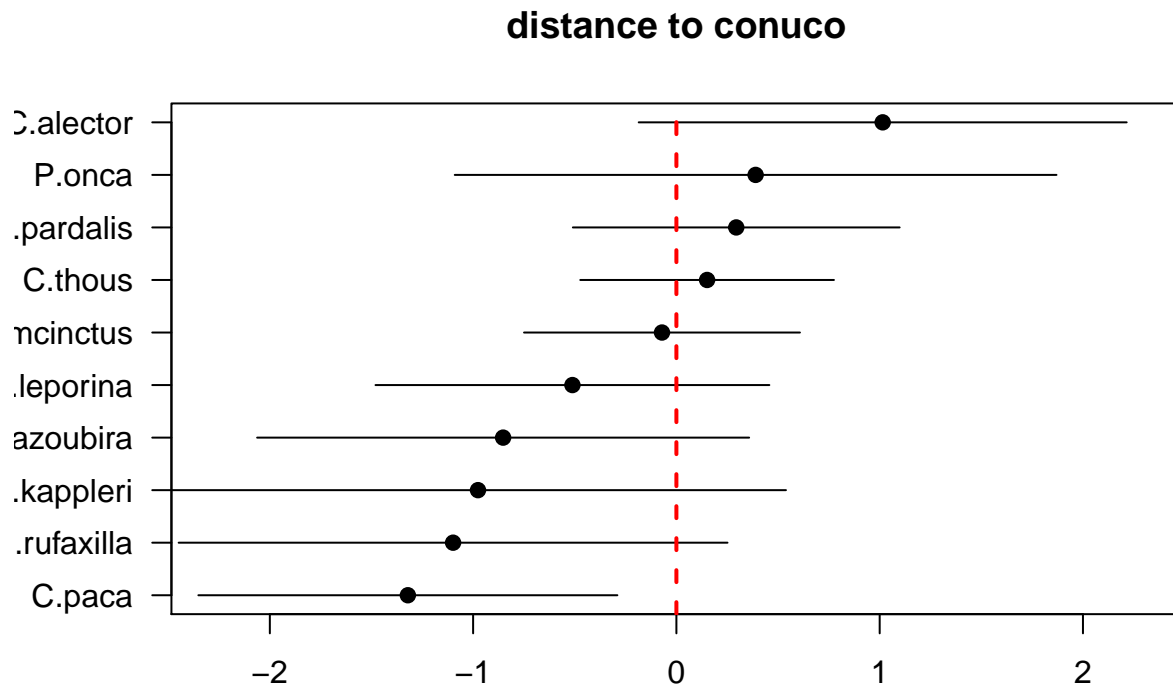
buf.fragmen

distance to conuco
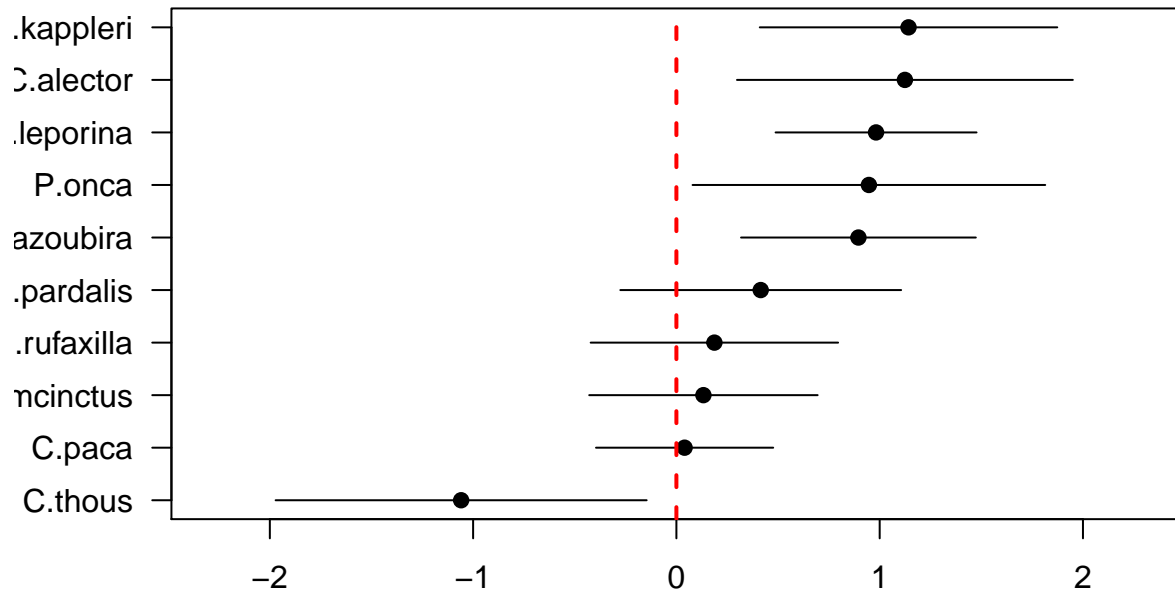
results per species

C. paca

Sum of AICc weights indicate a clear effect of p(sfrz) p(dras) and lam(dcon)

```
##
## Call:
## model.avg(object = oms03, subset = delta < 10)
##
## Component model call:
## occuRN(formula = ~<24 unique rhs>, data = UMF, K = 50)
##
## Component models:
##          df  logLik   AICc delta weight
## 236       5 -114.87 240.86  0.00   0.34
## 23456     7 -113.27 242.68  1.83   0.14
## 1236      6 -114.71 243.01  2.16   0.12
## 2346      6 -114.87 243.33  2.47   0.10
## 2345      6 -115.58 244.74  3.89   0.05
## 123456    8 -113.06 244.94  4.09   0.04
## 12346     7 -114.71 245.57  4.71   0.03
## 36        4 -118.59 245.91  5.05   0.03
## 3456      6 -116.26 246.10  5.24   0.03
## 12345     7 -115.34 246.83  5.97   0.02
## 136       5 -118.17 247.45  6.59   0.01
## 23        4 -119.38 247.48  6.63   0.01
```

```
## 26       4 -119.43 247.59  6.74    0.01
## 13456    7 -115.74 247.63  6.77    0.01
## 234      5 -118.34 247.80  6.94    0.01
## 346      5 -118.58 248.27  7.41    0.01
## 345      5 -118.76 248.63  7.78    0.01
## 126      5 -119.14 249.38  8.53    0.00
## 123      5 -119.18 249.48  8.62    0.00
## 2456     6 -118.04 249.66  8.81    0.00
## 1234     6 -118.08 249.74  8.89    0.00
## 1346     6 -118.14 249.86  9.00    0.00
## 1345     6 -118.17 249.93  9.07    0.00
## 246      5 -119.42 249.95  9.10    0.00
##
## Term codes:
##              p(date)                  p(dras)                  p(sfrz)
##                    1                        2                        3
##     lam(buf.fragmen) lam(I(buf.fragmen^2))          lam(dcon)
##                    4                        5                        6
##
## Model-averaged coefficients:
## (full average)
##                          Estimate Std. Error z value Pr(>|z|)
## lam(Int)                  -0.4646     0.4989   0.931  0.35179
## lam(dcon)                 -1.1186     0.6460   1.732  0.08331 .
## p(Int)                    -2.2774     0.6057   3.760  0.00017 ***
## p(dras)                    0.7634     0.4082   1.870  0.06146 .
## p(sfrz)                    1.6774     0.6409   2.617  0.00886 **
## lam(buf.fragmen)           0.1606     0.3157   0.509  0.61101
## lam(I(buf.fragmen^2))     -0.1756     0.3176   0.553  0.58045
## p(date)                   -0.0354     0.1247   0.284  0.77649
##
## (conditional average)
##                          Estimate Std. Error z value Pr(>|z|)
## lam(Int)                  -0.4646     0.4989   0.931  0.35179
## lam(dcon)                 -1.2560     0.5441   2.308  0.02098 *
## p(Int)                    -2.2774     0.6057   3.760  0.00017 ***
## p(dras)                    0.8482     0.3365   2.521  0.01170 *
## p(sfrz)                    1.7196     0.5903   2.913  0.00358 **
## lam(buf.fragmen)           0.3458     0.3881   0.891  0.37290
## lam(I(buf.fragmen^2))     -0.5832     0.3120   1.869  0.06160 .
## p(date)                   -0.1376     0.2154   0.639  0.52280
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Significant conditional coeficients for those parameters. Negative relationship with distance to conuco ("atracted") of conucos

D. leporina

Used linear model for EVI. Most support for p(sfrz)+lam(evi.mu), significant conditional coefficients for those parameters. Weak negative ("avoids") non-significant effect of conucos

```
##
## Call:
## model.avg(object = oms, subset = delta < 10)
```

```
##
## Component model call:
## occuRN(formula = ~<13 unique rhs>, data = UMF, K = 50)
##
## Component models:
##         df   logLik   AICc  delta  weight
## 34       4  -107.91  224.54  0.00   0.24
## 234      5  -107.11  225.33  0.79   0.16
## 345      5  -107.20  225.50  0.96   0.15
## 1234     6  -106.22  226.03  1.49   0.12
## 134      5  -107.46  226.04  1.49   0.12
## 1345     6  -106.61  226.81  2.26   0.08
## 2345     6  -106.73  227.05  2.51   0.07
## 12345    7  -105.78  227.71  3.17   0.05
## 4        3  -113.15  232.73  8.18   0.00
## 24       4  -112.07  232.86  8.32   0.00
## 45       4  -112.32  233.37  8.83   0.00
## 124      5  -111.52  234.15  9.61   0.00
## 245      5  -111.68  234.48  9.93   0.00
##
## Term codes:
##          p(date)           p(dras)           p(sfrz) lam(buf.fragmen)
##                1                 2                 3                4
##        lam(dcon)
##                5
##
## Model-averaged coefficients:
## (full average)
##                   Estimate Std. Error z value Pr(>|z|)
## lam(Int)          -0.64015    0.35756   1.790  0.07340 .
## lam(buf.fragmen)   0.98219    0.25222   3.894 9.85e-05 ***
## p(Int)            -2.46101    0.59487   4.137 3.52e-05 ***
## p(sfrz)            1.72730    0.61751   2.797  0.00515 **
## p(dras)            0.18758    0.32224   0.582  0.56048
## lam(dcon)         -0.18037    0.38194   0.472  0.63675
## p(date)            0.08418    0.16768   0.502  0.61564
##
## (conditional average)
##                   Estimate Std. Error z value Pr(>|z|)
## lam(Int)           -0.6402     0.3576   1.790  0.07340 .
## lam(buf.fragmen)    0.9822     0.2522   3.894 9.85e-05 ***
## p(Int)             -2.4610     0.5949   4.137 3.52e-05 ***
## p(sfrz)             1.7527     0.5852   2.995  0.00274 **
## p(dras)             0.4620     0.3591   1.287  0.19825
## lam(dcon)          -0.5115     0.4943   1.035  0.30079
## p(date)             0.2333     0.2077   1.123  0.26127
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

C. alector

Most support for p(dras)+p(sfrz)+lam(evi.mu)+lam(wcon), significant conditional coeficients for those parameters. Strong negative significative effect of conucos.

```
##
```

```
## Call:
## model.avg(object = oms, subset = delta < 10)
##
## Component model call:
## occuRN(formula = ~<18 unique rhs>, data = UMF, K = 50)
##
## Component models:
##        df logLik   AICc delta weight
## 2345    6 -67.53 148.64  0.00   0.21
## 34      4 -70.22 149.17  0.53   0.16
## 234     5 -69.46 150.04  1.39   0.11
## 245     5 -69.49 150.10  1.45   0.10
## 345     5 -69.85 150.81  2.17   0.07
## 12345   7 -67.49 151.14  2.50   0.06
## 134     5 -70.06 151.24  2.60   0.06
## 4       3 -72.67 151.78  3.13   0.04
## 24      4 -71.61 151.94  3.30   0.04
## 1245    6 -69.45 152.48  3.84   0.03
## 1234    6 -69.46 152.51  3.87   0.03
## 1345    6 -69.69 152.97  4.33   0.02
## 45      4 -72.34 153.41  4.77   0.02
## 14      4 -72.50 153.73  5.09   0.02
## 124     5 -71.61 154.32  5.68   0.01
## 145     5 -72.18 155.47  6.83   0.01
## 3       3 -75.40 157.22  8.58   0.00
## 23      4 -74.53 157.79  9.15   0.00
##
## Term codes:
##          p(date)          p(dras)          p(sfrz) lam(buf.fragmen)
##                1                2                3                4
##        lam(dcon)
##                5
##
## Model-averaged coefficients:
## (full average)
##                  Estimate Std. Error z value Pr(>|z|)
## lam(Int)         -1.155505   0.551818   2.094  0.03626 *
## lam(buf.fragmen)  1.118423   0.427927   2.614  0.00896 **
## lam(dcon)         0.534101   0.673892   0.793  0.42803
## p(Int)           -2.500998   1.071893   2.333  0.01963 *
## p(dras)           0.578150   0.613052   0.943  0.34565
## p(sfrz)           1.215582   1.042021   1.167  0.24339
## p(date)          -0.009343   0.142911   0.065  0.94787
##
## (conditional average)
##                  Estimate Std. Error z value Pr(>|z|)
## lam(Int)         -1.15551    0.55182    2.094  0.03626 *
## lam(buf.fragmen)  1.12412    0.42148    2.667  0.00765 **
## lam(dcon)         1.01482    0.61239    1.657  0.09749 .
## p(Int)           -2.50100    1.07189    2.333  0.01963 *
## p(dras)           0.97194    0.49908    1.947  0.05148 .
## p(sfrz)           1.67122    0.85518    1.954  0.05067 .
## p(date)          -0.03901    0.29001    0.135  0.89301
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

L. rufaxilla

Sum of AICc weights indicate a clear effect of p(sfrz) and large support for lam(buf.fragmen). Almost half of the models support lam(dcon)

```
##                       p(sfrz) lam(dcon) p(date) lam(buf.fragmen) p(dras)
## Sum of weights:       1.00    0.68      0.33    0.29             0.23
## N containing models:  16      16        16      16               16
```

Significant conditional coeficients for p(sfrz). Negative relationship with distance to conuco ("atracted") but non-significant effect of conucos

```
##                                  2.5 %      97.5 %
## lam(Int)          -1.25788042 -2.1502946 -0.3654662
## lam(dcon)         -1.09853320 -2.4485595  0.2514931
## p(Int)            -3.54396468 -5.4817772 -1.6061522
## p(sfrz)            3.31256294  1.2480025  5.3771234
## p(date)            0.36414267 -0.3633829  1.0916683
## lam(buf.fragmen)   0.18688130 -0.4217602  0.7955228
## p(dras)            0.05759071 -0.6556638  0.7708453
```

C.thous

Used linear model for EVI. Most support for p(sfrz)+lam(evi.mu), significant conditional coefficients for lam(evi.mu) (negative association). Weak negative ("avoids") non-significant effect of conucos

```
##                    lam(buf.fragmen) p(sfrz) p(dras) lam(dcon) p(date)
## Sum of weights:       0.92          0.49    0.27    0.27      0.24
## N containing models:  16            16      16      16        16
```

Coeficients with 95% CI

```
##                                  2.5 %      97.5 %
## lam(Int)          -1.74237748 -2.6053827 -0.8793723
## lam(buf.fragmen)  -1.05892997 -1.9715939 -0.1462661
## p(Int)            -0.77253856 -2.5108067  0.9657296
## p(sfrz)            1.54283390 -0.4809471  3.5666149
## p(dras)           -0.17545694 -0.7595815  0.4086677
## lam(dcon)          0.15100349 -0.4729509  0.7749579
## p(date)           -0.09481993 -0.8958472  0.7062074
```

D. kappleri

Most support for p(sfrz)+lam(evi.mu) but no significant conditional coefficients . Very weak non-significant effect of conucos.

```
##                    lam(buf.fragmen) p(sfrz) lam(dcon) p(dras) p(date)
## Sum of weights:       0.99          0.68    0.43      0.42    0.34
## N containing models:  16            16      16        16      16
```

Coeficients with 95% CI

```
##                                 2.5 %      97.5 %
## lam(Int)          -1.0736054 -2.6329317  0.4857209
## lam(buf.fragmen)   1.1418500  0.4100661  1.8736340
## p(Int)            -3.2311347 -5.7244532 -0.7378162
## p(sfrz)            1.5906273 -0.1508125  3.3320670
```

```
## p(dras)              0.6097667 -0.2492032  1.4687366
## lam(dcon)           -0.9760209 -2.4910651  0.5390234
## p(date)             -0.2751672 -0.7994965  0.2491622
```

L. pardalis

Most support for p(dras)+p(sfrz)+lam(evi.mu)+lam(wcon), significant conditional coeficients for those parameters. Strong negative significative effect of conucos.

```
##               lam(buf.fragmen) lam(dcon) p(dras) p(date) p(sfrz)
## Sum of weights:    0.40            0.29      0.25    0.24    0.24
## N containing models:  16            16        16      16      16
```

Coeficients with 95% CI

```
##                           2.5 %      97.5 %
## lam(Int)          -0.71674723 -1.9636751  0.5301806
## p(Int)            -2.21994555 -3.7099766 -0.7299145
## lam(buf.fragmen)   0.41485028 -0.2759281  1.1056287
## lam(dcon)          0.29442035 -0.5093328  1.0981735
## p(dras)            0.08984732 -0.6309387  0.8106333
## p(sfrz)            0.09929600 -1.6874752  1.8860672
## p(date)           -0.03816435 -0.7096218  0.6332931
```

D. novemcinctus

```
##               p(date) lam(buf.fragmen) lam(dcon) p(dras) p(sfrz)
## Sum of weights:    0.96    0.25              0.23    0.23    0.23
## N containing models:  16    16                16      16      16
```

Coeficients with 95% CI

```
##                             2.5 %       97.5 %
## lam(Int)          -0.159568681 -1.5120063  1.1928689
## p(Int)            -2.925537447 -4.6725324 -1.1785425
## p(date)           -1.012426116 -1.7129961 -0.3118561
## lam(buf.fragmen)   0.132946820 -0.4289635  0.6948572
## lam(dcon)         -0.070881719 -0.7495510  0.6077876
## p(dras)            0.080696608 -0.6467738  0.8081670
## p(sfrz)           -0.001160554 -1.7279632  1.7256421
```

M. americana

Best model is p(date) p(sfrz) lam(evi.mu) but very large coeficients for p(Int) and p(sfrz)

```
##               p(sfrz) lam(buf.fragmen) p(date) lam(dcon) p(dras)
## Sum of weights:    1.00    0.95              0.80    0.31      0.23
## N containing models:  16    16                16      16        16
```

Coeficients with 95% CI

```
##                               2.5 %       97.5 %
## lam(Int)         -1.9541958  -3.2795365 -0.62885500
## lam(buf.fragmen)  1.1404348   0.2657844  2.01508519
## p(Int)           -7.0053507 -11.8449030 -2.16579844
## p(date)          -1.0574949  -2.0175813 -0.09740843
## p(sfrz)           6.0465095   1.1750204 10.91799850
## lam(dcon)        -0.8603811  -2.9430470  1.22228479
## p(dras)           0.1307000  -1.3315325  1.59293254
```

T.tetradactyla

Null model is best model

```
##                    lam(buf.fragmen) lam(dcon) p(sfrz) p(dras) p(date)
## Sum of weights:        0.93             0.91     0.28    0.24    0.24
## N containing models:   16               16       16      16      16
```

Coeficients with 95% CI

```
##                               2.5 %       97.5 %
## lam(Int)         -0.53471421 -4.3864188  3.3169904
## lam(buf.fragmen)  1.79307819  0.1314742  3.4546821
## lam(dcon)         1.52174736  0.3885144  2.6549803
## p(Int)           -4.71644666 -8.0093985 -1.4234948
## p(sfrz)           1.15148112 -2.1454068  4.4483690
## p(date)          -0.15917784 -1.0835497  0.7651941
## p(dras)          -0.03471924 -1.0910234  1.0215849
```

E.barbara

```
##                    lam(dcon) lam(buf.fragmen) p(sfrz) p(date) p(dras)
## Sum of weights:      0.94         0.51           0.28    0.25    0.23
## N containing models: 16           16             16      16      16
```

Coeficients with 95% CI

```
##                               2.5 %       97.5 %
## lam(Int)          1.25586035 -1.4359532  3.9476739
## lam(dcon)        -2.14611707 -3.9797908 -0.3124434
## p(Int)           -5.36366407 -7.7525079 -2.9748202
## lam(buf.fragmen)  0.46837821 -0.1573244  1.0940808
## p(sfrz)           0.58646793 -1.1724255  2.3453613
## p(date)           0.10289881 -0.4876318  0.6934294
## p(dras)           0.02970977 -0.8093152  0.8687348
```

T.terrestris

```
##                    lam(buf.fragmen) p(sfrz) p(date) lam(dcon) p(dras)
## Sum of weights:        0.79           0.67    0.28    0.26      0.24
## N containing models:   16             16      16      16        16
```

Coeficients with 95% CI

```
##                              2.5 %      97.5 %
## lam(Int)         -1.5178693 -3.99316525 0.9574267
## lam(buf.fragmen)  1.0860765 -0.01899087 2.1911439
## p(Int)           -4.6344879 -9.68651178 0.4175359
## p(sfrz)           3.4382965 -1.19193189 8.0685250
## p(date)           0.3536900 -0.71975473 1.4271347
## p(dras)           0.2071011 -1.21125499 1.6254573
## lam(dcon)        -0.3181658 -2.27109583 1.6347643
```

D.imperfecta

```
##                    p(dras) lam(buf.fragmen) p(sfrz) lam(dcon) p(date)
## Sum of weights:      0.96      0.67            0.45    0.26      0.23
## N containing models: 16        16              16      16        16
```

Coeficients with 95% CI

```
##                            2.5 %      97.5 %
## lam(Int)          -1.20318218 -2.8031868  0.3968224
## lam(buf.fragmen)   0.94674061 -0.1202633  2.0137445
## p(Int)            -3.92150208 -6.9929992 -0.8500050
## p(dras)            1.49115948  0.4362694  2.5460496
## p(sfrz)            1.88698555 -0.9838135  4.7577846
## lam(dcon)          0.40089194 -1.5071479  2.3089318
## p(date)            0.01415737 -0.9622407  0.9905554
```

M.gouazoubira

```
##
## Call:
## model.avg(object = oms, subset = delta < 10)
##
## Component model call:
## occuRN(formula = ~<17 unique rhs>, data = UMF, K = 50)
##
## Component models:
##        df logLik   AICc delta weight
## 34      4 -83.94 176.61  0.00   0.29
## 345     5 -82.84 176.79  0.18   0.26
## 234     5 -83.93 178.97  2.36   0.09
## 134     5 -83.93 178.98  2.37   0.09
## 1345    6 -82.78 179.15  2.54   0.08
## 2345    6 -82.83 179.24  2.63   0.08
## 1234    6 -83.92 181.43  4.82   0.03
## 12345   7 -82.77 181.70  5.10   0.02
## 4       3 -88.07 182.58  5.97   0.01
## 45      4 -86.94 182.61  6.01   0.01
## 35      4 -87.18 183.09  6.49   0.01
## 135     5 -86.80 184.72  8.11   0.00
## 24      4 -88.04 184.82  8.21   0.00
## 14      4 -88.07 184.87  8.26   0.00
## 145     5 -86.94 184.98  8.38   0.00
## 245     5 -86.94 184.99  8.38   0.00
## 235     5 -87.10 185.32  8.71   0.00
##
## Term codes:
##         p(date)         p(dras)         p(sfrz) lam(buf.fragmen)
##               1               2               3                4
##       lam(dcon)
##               5
##
## Model-averaged coefficients:
## (full average)
##                    Estimate Std. Error z value Pr(>|z|)
## lam(Int)         -0.4662866  0.8303353   0.562 0.574413
## lam(buf.fragmen)  0.8776369  0.3173936   2.765 0.005690 **
## p(Int)           -3.9691552  1.1221054   3.537 0.000404 ***
## p(sfrz)           2.0026660  0.9378034   2.135 0.032721 *
## lam(dcon)        -0.4143304  0.6056390   0.684 0.493899
## p(dras)           0.0004078  0.1911171   0.002 0.998297
```

```
## p(date)              0.0137046  0.1256387    0.109 0.913139
##
## (conditional average)
##                   Estimate Std. Error z value Pr(>|z|)
## lam(Int)          -0.46629    0.83034   0.562 0.574413
## lam(buf.fragmen)   0.89547    0.29465   3.039 0.002373 **
## p(Int)            -3.96916    1.12210   3.537 0.000404 ***
## p(sfrz)            2.10127    0.84592   2.484 0.012992 *
## lam(dcon)         -0.85233    0.61744   1.380 0.167452
## p(dras)            0.00180    0.40156   0.004 0.996423
## p(date)            0.05927    0.25606   0.231 0.816948
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

N.nasua

```
##
## Call:
## model.avg(object = oms, subset = delta < 10)
##
## Component model call:
## occuRN(formula = ~<22 unique rhs>, data = UMF, K = 50)
##
## Component models:
##        df logLik  AICc delta weight
## 245     5 -17.46 46.03  0.00   0.22
## 24      4 -19.10 46.93  0.91   0.14
## 4       3 -20.50 47.43  1.40   0.11
## 2345    6 -17.17 47.92  1.89   0.08
## 45      4 -19.82 48.37  2.35   0.07
## 1245    6 -17.40 48.38  2.36   0.07
## 234     5 -18.82 48.75  2.72   0.06
## 124     5 -19.01 49.13  3.10   0.05
## 34      4 -20.21 49.15  3.12   0.05
## 14      4 -20.50 49.73  3.70   0.03
## 345     5 -19.52 50.14  4.12   0.03
## 12345   7 -17.10 50.35  4.33   0.03
## 145     5 -19.80 50.72  4.69   0.02
## 1234    6 -18.71 51.00  4.97   0.02
## 134     5 -20.21 51.53  5.50   0.01
## 1345    6 -19.51 52.60  6.57   0.01
## (Null)  2 -24.64 53.49  7.47   0.01
## 2       3 -23.97 54.37  8.34   0.00
## 3       3 -24.21 54.85  8.82   0.00
## 5       3 -24.29 55.01  8.98   0.00
## 1       3 -24.59 55.62  9.59   0.00
## 23      4 -23.57 55.86  9.83   0.00
##
## Term codes:
##         p(date)            p(dras)          p(sfrz) lam(buf.fragmen)
##               1                  2                3                4
##       lam(dcon)
##               5
##
```

```
## Model-averaged coefficients:
## (full average)
##                  Estimate Std. Error z value Pr(>|z|)
## lam(Int)         -2.90775    3.91889   0.742   0.4581
## lam(buf.fragmen)  3.83182    2.20721   1.736   0.0826 .
## lam(dcon)         1.18413    1.49039   0.795   0.4269
## p(Int)           -6.03721    2.45956   2.455   0.0141 *
## p(dras)           1.24797    1.28699   0.970   0.3322
## p(sfrz)           0.37384    1.16886   0.320   0.7491
## p(date)           0.03119    0.27637   0.113   0.9102
##
## (conditional average)
##                  Estimate Std. Error z value Pr(>|z|)
## lam(Int)          -2.9077     3.9189   0.742   0.4581
## lam(buf.fragmen)   3.8986     2.1671   1.799   0.0720 .
## lam(dcon)          2.2639     1.3425   1.686   0.0917 .
## p(Int)            -6.0372     2.4596   2.455   0.0141 *
## p(dras)            1.8897     1.1381   1.660   0.0968 .
## p(sfrz)            1.3139     1.8886   0.696   0.4866
## p(date)           0.1320     0.5567   0.237   0.8126
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

M.tridactyla

```
##
## Call:
## model.avg(object = oms, subset = delta < 10)
##
## Component model call:
## occuRN(formula = ~<32 unique rhs>, data = UMF, K = 50)
##
## Component models:
##         df logLik  QAICc delta weight
## 3        3 -51.02  92.07  0.00   0.13
## (Null)   2 -52.49  92.16  0.10   0.12
## 4        3 -51.74  93.24  1.17   0.07
## 2        3 -51.81  93.35  1.28   0.07
## 34       4 -50.41  93.45  1.39   0.06
## 23       4 -50.43  93.48  1.42   0.06
## 5        3 -52.33  94.21  2.14   0.04
## 35       4 -50.90  94.26  2.19   0.04
## 13       4 -51.00  94.42  2.35   0.04
## 1        3 -52.48  94.45  2.38   0.04
## 24       4 -51.25  94.82  2.75   0.03
## 234      5 -49.97  95.21  3.14   0.03
## 45       4 -51.72  95.59  3.52   0.02
## 14       4 -51.74  95.62  3.55   0.02
## 12       4 -51.77  95.68  3.61   0.02
## 25       4 -51.80  95.72  3.65   0.02
## 123      5 -50.37  95.86  3.79   0.02
## 345      5 -50.39  95.89  3.82   0.02
## 134      5 -50.40  95.91  3.84   0.02
## 235      5 -50.42  95.95  3.88   0.02
```

```
## 15        4 -52.32  96.57  4.50    0.01
## 135       5 -50.87  96.68  4.61    0.01
## 245       5 -51.11  97.07  5.01    0.01
## 124       5 -51.23  97.26  5.19    0.01
## 2345      6 -49.87  97.60  5.54    0.01
## 1234      6 -49.93  97.70  5.63    0.01
## 145       5 -51.72  98.06  5.99    0.01
## 125       5 -51.76  98.13  6.07    0.01
## 1235      6 -50.36  98.41  6.34    0.01
## 1345      6 -50.38  98.45  6.38    0.01
## 1245      6 -51.10  99.61  7.55    0.00
## 12345     7 -49.83 100.22  8.15    0.00
##
## Term codes:
##          p(date)              p(dras)              p(sfrz) lam(buf.fragmen)
##                1                    2                    3                4
##         lam(dcon)
##                5
##
## Model-averaged coefficients:
## (full average)
##                   Estimate Std. Error z value Pr(>|z|)
## lam(Int)           0.79849    2.76990   0.288    0.773
## p(Int)            -4.68582    3.00080   1.562    0.118
## p(sfrz)            0.90443    1.28719   0.703    0.482
## lam(buf.fragmen)   0.11621    0.24922   0.466    0.641
## p(dras)            0.13390    0.30033   0.446    0.656
## lam(dcon)         -0.01636    0.25730   0.064    0.949
## p(date)            0.01554    0.16600   0.094    0.925
##
## (conditional average)
##                   Estimate Std. Error z value Pr(>|z|)
## lam(Int)           0.79849    2.76990   0.288    0.773
## p(Int)            -4.68582    3.00080   1.562    0.118
## p(sfrz)            1.86433    1.27505   1.462    0.144
## lam(buf.fragmen)   0.35097    0.32433   1.082    0.279
## p(dras)            0.41320    0.40365   1.024    0.306
## lam(dcon)         -0.06761    0.51971   0.130    0.896
## p(date)            0.06667    0.33882   0.197    0.844
```

P. onca

If c-hat >1, then we use QAICc

```
##
## Call:
## model.avg(object = oms, subset = delta < 10)
##
## Component model call:
## occuRN(formula = ~<27 unique rhs>, data = UMF, K = 50)
##
## Component models:
##        df logLik   AICc delta weight
## 4       3 -45.15  96.72  0.00   0.27
## 45      4 -45.04  98.81  2.09   0.10
```

```
## 14       4 -45.14  99.00  2.28   0.09
## 24       4 -45.14  99.01  2.29   0.09
## 34       4 -45.14  99.01  2.29   0.09
## 245      5 -44.54 100.19  3.47   0.05
## (Null)   2 -48.29 100.78  4.06   0.04
## 124      5 -44.86 100.83  4.11   0.03
## 145      5 -45.03 101.18  4.46   0.03
## 345      5 -45.04 101.19  4.47   0.03
## 134      5 -45.13 101.38  4.66   0.03
## 234      5 -45.14 101.39  4.66   0.03
## 1245     6 -44.21 102.01  5.29   0.02
## 5        3 -47.95 102.33  5.60   0.02
## 2345     6 -44.54 102.67  5.95   0.01
## 2        3 -48.19 102.81  6.09   0.01
## 1        3 -48.23 102.89  6.16   0.01
## 3        3 -48.29 103.00  6.28   0.01
## 1234     6 -44.85 103.29  6.57   0.01
## 1345     6 -45.03 103.65  6.93   0.01
## 15       4 -47.88 104.48  7.76   0.01
## 12       4 -47.92 104.57  7.85   0.01
## 12345    7 -44.21 104.57  7.85   0.01
## 25       4 -47.94 104.61  7.89   0.01
## 35       4 -47.95 104.62  7.90   0.01
## 23       4 -48.19 105.11  8.39   0.00
## 13       4 -48.23 105.18  8.46   0.00
##
## Term codes:
##          p(date)          p(dras)          p(sfrz) lam(buf.fragmen)
##                1                2                3                4
##        lam(dcon)
##                5
##
## Model-averaged coefficients:
## (full average)
##                  Estimate Std. Error z value Pr(>|z|)
## lam(Int)         -1.31866    0.87886   1.500   0.1335
## lam(buf.fragmen)  0.83408    0.51637   1.615   0.1062
## p(Int)           -2.17526    0.89258   2.437   0.0148 *
## lam(dcon)         0.10999    0.43786   0.251   0.8017
## p(date)           0.03613    0.20994   0.172   0.8634
## p(dras)           0.23970    0.86329   0.278   0.7813
## p(sfrz)          -0.01054    0.48837   0.022   0.9828
##
## (conditional average)
##                  Estimate Std. Error z value Pr(>|z|)
## lam(Int)         -1.31866    0.87886   1.500   0.1335
## lam(buf.fragmen)  0.94693    0.44255   2.140   0.0324 *
## p(Int)           -2.17526    0.89258   2.437   0.0148 *
## lam(dcon)         0.38971    0.75518   0.516   0.6058
## p(date)           0.14509    0.40147   0.361   0.7178
## p(dras)           0.87848    1.47316   0.596   0.5510
## p(sfrz)          -0.04544    1.01330   0.045   0.9642
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Sum of QAICc-weights

```
##                      lam(buf.fragmen) lam(dcon) p(dras) p(date) p(sfrz)
## Sum of weights:      0.87             0.29      0.28    0.25    0.24
## N containing models: 16               16        16      16      16
```