TP 2 estimation des effectifs en populations fermées

On charge le package `RMark` qui appelle le logiciel Mark depuis `R`. On charge aussi le package `secr` qui permet d'implémenter le test de `closure`.

```
library(RMark)
library(secr)
```

Exercice 1 : souris sylvestre

Lecture et formatage des données

On commence par lire les données qui se trouvent dans le répertoire dat/

```
mouse <- convert.inp("dat/deer-mouse-nogroup.inp",
                     group.df = NULL,
                     covariates = NULL)
```

On regarde les 10 premières lignes du fichier.

```
head(mouse)
```

```
##       ch freq
## 1 111111    1
## 2 100111    1
## 3 110011    1
## 4 110111    1
## 5 111111    1
## 6 110111    1
```

Les 10 dernières lignes.

```
tail(mouse)
```

```
##        ch freq
## 33 000010    1
## 34 000010    1
## 35 000010    1
## 36 000001    1
## 37 000001    1
## 38 000001    1
```

On fait les tests de fermeture. Pour cela, il nous faut d'abord convertir les données au format requis pour utiliser le package secr qui fait ces tests. Le formatage consiste à mettre un espace entre les colonnes de capture.

```
mouse_secr <- unRMarkInput(mouse)
```

On peut utiliser la fonction summary de R pour obtenir un résumé des données.

```
summary(mouse_secr)
```

```
## Object class       capthist
##
## Counts by occasion
##             1  2  3  4  5  6 Total
## n          15 20 16 19 25 25   120
## u          15  8  6  3  3  3    38
## f           9  6  7  6  6  4    38
## M(t+1)     15 23 29 32 35 38    38
## losses      0  0  0  0  0  0     0
## detections 15 20 16 19 25 25   120
```

Test de l'hypothèse de fermeture

On fait enfin les tests. Par défaut, seul le test d'Otis est fait. En rajoutant l'option "SB = TRUE", on fait aussi le test de Stanley et Burnham.

```
closure.test(mouse_secr, SB = TRUE)
```

```
## $Otis
##  statistic         p
##  0.7649179 0.7778398
##
## $Xc
##  statistic df         p
##     11.668  7 0.1120193
##
## $NRvsJS
##  statistic df          p
##    9.31129  3 0.02542603
##
## $NMvsJS
##   statistic df         p
##  0.04895105  1 0.8248987
##
## $MtvsNR
##  statistic df        p
##   2.356705  4 0.670465
##
## $MtvsNM
##  statistic df          p
##   11.61904  6 0.07102745
##
## $compNRvsJS
##   Occasion  Chisquare df           p
## 1        2 7.44579710  1 0.006358475
```

```
## 2        3 0.04505929  1 0.831895047
## 3        4 1.82043344  1 0.177261692
## 4        5         NA NA          NA
##
## $compNMvsJS
##   Occasion  Chisquare df         p
## 1        2         NA NA        NA
## 2        3         NA NA        NA
## 3        4         NA NA        NA
## 4        5 0.04895105  1 0.8248987
```

Une première série de modèles

Pour utiliser RMark, on passe par 3 étapes : la préparation des données, la définition des modèles et l'ajustement à proprement parler.

On commence par préparer les données.

```
mouse.proc <- process.data(mouse,
                           begin.time = 1,
                           model = "FullHet")
mouse.ddl <- make.design.data(mouse.proc)
```

On définit les modèles que l'on souhaite ajuster grâce à une fonction R qui fait 3 choses : spéficication des effets, création d'une liste des modèles à ajuster et préparation pour envoi à Mark. Par défaut, Mark considère un effet comportement et distingue une probabilité de capture c et une autre de recapture p. On utilise "share = TRUE" pour fusionner ces deux paramètres en une seule probabilité de capture.

```
run.mouse <- function() {

## On specifie les effets

  # M0 : p constant dans le temps
  p.dot <- list(formula =  ~ 1, share = TRUE)
  # Mb : p (recapture) different de c (premiere capture) et constants dans le temps
  p.dot.behav <- list(formula =  ~ 1)
  # Mt : p varie selon la session (dans le temps)
  p.time <- list(formula =  ~ time, share = TRUE)
  # Mh : p est heterogene entre individu
  p.h <- list(formula = ~ mixture, share = TRUE)
  # Mtb
  p.time.behav <- list(formula =  ~ time)
  # Mbh
  p.h.behav <- list(formula =  ~ mixture)
  # Mth
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  # Mtbh
  p.h.time.behav <- list(formula =  ~ mixture + time)

## On construit la liste des modeles
  mouse.model.list <- create.model.list("FullHet")

## On prépare le tout pour envoi a Mark
```

```
  mouse.results <- mark.wrapper(mouse.model.list,
                                data = mouse.proc,
                                ddl = mouse.ddl)

## On retourne les resultats
  return(mouse.results)
}
```

On fait tourner tous les modèles d'un coup.

```
mouse.results <- run.mouse()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=1)
## -2lnL:  109.5069
## AICc :  115.614  (unadjusted=111.52455)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  7.308782e-04 0.000000e+00  7.308782e-04 7.308782e-04
## p:(Intercept)   1.053605e-01 1.326371e-01 -1.546082e-01 3.653292e-01
## f0:(Intercept) -1.845682e+01 1.353555e+04 -2.654813e+04 2.651122e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5001827
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
##
## Real Parameter f0
##
##             1
##  9.645049e-09
##
## Output summary for FullHet model
```

```
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  97.98748
## AICc :  106.1668  (unadjusted=104.09462)
##
## Beta
##                      estimate          se          lcl         ucl
## pi:(Intercept) -1.150514e-05 457.9519900 -897.5859300 897.5859100
## p:(Intercept)  -6.525620e-01   0.3230649   -1.2857692  -0.0193548
## c:(Intercept)   4.554755e-01   0.1772735    0.1080195   0.8029316
## f0:(Intercept)  1.040116e+00   1.0904391   -1.0971444   3.1773772
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999971
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124
## mixture:2 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124 0.3424124
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
##
##         1
##  2.829546
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=1)
## -2lnL:  1
## AICc :  NA  (unadjusted=Not a Number                )
##
## Beta
##                estimate se lcl ucl
## pi:(Intercept)      Inf  0 Inf Inf
## p:(Intercept)       Inf  0 Inf Inf
## p:mixture2          Inf  0 Inf Inf
## f0:(Intercept)      Inf  0 Inf Inf
##
##
```

```
## Real Parameter pi
##
##
## mixture:1 5.562685e-309
##
##
## Real Parameter p
##
##                        1             2             3             4             5
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##                        6
## mixture:1 5.562685e-309
## mixture:2 5.562685e-309
##
##
## Real Parameter c
##
##                        2             3             4             5             6
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##
##
## Real Parameter f0
##
##   1
##  NA
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=4)
## -2lnL:  97.98748
## AICc :  108.2577  (unadjusted=106.16685)
##
## Beta
##                      estimate        se        lcl        ucl
## pi:(Intercept) -9.281200e-03 0.0000000 -0.0092812 -0.0092812
## p:(Intercept)  -6.525641e-01 1.4669450 -3.5277764  2.2226481
## p:mixture2      3.074535e-06 2.8486359 -5.5833234  5.5833296
## c:(Intercept)   4.554755e-01 0.1772735  0.1080195  0.8029316
## f0:(Intercept)  1.040119e+00 1.0904362 -1.0971359  3.1773741
##
##
## Real Parameter pi
##
##
## mixture:1 0.4976797
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.3424119 0.3424119 0.3424119 0.3424119 0.3424119 0.3424119
```

```
## mixture:2 0.3424126 0.3424126 0.3424126 0.3424126 0.3424126 0.3424126
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
##
##         1
##  2.829554
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  9
## -2lnL:  80.75912
## AICc :  99.58481
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -0.3007797 0.5739913 -1.4258028  0.8242433
## p:(Intercept)   0.6308275 0.5695652 -0.4855204  1.7471754
## p:time2         0.6813490 0.5269159 -0.3514063  1.7141042
## p:time3         0.1400699 0.5295160 -0.8977814  1.1779211
## p:time4         0.5482069 0.5267874 -0.4842965  1.5807103
## p:time5         1.3410905 0.5353028  0.2918970  2.3902840
## p:time6         1.3410904 0.5353028  0.2918969  2.3902840
## p:mixture2     -2.2472085 0.3887934 -3.0092435 -1.4851734
## f0:(Intercept)  0.8024616 1.2065518 -1.5623800  3.1673031
##
##
## Real Parameter pi
##
##
## mixture:1 0.4253669
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.6526771 0.7878771 0.6837150 0.7647741 0.8778170 0.8778170
## mixture:2 0.1657046 0.2819049 0.1859852 0.2557505 0.4316087 0.4316087
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.7878771 0.6837150 0.7647741 0.8778170 0.8778170
## mixture:2 0.2819049 0.1859852 0.2557505 0.4316087 0.4316087
##
```

```
##
## Real Parameter f0
##
##         1
##  2.231026
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  10  (unadjusted=6)
## -2lnL:  93.72121
## AICc :  114.735  (unadjusted=106.1013)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)    0.3332833 6.352300e+02 -1.244718e+03 1.245384e+03
## p:(Intercept)    -0.7999476 5.724366e+02 -1.122776e+03 1.121176e+03
## p:mixture2        0.8517158 1.696353e+03 -3.324001e+03 3.325705e+03
## p:time2          -0.1366813 2.604585e+02 -5.106354e+02 5.103620e+02
## p:time3           0.1558500 5.156033e+02 -1.010427e+03 1.010738e+03
## p:time4          -0.0796387 6.793274e+02 -1.331561e+03 1.331402e+03
## p:time5           0.6745213 8.014551e+02 -1.570177e+03 1.571526e+03
## p:time6          18.5744300 5.267234e+03 -1.030520e+04 1.034235e+04
## c:(Intercept)     0.4554755 1.772735e-01  1.080195e-01 8.029316e-01
## f0:(Intercept) -22.9280110 2.942051e+04 -5.768713e+04 5.764128e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.582558
##
##
## Real Parameter p
##
##                    1         2         3         4         5 6
## mixture:1 0.3100367 0.2815818 0.3443209 0.2932635 0.4686845 1
## mixture:2 0.5129392 0.4787845 0.5517189 0.4930328 0.6739905 1
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
##
##             1
##  1.102786e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
```

```
##
## Npar :  8  (unadjusted=6)
## -2lnL:  99.67496
## AICc :  116.3325  (unadjusted=112.05505)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept)  -0.000038264 0.0000000  -0.000038264  -0.000038264
## p:(Intercept)   -0.427443900 0.3318810  -1.077930700   0.223042800
## p:time2          0.532804400 0.4644359  -0.377489900   1.443098700
## p:time3          0.108990100 0.4670113  -0.806352100   1.024332300
## p:time4          0.427443900 0.4641208  -0.482233000   1.337120700
## p:time5          1.081370200 0.4765166   0.147397600   2.015342700
## p:time6          1.081370100 0.4765165   0.147397700   2.015342600
## f0:(Intercept) -18.751746000 0.0000000 -18.751746000 -18.751746000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999904
##
##
## Real Parameter p
##
##                   1         2         3   4         5         6
## mixture:1 0.3947369 0.5263158 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.3947369 0.5263158 0.4210526 0.5 0.6578947 0.6578947
##
##
## Real Parameter c
##
##                   2         3   4         5         6
## mixture:1 0.5263158 0.4210526 0.5 0.6578947 0.6578947
## mixture:2 0.5263158 0.4210526 0.5 0.6578947 0.6578947
##
##
## Real Parameter f0
##
##             1
##  7.181584e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  9  (unadjusted=6)
## -2lnL:  93.72121
## AICc :  112.5469  (unadjusted=106.1013)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept)  3.844612e-05 4.919326e+02 -9.641879e+02 9.641880e+02
## p:(Intercept)  -4.274441e-01 3.318806e-01 -1.077930e+00 2.230419e-01
## p:time2        -2.011646e-01 5.493734e-01 -1.277936e+00 8.756073e-01
```

```
## p:time3         2.197900e-02 6.228339e-01 -1.198775e+00 1.242733e+00
## p:time4        -2.657028e-01 7.811172e-01 -1.796693e+00 1.265287e+00
## p:time5         4.274440e-01 8.813679e-01 -1.300037e+00 2.154925e+00
## p:time6         1.912297e+01 7.919789e+03 -1.550366e+04 1.554191e+04
## c:(Intercept)   4.554754e-01 1.772735e-01  1.080194e-01 8.029315e-01
## f0:(Intercept) -2.287208e+01 1.240994e+04 -2.434636e+04 2.430062e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000096
##
##
## Real Parameter p
##
##                   1         2   3         4   5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333334 0.5 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333334 0.5 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
##
##             1
##  1.166225e-10
```

On examine les résultats.

```
mouse.results
```

```
##                                 model npar      AICc DeltaAICc weight Deviance
## 1               pi(~1)p(~1)c()f0(~1)    3 115.61399        NA     NA 85.44111
## 2             pi(~1)p(~1)c(~1)f0(~1)    4 106.16685        NA     NA 73.92174
## 3          pi(~1)p(~mixture)c()f0(~1)    4        NA        NA     NA  2.00000
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 108.25775        NA     NA 73.92174
## 5   pi(~1)p(~time + mixture)c()f0(~1)    9  99.58481        NA     NA 56.69338
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   10 114.73503        NA     NA 69.65547
## 7             pi(~1)p(~time)c()f0(~1)    8 116.33249        NA     NA 75.60922
## 8           pi(~1)p(~time)c(~1)f0(~1)    9 112.54690        NA     NA 69.65547
```

Le nom des modèles n'est pas limpide. On fait le lien entre la première colonne qui donne le numéro du modèle, et la liste des modèles qu'on a définie au-dessus.

```
names(mouse.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
```

```
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

Par exemple, si l'on veut afficher les résultats du modèle M_0, il s'agit du modèle 1 "p.dot". On peut afficher la probabilité de détection avec l'intervalle de confiance associé.

```
mouse.results$p.dot$results$real
```

```
##                  estimate          se          lcl          ucl fixed note
## pi g1 m1    5.001827e-01 0.000000000 5.001827e-01 5.001827e-01
## p g1 t1 m1  5.263158e-01 0.033067400 4.614248e-01 5.903299e-01
## f0 g1 a0 t1 9.645049e-09 0.000130551 1.868023e-12 4.979968e-05
```

On obtient aussi une estimation de l'effectif.

```
mouse.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate lcl      ucl
## 1       38  38 38.00005
```

Le meilleur modèle selon l'AIC est le modèle numéroté 4 qui correspond à "p.h.behav". On affiche les résults pour ce modèle.

```
mouse.results$p.h.behav$results$real
```

```
##              estimate        se       lcl        ucl fixed note
## pi g1 m1    0.4976797 0.0000000 0.4976797  0.4976797
## p g1 t1 m1  0.3424119 0.3303061 0.0285322  0.9022650
## p g1 t1 m2  0.3424126 0.3274032 0.0292411  0.9000139
## c g1 t2 m1  0.6119403 0.0420970 0.5269786  0.6906012
## f0 g1 a0 t1 2.8295540 3.0854481 0.4991991 16.0384410
```

```
mouse.results$p.h.behav$results$derived
```

```
## $`N Population Size`
##   estimate     lcl      ucl
## 1 40.82955 38.4992 54.03844
```

Analyses séparées, mâles vs. femelles

Ici on sépare mâles et femelles et on reproduit l'analyse ci-dessus.On commence par lire les données. On spécifie le groupe, ici les mâles d'abord, puis les femelles.

```
mouse <- convert.inp("dat/deer-mouse-sex2G-MF.inp",
                     group.df = data.frame(sex = c("M","F")),
                     covariates = NULL)
```

On inspecte les données.

```r
head(mouse)
```

```
##         ch freq sex
## 1:1 111111    1   M
## 1:3 110011    1   M
## 1:4 110111    1   M
## 1:5 111111    1   M
## 1:6 110111    1   M
## 1:7 111110    1   M
```

```r
tail(mouse)
```

```
##          ch freq sex
## 2:28 001010    1   F
## 2:29 001000    1   F
## 2:30 000100    1   F
## 2:32 000110    1   F
## 2:34 000010    1   F
## 2:38 000001    1   F
```

On sépare mâles et femelles en deux jeux de données.

```r
mouseM <- mouse[mouse$sex == "M", ]
mouseF <- mouse[mouse$sex == "F", ]
```

On formate les données pour effectuer les tests de l'hypothèse de fermeture.

```r
mouseM_secr <- unRMarkInput(mouseM) # on convertit au bon format
mouseF_secr <- unRMarkInput(mouseF) # on convertit au bon format
```

On fait les tests de fermeture, les mâles d'abord.

```r
closure.test(mouseM_secr, SB = TRUE)
```

```
## $Otis
##  statistic        p
##   1.408787 0.920551
##
## $Xc
##  statistic df          p
##   11.31081  6 0.07923259
##
## $NRvsJS
##  statistic df           p
##   9.316319  2 0.009483899
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
```

```
##  statistic df         p
##   1.994488  4 0.7367727
##
## $MtvsNM
##  statistic df          p
##   11.31081  6 0.07923259
##
## $compNRvsJS
##   Occasion Chisquare df          p
## 1        2  5.619444  1 0.01776228
## 2        3        NA NA         NA
## 3        4  3.696875  1 0.05451448
## 4        5        NA NA         NA
##
## $compNMvsJS
##   Occasion Chisquare df  p
## 1        2        NA NA NA
## 2        3        NA NA NA
## 3        4        NA NA NA
## 4        5        NA NA NA
```

Les femelles ensuite.

```
closure.test(mouseF_secr, SB = TRUE)
```

```
## $Otis
##  statistic         p
##  0.2255718 0.5892328
##
## $Xc
##  statistic df         p
##   3.362287  5 0.6443199
##
## $NRvsJS
##  statistic df         p
##    1.63254  1 0.2013521
##
## $NMvsJS
##  statistic df         p
##  0.2539683  1 0.6142947
##
## $MtvsNR
##  statistic df         p
##   1.729747  4 0.7853071
##
## $MtvsNM
##  statistic df        p
##   3.108319  4 0.539865
##
## $compNRvsJS
##   Occasion Chisquare df         p
## 1        2        NA NA        NA
## 2        3   1.63254  1 0.2013521
```

```
## 3        4        NA NA        NA
## 4        5        NA NA        NA
##
## $compNMvsJS
##   Occasion Chisquare df         p
## 1        2        NA NA        NA
## 2        3        NA NA        NA
## 3        4        NA NA        NA
## 4        5 0.2539683  1 0.6142947
```

Les modèles maintenant. Commençons par les mâles.

```
mouse.proc <- process.data(mouseM,
                           begin.time = 1,
                           model = "FullHet")
mouse.ddl <- make.design.data(mouse.proc)
```

La liste des modèles.

```
run.mouse <- function() {

  # sans l'effet sexe
  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ time + mixture)

  mouse.model.list <- create.model.list("FullHet")

  mouse.results <- mark.wrapper(mouse.model.list,
                                data = mouse.proc,
                                ddl = mouse.ddl)

  return(mouse.results)
}
```

On lance Mark.

```
mouse.results <- run.mouse()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=1)
## -2lnL:  75.69613
## AICc :  81.89285  (unadjusted=77.728386)
##
```

```
## Beta
##                     estimate se           lcl           ucl
## pi:(Intercept)  5.099910e-05  0  5.099910e-05  5.099910e-05
## p:(Intercept)   5.193003e-01  0  5.193003e-01  5.193003e-01
## f0:(Intercept) -1.801195e+01  0 -1.801195e+01 -1.801195e+01
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000127
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
## mixture:2 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
## mixture:2 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
##
##
## Real Parameter f0
##
##             1
##  1.504903e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  66.768
## AICc :  75.09858  (unadjusted=70.865562)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept)  1.970108e-04 0.0000000  1.970108e-04  1.970108e-04
## p:(Intercept)  -1.743609e-01 0.2960053 -7.545312e-01  4.058095e-01
## c:(Intercept)   9.694076e-01 0.2503919  4.786394e-01  1.460176e+00
## f0:(Intercept) -1.802591e+01 0.0000000 -1.802591e+01 -1.802591e+01
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000493
##
##
## Real Parameter p
```

```
##
##                    1         2         3         4         5         6
## mixture:1 0.4565199 0.4565199 0.4565199 0.4565199 0.4565199 0.4565199
## mixture:2 0.4565199 0.4565199 0.4565199 0.4565199 0.4565199 0.4565199
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.7250014 0.7250014 0.7250014 0.7250014 0.7250014
## mixture:2 0.7250014 0.7250014 0.7250014 0.7250014 0.7250014
##
##
## Real Parameter f0
##
##              1
##  1.484048e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  63.91043
## AICc :  72.24101
##
## Beta
##                    estimate        se        lcl        ucl
## pi:(Intercept) -0.2917222 0.8369741  -1.932191  1.3487470
## p:(Intercept)  -0.6285992 0.7041731  -2.008779  0.7515802
## p:mixture2      2.1939314 0.5210737   1.172627  3.2152359
## f0:(Intercept) -1.8195909 7.9446459 -17.391097 13.7519150
##
##
## Real Parameter pi
##
##
## mixture:1 0.4275823
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.3478282 0.3478282 0.3478282 0.3478282 0.3478282 0.3478282
## mixture:2 0.8271172 0.8271172 0.8271172 0.8271172 0.8271172 0.8271172
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.3478282 0.3478282 0.3478282 0.3478282 0.3478282
## mixture:2 0.8271172 0.8271172 0.8271172 0.8271172 0.8271172
##
##
## Real Parameter f0
```

```
##
##         1
##  0.162092
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5
## -2lnL:  63.42531
## AICc :  73.92531
##
## Beta
##                  estimate        se        lcl        ucl
## pi:(Intercept) -0.2497437 0.8601161 -1.9355713  1.4360839
## p:(Intercept)   1.8841459 1.3075647 -0.6786809  4.4469727
## p:mixture2     -3.6829942 1.8332438 -7.2761522 -0.0898363
## c:(Intercept)   0.9694005 0.2503915  0.4786331  1.4601680
## f0:(Intercept)  1.7161429 2.5618898 -3.3051612  6.7374470
##
##
## Real Parameter pi
##
##
## mixture:1 0.4378866
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.8680866 0.8680866 0.8680866 0.8680866 0.8680866 0.8680866
## mixture:2 0.1419913 0.1419913 0.1419913 0.1419913 0.1419913 0.1419913
##
##
## Real Parameter c
##
##               2     3     4     5     6
## mixture:1 0.725 0.725 0.725 0.725 0.725
## mixture:2 0.725 0.725 0.725 0.725 0.725
##
##
## Real Parameter f0
##
##        1
##  5.56303
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  9  (unadjusted=8)
## -2lnL:  50.46091
## AICc :  70.01264  (unadjusted=67.691682)
##
## Beta
##                     estimate           se           lcl          ucl
```

```
## pi:(Intercept) -2.294975e-01 6.798557e-01 -1.562015e+00 1.103020e+00
## p:(Intercept)  -1.054117e+00 7.076097e-01 -2.441032e+00 3.327977e-01
## p:time2         8.890450e-01 7.822769e-01 -6.442178e-01 2.422308e+00
## p:time3        -1.105874e+00 7.670462e-01 -2.609284e+00 3.975370e-01
## p:time4         4.061195e-07 7.551235e-01 -1.480042e+00 1.480042e+00
## p:time5         1.212073e+00 8.018799e-01 -3.596114e-01 2.783758e+00
## p:time6         1.212073e+00 8.018799e-01 -3.596113e-01 2.783758e+00
## p:mixture2      2.572072e+00 5.507372e-01  1.492627e+00 3.651517e+00
## f0:(Intercept) -1.597606e+01 2.361958e+04 -4.631035e+04 4.627839e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.4428761
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.2584352 0.4588254 0.1034013 0.2584353 0.5394071 0.5394071
## mixture:2 0.8202371 0.9173595 0.6015868 0.8202372 0.9387755 0.9387755
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.4588254 0.1034013 0.2584353 0.5394071 0.5394071
## mixture:2 0.9173595 0.6015868 0.8202372 0.9387755 0.9387755
##
##
## Real Parameter f0
##
##             1
##  1.152615e-07
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c(~1)f0(~1)
##
## Npar :  10  (unadjusted=5)
## -2lnL:  54.94338
## AICc :  76.85642  (unadjusted=65.443377)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)  -1.8655490 7.440475e+02 -1.460199e+03  1456.467600
## p:(Intercept)    2.9658421 8.484431e+02 -1.659983e+03  1665.914400
## p:time2         -0.3047660 1.712605e+02 -3.359754e+02   335.365890
## p:time3        -18.4937890 3.512534e+03 -6.903061e+03  6866.073400
## p:time4         -1.4439703 1.825813e+02 -3.593034e+02   356.415460
## p:time5         -0.0513809 1.827482e+02 -3.582378e+02   358.135010
## p:time6         37.6356320 1.517070e+04 -2.969693e+04 29772.205000
## p:mixture2      -2.9151676 9.303994e+02 -1.826498e+03  1820.667700
## c:(Intercept)    0.9693998 2.503915e-01  4.786325e-01     1.460167
```

```
## f0:(Intercept) -41.2901840 0.000000e+00 -4.129018e+01   -41.290184
##
##
## Real Parameter pi
##
##
## mixture:1 0.1340576
##
##
## Real Parameter p
##
##                    1         2            3         4         5 6
## mixture:1 0.9510069 0.9346904 1.804257e-07 0.8208139 0.9485567 1
## mixture:2 0.5126659 0.4368167 9.778163e-09 0.1988821 0.4998234 1
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.7249999 0.7249999 0.7249999 0.7249999 0.7249999
## mixture:2 0.7249999 0.7249999 0.7249999 0.7249999 0.7249999
##
##
## Real Parameter f0
##
##             1
##  1.169233e-18
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  8  (unadjusted=6)
## -2lnL:  65.74697
## AICc :  82.97774  (unadjusted=78.452851)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept)  8.810234e-06    0.0000000  8.810234e-06 8.810234e-06
## p:(Intercept)   2.876816e-01    0.4409585 -5.765969e-01 1.151960e+00
## p:time2         6.286093e-01    0.6540473 -6.533234e-01 1.910542e+00
## p:time3        -7.731893e-01    0.6295772 -2.007161e+00 4.607820e-01
## p:time4         5.136668e-07    0.6236093 -1.222274e+00 1.222275e+00
## p:time5         8.754693e-01    0.6759765 -4.494446e-01 2.200383e+00
## p:time6         8.754694e-01    0.6759764 -4.494444e-01 2.200383e+00
## f0:(Intercept) -1.748657e+01 3894.6678000 -7.651036e+03 7.616062e+03
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000022
##
##
## Real Parameter p
```

```
##
##                   1         2         3         4         5         6
## mixture:1 0.5714285 0.7142858 0.3809524 0.5714286 0.7619048 0.7619048
## mixture:2 0.5714285 0.7142858 0.3809524 0.5714286 0.7619048 0.7619048
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.7142858 0.3809524 0.5714286 0.7619048 0.7619048
## mixture:2 0.7142858 0.3809524 0.5714286 0.7619048 0.7619048
##
##
## Real Parameter f0
##
##             1
##  2.544946e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  9  (unadjusted=5)
## -2lnL:  54.94338
## AICc :  74.4951  (unadjusted=65.443377)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept)  2.915097e-05    0.0000000  2.915097e-05 2.915097e-05
## p:(Intercept)   2.876820e-01    0.4409582 -5.765961e-01 1.151960e+00
## p:time2        -5.108258e-01    0.8027722 -2.084259e+00 1.062608e+00
## p:time3        -1.904431e+01 4803.1822000 -9.433282e+03 9.395193e+03
## p:time4        -1.673977e+00    1.2018502 -4.029603e+00 6.816496e-01
## p:time5        -2.876829e-01    1.0929038 -2.429774e+00 1.854408e+00
## p:time6         2.215236e+01 9503.1746000 -1.860407e+04 1.864838e+04
## c:(Intercept)   9.694005e-01    0.2503915  4.786331e-01 1.460168e+00
## f0:(Intercept) -2.304128e+01 9078.8113000 -1.781751e+04 1.777143e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000073
##
##
## Real Parameter p
##
##                   1         2            3         4         5 6
## mixture:1 0.5714285 0.4444444 7.146584e-09 0.1999999 0.4999998 1
## mixture:2 0.5714285 0.4444444 7.146584e-09 0.1999999 0.4999998 1
##
##
## Real Parameter c
##
##               2     3     4     5     6
```

```
## mixture:1 0.725 0.725 0.725 0.725 0.725
## mixture:2 0.725 0.725 0.725 0.725 0.725
##
##
## Real Parameter f0
##
##             1
##  9.846909e-11
```

Et on inspecte les résultats.

```
mouse.results
```

```
##                                 model npar     AICc DeltaAICc       weight
## 5   pi(~1)p(~time + mixture)c()f0(~1)    9 70.01264  0.000000 0.5912507181
## 3          pi(~1)p(~mixture)c()f0(~1)    4 72.24101  2.228371 0.1940380875
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 73.92531  3.912674 0.0835882720
## 8           pi(~1)p(~time)c(~1)f0(~1)    9 74.49510  4.482464 0.0628661683
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 75.09858  5.085942 0.0464914752
## 6 pi(~1)p(~time + mixture)c(~1)f0(~1)   10 76.85642  6.843783 0.0193046980
## 1                pi(~1)p(~1)c()f0(~1)    3 81.89285 11.880212 0.0015560243
## 7             pi(~1)p(~time)c()f0(~1)    8 82.97774 12.965101 0.0009045566
##   Deviance
## 5 41.07713
## 3 54.52665
## 4 54.04153
## 8 45.55960
## 2 57.38422
## 6 45.55960
## 1 66.31235
## 7 56.36319
```

Les noms des modèles.

```
names(mouse.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

On examine les résultats obtenus selon le meilleur modèle (#5).

```
mouse.results$p.h.time$results$real
```

```
##                 estimate        se          lcl          ucl fixed note
## pi g1 m1    4.428761e-01 0.1677455 1.733578e-01 0.7508255000
## p g1 t1 m1  2.584352e-01 0.1356109 8.009680e-02 0.5824399000
## p g1 t2 m1  4.588254e-01 0.1689821 1.825840e-01 0.7629268000
## p g1 t3 m1  1.034013e-01 0.0672791 2.705750e-02 0.3235244000
## p g1 t4 m1  2.584353e-01 0.1356110 8.009680e-02 0.5824401000
## p g1 t5 m1  5.394071e-01 0.1691684 2.356615e-01 0.8164572000
## p g1 t6 m1  5.394071e-01 0.1691684 2.356615e-01 0.8164571000
```

```
## p g1 t1 m2  8.202371e-01 0.1135911 5.020026e-01 0.9538187000
## p g1 t2 m2  9.173595e-01 0.0623667 6.888153e-01 0.9823535000
## p g1 t3 m2  6.015868e-01 0.1590736 2.913670e-01 0.8472142000
## p g1 t4 m2  8.202372e-01 0.1135911 5.020026e-01 0.9538188000
## p g1 t5 m2  9.387755e-01 0.0482113 7.476215e-01 0.9875572000
## p g1 t6 m2  9.387755e-01 0.0482113 7.476214e-01 0.9875572000
## f0 g1 a0 t1 1.152615e-07 0.0027224 1.744444e-11 0.0007615736
```

```
mouse.results$p.h.time$results$derived
```

```
## $`N Population Size`
##   estimate lcl      ucl
## 1       21  21 21.00076
```

On procède de même pour les femelles.

```
mouse.proc <- process.data(mouseF,
                           begin.time = 1,
                           model = "FullHet")
mouse.ddl <- make.design.data(mouse.proc)
```

La liste des modèles.

```
run.mouse <- function() {

  # sans l'effet sexe
  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ mixture + time)

  mouse.model.list <- create.model.list("FullHet")

  mouse.results <- mark.wrapper(mouse.model.list,
                                data = mouse.proc,
                                ddl = mouse.ddl)

  return(mouse.results)
}
```

On lance Mark.

```
mouse.results <- run.mouse()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
```

```
## Npar :  3
## -2lnL:  70.33432
## AICc :  76.57922
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept) -2.118889e-05 0.0000000 -2.118889e-05 -2.118889e-05
## p:(Intercept)  -4.302319e-01 0.2268952 -8.749465e-01  1.448270e-02
## f0:(Intercept) -1.077744e+00 3.2711826 -7.489262e+00  5.333774e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999947
##
##
## Real Parameter p
##
##                  1        2        3        4        5        6
## mixture:1 0.394071 0.394071 0.394071 0.394071 0.394071 0.394071
## mixture:2 0.394071 0.394071 0.394071 0.394071 0.394071 0.394071
##
##
## Real Parameter c
##
##                  2        3        4        5        6
## mixture:1 0.394071 0.394071 0.394071 0.394071 0.394071
## mixture:2 0.394071 0.394071 0.394071 0.394071 0.394071
##
##
## Real Parameter f0
##
##          1
##  0.3403626
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  68.40103
## AICc :  76.8134  (unadjusted=74.645923)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  8.912229e-06 2508.3000000 -4916.2681000 4916.2682000
## p:(Intercept)  -1.006540e+00    0.5819543    -2.1471705    0.1340902
## c:(Intercept)  -2.231435e-01    0.2738613    -0.7599116    0.3136246
## f0:(Intercept)  9.499844e-01    1.5239208    -2.0369004    3.9368693
##
##
## Real Parameter pi
##
##
```

```
## mixture:1 0.5000022
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575
## mixture:2 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.4444445 0.4444445 0.4444445 0.4444445 0.4444445
## mixture:2 0.4444445 0.4444445 0.4444445 0.4444445 0.4444445
##
##
## Real Parameter f0
##
##         1
##  2.585669
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  69.88198
## AICc :  78.29435
##
## Beta
##                   estimate        se       lcl       ucl
## pi:(Intercept) -0.7074661 2.7619388 -6.120866 4.7059341
## p:(Intercept)   0.2046782 1.0008646 -1.757016 2.1663728
## p:mixture2     -1.0885035 0.8765198 -2.806482 0.6294753
## f0:(Intercept)  0.0850406 2.0866774 -4.004847 4.1749284
##
##
## Real Parameter pi
##
##
## mixture:1 0.330159
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.5509917 0.5509917 0.5509917 0.5509917 0.5509917 0.5509917
## mixture:2 0.2923857 0.2923857 0.2923857 0.2923857 0.2923857 0.2923857
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.5509917 0.5509917 0.5509917 0.5509917 0.5509917
```

```
## mixture:2 0.2923857 0.2923857 0.2923857 0.2923857 0.2923857
##
##
## Real Parameter f0
##
##         1
##  1.088761
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=4)
## -2lnL:  68.40103
## AICc :  79.02603  (unadjusted=76.813396)
##
## Beta
##                      estimate        se        lcl        ucl
## pi:(Intercept) -3.332600e-03 0.0000000 -0.0033326 -0.0033326
## p:(Intercept)  -1.006540e+00 0.8526169 -2.6776692  0.6645893
## p:mixture2     -1.058693e-06 1.2441785 -2.4385910  2.4385889
## c:(Intercept)  -2.231436e-01 0.2738613 -0.7599118  0.3136245
## f0:(Intercept)  9.499851e-01 1.5239209 -2.0368999  3.9368700
##
##
## Real Parameter pi
##
##
## mixture:1 0.4991668
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575 0.2676575
## mixture:2 0.2676573 0.2676573 0.2676573 0.2676573 0.2676573 0.2676573
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.4444444 0.4444444 0.4444444 0.4444444 0.4444444
## mixture:2 0.4444444 0.4444444 0.4444444 0.4444444 0.4444444
##
##
## Real Parameter f0
##
##         1
##  2.585671
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  9
## -2lnL:  62.12122
```

```
## AICc :  82.07774
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept) -0.7417541 2.0079703 -4.6773759 3.1938677
## p:(Intercept)  -0.8527038 1.0601427 -2.9305836 1.2251760
## p:time2         0.7040747 0.8546605 -0.9710600 2.3792094
## p:time3         1.5054187 0.8304248 -0.1222140 3.1330514
## p:time4         1.2546837 0.8331167 -0.3782250 2.8875925
## p:time5         1.7491637 0.8315546  0.1193166 3.3790108
## p:time6         1.7491637 0.8315546  0.1193166 3.3790108
## p:mixture2     -1.3140920 0.8181664 -2.9176983 0.2895142
## f0:(Intercept)  0.0661258 2.0573181 -3.9662178 4.0984694
##
##
## Real Parameter pi
##
##
## mixture:1 0.3226207
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6
## mixture:1 0.2988660 0.4629110 0.6576220 0.5991633 0.7102215 0.7102215
## mixture:2 0.1027721 0.1880515 0.3404303 0.2865678 0.3970835 0.3970835
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.4629110 0.6576220 0.5991633 0.7102215 0.7102215
## mixture:2 0.1880515 0.3404303 0.2865678 0.3970835 0.3970835
##
##
## Real Parameter f0
##
##         1
##  1.068361
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  10  (unadjusted=6)
## -2lnL:  61.55523
## AICc :  83.97281  (unadjusted=74.439437)
##
## Beta
##                    estimate           se           lcl           ucl
## pi:(Intercept)   0.2277595    0.0000000  2.277595e-01     0.2277595
## p:(Intercept)   -3.5693315    0.0000000 -3.569332e+00    -3.5693315
## p:mixture2       3.0098636  208.8920700 -4.064186e+02   412.4383400
## p:time2          1.2398689  136.0908200 -2.654982e+02   267.9778800
## p:time3          3.6940254  162.1341200 -3.140889e+02   321.4769100
```

```
## p:time4          3.5384735    0.0000000  3.538473e+00     3.5384735
## p:time5          3.5664055    0.0000000  3.566406e+00     3.5664055
## p:time6         21.3970720 7267.9418000 -1.422377e+04 14266.5630000
## c:(Intercept)   -0.2231406    0.2738612 -7.599086e-01     0.3136273
## f0:(Intercept) -19.2944580 3614.2217000 -7.103169e+03  7064.5803000
##
##
## Real Parameter pi
##
##
## mixture:1 0.556695
##
##
## Real Parameter p
##
##                    1         2         3         4         5 6
## mixture:1 0.0274026 0.0887121 0.5311331 0.4922861 0.4992685 1
## mixture:2 0.3636706 0.6638282 0.9582959 0.9516166 0.9528866 1
##
##
## Real Parameter c
##
##                    2         3         4         5         6
## mixture:1 0.4444452 0.4444452 0.4444452 0.4444452 0.4444452
## mixture:2 0.4444452 0.4444452 0.4444452 0.4444452 0.4444452
##
##
## Real Parameter f0
##
##             1
##  4.173722e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  8  (unadjusted=7)
## -2lnL:  62.94848
## AICc :  80.49687  (unadjusted=78.139968)
##
## Beta
##                       estimate          se           lcl          ucl
## pi:(Intercept) -1.541584e-05 847.9657000 -1662.0128000 1662.0128000
## p:(Intercept)  -1.554469e+00   0.6394800    -2.8078502   -0.3010885
## p:time2         6.626578e-01   0.8281837    -0.9605824    2.2858979
## p:time3         1.414955e+00   0.7993850    -0.1518399    2.9817495
## p:time4         1.178215e+00   0.8034178    -0.3964839    2.7529139
## p:time5         1.647837e+00   0.7997695     0.0802891    3.2153858
## p:time6         1.647838e+00   0.7997696     0.0802891    3.2153859
## f0:(Intercept) -1.620887e+00   5.1619212   -11.7382530    8.4964791
##
##
## Real Parameter pi
##
##
```

```
## mixture:1 0.4999961
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6
## mixture:1 0.1744417 0.2907361 0.4651778 0.4070306 0.5233251 0.5233251
## mixture:2 0.1744417 0.2907361 0.4651778 0.4070306 0.5233251 0.5233251
##
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.2907361 0.4651778 0.4070306 0.5233251 0.5233251
## mixture:2 0.2907361 0.4651778 0.4070306 0.5233251 0.5233251
##
##
## Real Parameter f0
##
##          1
##  0.1977233
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  9  (unadjusted=6)
## -2lnL:  61.55523
## AICc :  81.51175  (unadjusted=74.439437)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -1.309811e-05  638.5437300 -1.251546e+03  1251.5457000
## p:(Intercept)  -1.540444e+00    0.6362087 -2.787413e+00    -0.2934747
## p:time2         6.241523e-01    0.8687703 -1.078637e+00     2.3269420
## p:time3         1.945909e+00    0.9063267  1.695081e-01     3.7223088
## p:time4         1.540444e+00    1.1852261 -7.825997e-01     3.8634866
## p:time5         1.540444e+00    1.5507286 -1.498984e+00     4.5798722
## p:time6         2.088823e+01 9451.3036000 -1.850367e+04 18545.4440000
## c:(Intercept)  -2.231436e-01    0.2738613 -7.599117e-01     0.3136245
## f0:(Intercept) -1.926863e+01 3383.5502000 -6.651027e+03  6612.4899000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999967
##
##
## Real Parameter p
##
##                   1         2         3         4         5 6
## mixture:1 0.1764708 0.2857141 0.5999999 0.4999999 0.5000001 1
## mixture:2 0.1764708 0.2857141 0.5999999 0.4999999 0.5000001 1
##
```

```
##
## Real Parameter c
##
##                   2         3         4         5         6
## mixture:1 0.4444444 0.4444444 0.4444444 0.4444444 0.4444444
## mixture:2 0.4444444 0.4444444 0.4444444 0.4444444 0.4444444
##
##
## Real Parameter f0
##
##             1
##  4.282908e-09
```

Et on inspecte les résultats.

```
mouse.results
```

```
##                                 model npar     AICc DeltaAICc      weight
## 1               pi(~1)p(~1)c()f0(~1)    3 76.57922 0.0000000 0.342157625
## 2             pi(~1)p(~1)c(~1)f0(~1)    4 76.81340 0.2341782 0.304351242
## 3          pi(~1)p(~mixture)c()f0(~1)    4 78.29435 1.7151332 0.145140891
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 79.02603 2.4468070 0.100672030
## 7            pi(~1)p(~time)c()f0(~1)    8 80.49687 3.9176471 0.048252515
## 8          pi(~1)p(~time)c(~1)f0(~1)    9 81.51175 4.9325298 0.029049656
## 5   pi(~1)p(~time + mixture)c()f0(~1)    9 82.07774 5.4985248 0.021889545
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   10 83.97281 7.3935905 0.008486497
##   Deviance
## 1 46.56039
## 2 44.62709
## 3 46.10805
## 4 44.62709
## 7 39.17455
## 8 37.78130
## 5 38.34729
## 6 37.78130
```

Les noms des modèles.

```
names(mouse.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

On examine les résultats obtenus selon le meilleur modèle (#1).

```
mouse.results$p.dot$results$real
```

```
##              estimate        se       lcl       ucl fixed note
## pi g1 m1    0.4999947 0.0000000 0.4999947 0.4999947
## p g1 t1 m1  0.3940710 0.0541778 0.2942261 0.5036206
## f0 g1 a0 t1 0.3403626 1.1133883 0.0157383 7.3608345
```

```
mouse.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 17.34036 17.01574 24.36083
```

Analyse avec un effet sexe

Il est un peu dommage de séparer mâles et femelles en deux analyses séparées. En effet, on pourrait vouloir tester un effet sexe sur la probabilité de détection. On reprend l'analyse en considérant le jeu de données dans son entier.

```
mouse <- convert.inp("dat/deer-mouse-sex2G-MF.inp",
                     group.df = data.frame(sex = c("M","F")),
                     covariates = NULL)
head(mouse)
```

```
##         ch freq sex
## 1:1 111111    1   M
## 1:3 110011    1   M
## 1:4 110111    1   M
## 1:5 111111    1   M
## 1:6 110111    1   M
## 1:7 111110    1   M
```

```
tail(mouse)
```

```
##          ch freq sex
## 2:28 001010    1   F
## 2:29 001000    1   F
## 2:30 000100    1   F
## 2:32 000110    1   F
## 2:34 000010    1   F
## 2:38 000001    1   F
```

On passe à la définition des modèles maintenant. On commence par préparer les données. On utilise l'option "groups =”sex"" pour préciser qu'on va considérer des modèles avec l'effet sexe.

```
mouse.proc <- process.data(mouse,
                           begin.time = 1,
                           model = "FullHet",
                           groups = "sex")
mouse.ddl <- make.design.data(mouse.proc)
```

La liste des modèles. Ce sont les mêmes qu'au-dessus, auxquels on a ajouté d'autres modèles avec l'effet sexe.

```
run.mouse <- function() {

  # sans l'effet sexe
  p.dot <- list(formula =  ~ 1, share = TRUE)
```

```
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ mixture + time)

  # avec l'effet sexe
  p.sex <- list(formula =  ~ sex, share = TRUE)
  p.sex.behav <- list(formula =  ~ sex)
  p.time.sex <- list(formula =  ~ time + sex, share = TRUE)
  p.time.behav.sex <- list(formula =  ~ sex + time)
  p.h.sex <- list(formula = ~ mixture + sex, share = TRUE)
  p.h.behav.sex <- list(formula =  ~ sex + mixture)
  p.h.time.sex <- list(formula = ~ time + mixture + sex, share = TRUE)
  p.h.time.behav.sex <- list(formula =  ~ sex + time + mixture)

  mouse.model.list <- create.model.list("FullHet")

  mouse.results <- mark.wrapper(mouse.model.list,
                                data = mouse.proc,
                                ddl = mouse.ddl)

  return(mouse.results)
}
```

On fait tourner tous ces modèles, et on inspecte le classement.

```
mouse.results <- run.mouse()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=1)
## -2lnL:  157.6728
## AICc :  163.78  (unadjusted=159.69052)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept)  2.888803e-04 0.0000000  2.888803e-04  2.888803e-04
## p:(Intercept)   1.053605e-01 0.1326371 -1.546081e-01  3.653292e-01
## f0:(Intercept) -2.349739e+01 0.0000000 -2.349739e+01 -2.349739e+01
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000722
##
## Group:sexM
##
```

```
## mixture:1 0.5000722
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
## mixture:2 0.5263158 0.5263158 0.5263158 0.5263158 0.5263158
##
##
## Real Parameter f0
## Group:sexF
##             1
##  6.240408e-11
##
## Group:sexM
##             1
##  6.240408e-11
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  147.5555
## AICc :  155.7349  (unadjusted=153.66264)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  7.735690e-06 1448.1666000 -2838.4067000 2838.4067000
## p:(Intercept)  -5.331237e-01    0.3104181    -1.1415431    0.0752957
## c:(Intercept)   4.554755e-01    0.1772735     0.1080195    0.8029316
## f0:(Intercept) -3.145496e-01    1.7272199    -3.6999006    3.0708014
##
##
## Real Parameter pi
## Group:sexF
##
```

```
## mixture:1 0.5000019
##
## Group:sexM
##
## mixture:1 0.5000019
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3697886 0.3697886 0.3697886 0.3697886 0.3697886 0.3697886
## mixture:2 0.3697886 0.3697886 0.3697886 0.3697886 0.3697886 0.3697886
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.3697886 0.3697886 0.3697886 0.3697886 0.3697886 0.3697886
## mixture:2 0.3697886 0.3697886 0.3697886 0.3697886 0.3697886 0.3697886
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
## Group:sexF
##          1
##  0.7301176
##
## Group:sexM
##          1
##  0.7301176
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  142.225
## AICc :  150.4043
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept)  0.4152349 0.6397357 -0.8386471 1.6691169
## p:(Intercept)  -0.7271258 0.4231274 -1.5564554 0.1022039
## p:mixture2      2.0499907 0.3936868  1.2783646 2.8216168
## f0:(Intercept) -0.5151934 1.9306852 -4.2993366 3.2689497
##
```

```
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.6023424
##
## Group:sexM
##
## mixture:1 0.6023424
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3258258 0.3258258 0.3258258 0.3258258 0.3258258 0.3258258
## mixture:2 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.3258258 0.3258258 0.3258258 0.3258258 0.3258258 0.3258258
## mixture:2 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.3258258 0.3258258 0.3258258 0.3258258 0.3258258
## mixture:2 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.3258258 0.3258258 0.3258258 0.3258258 0.3258258
## mixture:2 0.7896580 0.7896580 0.7896580 0.7896580 0.7896580
##
##
## Real Parameter f0
## Group:sexF
##         1
##  0.597385
##
## Group:sexM
##         1
##  0.597385
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=4)
## -2lnL:  147.5555
## AICc :  157.8258  (unadjusted=155.73487)
##
## Beta
##                       estimate        se         lcl        ucl
## pi:(Intercept) -4.252234e+00 0.0000000  -4.2522338 -4.2522338
```

```
## p:(Intercept)  -5.331221e-01 4.9485485 -10.2322770  9.1660332
## p:mixture2     -5.697270e-07 5.0090916  -9.8178203  9.8178191
## c:(Intercept)   4.554755e-01 0.1772735   0.1080195  0.8029316
## f0:(Intercept) -3.145579e-01 1.7272293  -3.6999275  3.0708116
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.0140327
##
## Group:sexM
##
## mixture:1 0.0140327
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3697890 0.3697890 0.3697890 0.3697890 0.3697890 0.3697890
## mixture:2 0.3697889 0.3697889 0.3697889 0.3697889 0.3697889 0.3697889
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.3697890 0.3697890 0.3697890 0.3697890 0.3697890 0.3697890
## mixture:2 0.3697889 0.3697889 0.3697889 0.3697889 0.3697889 0.3697889
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
## Group:sexF
##          1
##  0.7301116
##
## Group:sexM
##          1
##  0.7301116
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex + mixture)c(~1)f0(~1)
##
## Npar :  6  (unadjusted=5)
## -2lnL:  146.6121
```

```
## AICc :  158.9921  (unadjusted=156.88232)
##
## Beta
##                       estimate        se        lcl        ucl
## pi:(Intercept) -3.073308e+00 0.0000000 -3.0733079 -3.0733079
## p:(Intercept)  -7.199033e-01 3.4118536 -7.4071366  5.9673300
## p:sexM          3.998280e-01 0.4141434 -0.4118931  1.2115491
## p:mixture2      2.234522e-05 3.5496712 -6.9573334  6.9573781
## c:(Intercept)   4.554755e-01 0.1772735  0.1080195  0.8029316
## f0:(Intercept) -4.253530e-01 1.8511928 -4.0536910  3.2029850
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.0442218
##
## Group:sexM
##
## mixture:1 0.0442218
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3274143 0.3274143 0.3274143 0.3274143 0.3274143 0.3274143
## mixture:2 0.3274192 0.3274192 0.3274192 0.3274192 0.3274192 0.3274192
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.4206574 0.4206574 0.4206574 0.4206574 0.4206574 0.4206574
## mixture:2 0.4206628 0.4206628 0.4206628 0.4206628 0.4206628 0.4206628
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
## Group:sexF
##         1
##  0.653539
##
## Group:sexM
##         1
##  0.653539
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + sex)c()f0(~1)
##
## Npar :  5
## -2lnL:  136.9887
## AICc :  147.2589
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept)  0.8595293 0.6488561 -0.4122287 2.1312873
## p:(Intercept)  -0.2402765 0.3895832 -1.0038595 0.5233064
## p:mixture2     -2.6445015 1.5398840 -5.6626743 0.3736712
## p:sexM          1.3318665 0.4291950  0.4906444 2.1730886
## f0:(Intercept)  1.0300692 1.9350746 -2.7626771 4.8228154
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.7025623
##
## Group:sexM
##
## mixture:1 0.7025623
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182
## mixture:2 0.0529112 0.0529112 0.0529112 0.0529112 0.0529112 0.0529112
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.7486810 0.7486810 0.7486810 0.7486810 0.7486810 0.7486810
## mixture:2 0.1746661 0.1746661 0.1746661 0.1746661 0.1746661 0.1746661
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.4402182 0.4402182 0.4402182 0.4402182 0.4402182
## mixture:2 0.0529112 0.0529112 0.0529112 0.0529112 0.0529112
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.7486810 0.7486810 0.7486810 0.7486810 0.7486810
## mixture:2 0.1746661 0.1746661 0.1746661 0.1746661 0.1746661
##
##
## Real Parameter f0
## Group:sexF
##        1
```

```
##  2.80126
##
## Group:sexM
##        1
##  2.80126
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  9
## -2lnL:  130.1122
## AICc :  148.9379
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -0.3903998 0.5954139 -1.5574110  0.7766115
## p:(Intercept)   0.7291667 0.5906038 -0.4284167  1.8867502
## p:time2         0.6856501 0.5287544 -0.3507086  1.7220087
## p:time3         0.1412204 0.5316899 -0.9008918  1.1833326
## p:time4         0.5517951 0.5286141 -0.4842886  1.5878789
## p:time5         1.3531225 0.5386833  0.2973033  2.4089418
## p:time6         1.3531225 0.5386833  0.2973032  2.4089417
## p:mixture2     -2.1869349 0.4019846 -2.9748248 -1.3990450
## f0:(Intercept) -0.7217380 2.2059104 -5.0453225  3.6018466
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4036211
##
## Group:sexM
##
## mixture:1 0.4036211
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5         6
## mixture:1 0.6746224 0.8045246 0.7048262 0.7826135 0.8891698 0.8891698
## mixture:2 0.1888089 0.3160211 0.2113932 0.2878246 0.4738624 0.4738624
##
## Group:sexM
##                    1         2         3         4         5         6
## mixture:1 0.6746224 0.8045246 0.7048262 0.7826135 0.8891698 0.8891698
## mixture:2 0.1888089 0.3160211 0.2113932 0.2878246 0.4738624 0.4738624
##
##
## Real Parameter c
## Group:sexF
##                    2         3         4         5         6
## mixture:1 0.8045246 0.7048262 0.7826135 0.8891698 0.8891698
## mixture:2 0.3160211 0.2113932 0.2878246 0.4738624 0.4738624
##
```

```
## Group:sexM
##                    2         3         4         5         6
## mixture:1 0.8045246 0.7048262 0.7826135 0.8891698 0.8891698
## mixture:2 0.3160211 0.2113932 0.2878246 0.4738624 0.4738624
##
##
## Real Parameter f0
## Group:sexF
##         1
##  0.485907
##
## Group:sexM
##         1
##  0.485907
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  10  (unadjusted=6)
## -2lnL:  141.8872
## AICc :  162.901  (unadjusted=154.26727)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept)  -3.4458469 1.247166e+02 -2.478904e+02   240.9987600
## p:(Intercept)    3.6627429 0.000000e+00  3.662743e+00     3.6627429
## p:mixture2      -4.1682254 0.000000e+00 -4.168225e+00    -4.1682254
## p:time2         -0.1267000 1.241351e+01 -2.445717e+01    24.2037700
## p:time3          0.0998333 1.274513e+01 -2.488063e+01    25.0802980
## p:time4         -0.1877683 1.267362e+01 -2.502806e+01    24.6525190
## p:time5          0.5054407 1.267366e+01 -2.433493e+01    25.3458120
## p:time6         22.9770600 1.788800e+04 -3.503751e+04 35083.4650000
## c:(Intercept)    0.4554841 1.772737e-01  1.080277e-01     0.8029405
## f0:(Intercept) -21.0784230 5.622759e+03 -1.104169e+04 10999.5290000
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.030893
##
## Group:sexM
##
## mixture:1 0.030893
##
##
## Real Parameter p
## Group:sexF
##                    1         2         3         4         5 6
## mixture:1 0.9749800 0.9716961 0.9773033 0.9699673 0.9847556 1
## mixture:2 0.3762531 0.3470158 0.3999558 0.3333103 0.4999895 1
##
## Group:sexM
##                    1         2         3         4         5 6
```

```
## mixture:1 0.9749800 0.9716961 0.9773033 0.9699673 0.9847556 1
## mixture:2 0.3762531 0.3470158 0.3999558 0.3333103 0.4999895 1
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119423 0.6119423 0.6119423 0.6119423 0.6119423
## mixture:2 0.6119423 0.6119423 0.6119423 0.6119423 0.6119423
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119423 0.6119423 0.6119423 0.6119423 0.6119423
## mixture:2 0.6119423 0.6119423 0.6119423 0.6119423 0.6119423
##
##
## Real Parameter f0
## Group:sexF
##             1
##  7.010631e-10
##
## Group:sexM
##             1
##  7.010631e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex + time + mixture)c(~1)f0(~1)
##
## Npar :  11  (unadjusted=7)
## -2lnL:  141.1712
## AICc :  164.3934  (unadjusted=155.68027)
##
## Beta
##                     estimate           se           lcl           ucl
## pi:(Intercept) -14.3107360 0.000000e+00 -1.431074e+01   -14.3107360
## p:(Intercept)    0.4107473 0.000000e+00  4.107473e-01     0.4107473
## p:sexM           0.3745848 4.435507e-01 -4.947746e-01     1.2439441
## p:time2         -0.1419029 5.558616e-01 -1.231392e+00     0.9475859
## p:time3          0.1050510 6.332038e-01 -1.136028e+00     1.3461304
## p:time4         -0.2689025 7.841455e-01 -1.805828e+00     1.2680227
## p:time5          0.3881638 8.858543e-01 -1.348111e+00     2.1244382
## p:time6         32.4815240 1.288209e+04 -2.521642e+04 25281.3800000
## p:mixture2      -1.0489579 0.000000e+00 -1.048958e+00    -1.0489579
## c:(Intercept)    0.4554755 1.772735e-01  1.080194e-01     0.8029316
## f0:(Intercept) -25.7032700 1.460648e+04 -2.865441e+04 28603.0030000
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 6.094332e-07
##
## Group:sexM
##
```

```
## mixture:1 6.094332e-07
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5 6
## mixture:1 0.6012670 0.5668092 0.6261647 0.5354019 0.6897415 1
## mixture:2 0.3456511 0.3142954 0.3697802 0.2875909 0.4378120 1
##
## Group:sexM
##                   1         2         3         4         5 6
## mixture:1 0.6868281 0.6555282 0.7089692 0.6263125 0.7637763 1
## mixture:2 0.4344726 0.3999847 0.4604391 0.3699274 0.5310943 1
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
## Group:sexF
##             1
##  6.874037e-12
##
## Group:sexM
##             1
##  6.874037e-12
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture + sex)c()f0(~1)
##
## Npar :  10
## -2lnL:  125.3031
## AICc :  146.3169
##
## Beta
##                   estimate        se        lcl       ucl
## pi:(Intercept)  0.8562571 0.6675071 -0.4520568 2.1645710
## p:(Intercept)  -0.8381400 0.6738122 -2.1588120 0.4825319
## p:time2         0.6470857 0.5129322 -0.3582614 1.6524328
## p:time3         0.1318701 0.5137406 -0.8750615 1.1388017
## p:time4         0.5190745 0.5121578 -0.4847548 1.5229038
## p:time5         1.3006929 0.5277913  0.2662220 2.3351638
## p:time6         1.3006930 0.5277913  0.2662221 2.3351640
## p:mixture2     -2.5544269 1.9136054 -6.3050936 1.1962398
## p:sexM          1.3736220 0.5177310  0.3588692 2.3883748
```

```
## f0:(Intercept)  0.7154286 2.5700990 -4.3219655 5.7528227
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.7018781
##
## Group:sexM
##
## mixture:1 0.7018781
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3019267 0.4523812 0.3304236 0.4209035 0.6136196 0.6136196
## mixture:2 0.0325286 0.0603424 0.0369444 0.0534796 0.1098891 0.1098891
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.6307608 0.7654092 0.6609100 0.7416489 0.8624957 0.8624957
## mixture:2 0.1172281 0.2023196 0.1315784 0.1824448 0.3277780 0.3277780
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.4523812 0.3304236 0.4209035 0.6136196 0.6136196
## mixture:2 0.0603424 0.0369444 0.0534796 0.1098891 0.1098891
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.7654092 0.6609100 0.7416489 0.8624957 0.8624957
## mixture:2 0.2023196 0.1315784 0.1824448 0.3277780 0.3277780
##
##
## Real Parameter f0
## Group:sexF
##         1
##  2.045063
##
## Group:sexM
##         1
##  2.045063
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  146.1409
## AICc :  154.3203  (unadjusted=150.19425)
##
## Beta
```

```
##                      estimate           se           lcl          ucl
## pi:(Intercept) -1.426573e-04  560.9479100 -1099.4581000 1099.4578000
## p:(Intercept)  -3.973018e-01    0.2019497    -0.7931232   -0.0014803
## p:sexM          9.166020e-01    0.2733469     0.3808421    1.4523618
## f0:(Intercept) -1.640767e+01 2842.2371000 -5587.1925000 5554.3771000
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999643
##
## Group:sexM
##
## mixture:1 0.4999643
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608
## mixture:2 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
## mixture:2 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608
## mixture:2 0.4019608 0.4019608 0.4019608 0.4019608 0.4019608
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
## mixture:2 0.6269841 0.6269841 0.6269841 0.6269841 0.6269841
##
##
## Real Parameter f0
## Group:sexF
##             1
##  7.485801e-08
##
## Group:sexM
##             1
##  7.485801e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=4)
```

```
## -2lnL:  146.6121
## AICc :  156.8823  (unadjusted=154.79143)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept)  8.103753e-06 0.0000000  8.103753e-06  8.103753e-06
## p:(Intercept)  -7.198825e-01 0.3614799 -1.428383e+00 -1.138180e-02
## p:sexM          3.998279e-01 0.4141435 -4.118933e-01  1.211549e+00
## c:(Intercept)   4.554755e-01 0.1772735  1.080195e-01  8.029316e-01
## f0:(Intercept) -4.253466e-01 1.8511767 -4.053653e+00  3.202960e+00
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.500002
##
## Group:sexM
##
## mixture:1 0.500002
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.3274189 0.3274189 0.3274189 0.3274189 0.3274189 0.3274189
## mixture:2 0.3274189 0.3274189 0.3274189 0.3274189 0.3274189 0.3274189
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625
## mixture:2 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625 0.4206625
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
## Group:sexF
##          1
##  0.6535433
##
## Group:sexM
##          1
##  0.6535433
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  8  (unadjusted=6)
## -2lnL:  147.8409
## AICc :  164.4985  (unadjusted=160.22102)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept)   0.00013509    0.0000000  1.350900e-04 1.350900e-04
## p:(Intercept)   -0.42744420    0.3318808 -1.077931e+00 2.230422e-01
## p:time2          0.53280500    0.4644355 -3.774886e-01 1.443099e+00
## p:time3          0.10899000    0.4670112 -8.063520e-01 1.024332e+00
## p:time4          0.42744420    0.4641207 -4.822324e-01 1.337121e+00
## p:time5          1.08137090    0.4765165  1.473985e-01 2.015343e+00
## p:time6          1.08137110    0.4765165  1.473988e-01 2.015344e+00
## f0:(Intercept) -16.32750800 2484.5685000 -4.886082e+03 4.853427e+03
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000338
##
## Group:sexM
##
## mixture:1 0.5000338
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3   4         5         6
## mixture:1 0.3947368 0.5263158 0.4210525 0.5 0.6578948 0.6578948
## mixture:2 0.3947368 0.5263158 0.4210525 0.5 0.6578948 0.6578948
##
## Group:sexM
##                   1         2         3   4         5         6
## mixture:1 0.3947368 0.5263158 0.4210525 0.5 0.6578948 0.6578948
## mixture:2 0.3947368 0.5263158 0.4210525 0.5 0.6578948 0.6578948
##
##
## Real Parameter c
## Group:sexF
##                   2         3   4         5         6
## mixture:1 0.5263158 0.4210525 0.5 0.6578948 0.6578948
## mixture:2 0.5263158 0.4210525 0.5 0.6578948 0.6578948
##
## Group:sexM
##                   2         3   4         5         6
## mixture:1 0.5263158 0.4210525 0.5 0.6578948 0.6578948
## mixture:2 0.5263158 0.4210525 0.5 0.6578948 0.6578948
##
##
```

```
## Real Parameter f0
## Group:sexF
##             1
##  8.110611e-08
##
## Group:sexM
##             1
##  8.110611e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  9  (unadjusted=6)
## -2lnL:  141.8872
## AICc :  160.7129  (unadjusted=154.26727)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  1.612282e-04 0.000000e+00  1.612282e-04 1.612282e-04
## p:(Intercept)  -4.274441e-01 3.318808e-01 -1.077930e+00 2.230424e-01
## p:time2        -2.011647e-01 5.493737e-01 -1.277937e+00 8.756077e-01
## p:time3         2.197900e-02 6.228342e-01 -1.198776e+00 1.242734e+00
## p:time4        -2.657031e-01 7.811175e-01 -1.796693e+00 1.265287e+00
## p:time5         4.274438e-01 8.813690e-01 -1.300040e+00 2.154927e+00
## p:time6         2.277681e+01 0.000000e+00  2.277681e+01 2.277681e+01
## c:(Intercept)   4.554756e-01 1.772735e-01  1.080195e-01 8.029316e-01
## f0:(Intercept) -2.181431e+01 1.196392e+04 -2.347109e+04 2.342746e+04
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000403
##
## Group:sexM
##
## mixture:1 0.5000403
##
##
## Real Parameter p
## Group:sexF
##                   1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333333 0.4999999 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333333 0.4999999 1
##
## Group:sexM
##                   1         2   3         4         5 6
## mixture:1 0.3947368 0.3478261 0.4 0.3333333 0.4999999 1
## mixture:2 0.3947368 0.3478261 0.4 0.3333333 0.4999999 1
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
```

```
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
## Group:sexF
##            1
##  3.35866e-10
##
## Group:sexM
##            1
##  3.35866e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~sex + time)c(~1)f0(~1)
##
## Npar :  10  (unadjusted=7)
## -2lnL:  141.1712
## AICc :  162.185  (unadjusted=155.68027)
##
## Beta
##                      estimate           se           lcl          ucl
## pi:(Intercept)  2.860366e-04 7.905772e+03 -1.549531e+04 1.549531e+04
## p:(Intercept)  -6.382093e-01 4.191034e-01 -1.459652e+00 1.832333e-01
## p:sexM          3.745848e-01 4.435508e-01 -4.947748e-01 1.243944e+00
## p:time2        -1.419031e-01 5.558625e-01 -1.231394e+00 9.475874e-01
## p:time3         1.050502e-01 6.332039e-01 -1.136029e+00 1.346130e+00
## p:time4        -2.689041e-01 7.841470e-01 -1.805832e+00 1.268024e+00
## p:time5         3.881619e-01 8.858604e-01 -1.348125e+00 2.124448e+00
## p:time6         2.063352e+01 8.257030e+04 -1.618171e+05 1.618584e+05
## c:(Intercept)   4.554756e-01 1.772735e-01  1.080195e-01 8.029317e-01
## f0:(Intercept) -1.958278e+01 5.099413e+03 -1.001443e+04 9.975267e+03
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.5000715
##
## Group:sexM
##
## mixture:1 0.5000715
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5 6
## mixture:1 0.3456514 0.3142957 0.3697804 0.2875909 0.4378118 1
## mixture:2 0.3456514 0.3142957 0.3697804 0.2875909 0.4378118 1
```

```
##
## Group:sexM
##                   1        2         3         4         5 6
## mixture:1 0.4344729 0.399985 0.4604393 0.3699273 0.5310942 1
## mixture:2 0.4344729 0.399985 0.4604393 0.3699273 0.5310942 1
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
## mixture:2 0.6119403 0.6119403 0.6119403 0.6119403 0.6119403
##
##
## Real Parameter f0
## Group:sexF
##             1
##  3.128302e-09
##
## Group:sexM
##             1
##  3.128302e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + sex)c()f0(~1)
##
## Npar :  9  (unadjusted=7)
## -2lnL:  135.7705
## AICc :  154.5961  (unadjusted=150.27955)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept) -2.133852e-05    0.0000000 -2.133852e-05 -2.133852e-05
## p:(Intercept)  -9.848602e-01    0.3813509 -1.732308e+00 -2.374123e-01
## p:time2         5.630686e-01    0.4776014 -3.730302e-01  1.499167e+00
## p:time3         1.149490e-01    0.4796139 -8.250943e-01  1.054992e+00
## p:time4         4.515726e-01    0.4771379 -4.836176e-01  1.386763e+00
## p:time5         1.142637e+00    0.4904564  1.813420e-01  2.103931e+00
## p:time6         1.142636e+00    0.4904564  1.813417e-01  2.103931e+00
## p:sexM          9.614725e-01    0.2811732  4.103731e-01  1.512572e+00
## f0:(Intercept) -1.730498e+01 3596.2604000 -7.065975e+03  7.031366e+03
##
##
## Real Parameter pi
## Group:sexF
##
## mixture:1 0.4999947
##
## Group:sexM
```

```
##
## mixture:1 0.4999947
##
##
## Real Parameter p
## Group:sexF
##                   1         2         3         4         5         6
## mixture:1 0.2719285 0.3960881 0.2952728 0.3697504 0.5393625 0.5393624
## mixture:2 0.2719285 0.3960881 0.2952728 0.3697504 0.5393625 0.5393624
##
## Group:sexM
##                   1         2         3         4         5         6
## mixture:1 0.4941533 0.6317382 0.5228743 0.6054402 0.7538494 0.7538493
## mixture:2 0.4941533 0.6317382 0.5228743 0.6054402 0.7538494 0.7538493
##
##
## Real Parameter c
## Group:sexF
##                   2         3         4         5         6
## mixture:1 0.3960881 0.2952728 0.3697504 0.5393625 0.5393624
## mixture:2 0.3960881 0.2952728 0.3697504 0.5393625 0.5393624
##
## Group:sexM
##                   2         3         4         5         6
## mixture:1 0.6317382 0.5228743 0.6054402 0.7538494 0.7538493
## mixture:2 0.6317382 0.5228743 0.6054402 0.7538494 0.7538493
##
##
## Real Parameter f0
## Group:sexF
##             1
##  3.051694e-08
##
## Group:sexM
##             1
##  3.051694e-08
```

```
mouse.results
```

```
##                                        model npar     AICc  DeltaAICc
## 10   pi(~1)p(~time + mixture + sex)c()f0(~1)   10 146.3169  0.0000000
## 6           pi(~1)p(~mixture + sex)c()f0(~1)    5 147.2589  0.9420054
## 7          pi(~1)p(~time + mixture)c()f0(~1)    9 148.9379  2.6209832
## 3                 pi(~1)p(~mixture)c()f0(~1)    4 150.4044  4.0874273
## 11                    pi(~1)p(~sex)c()f0(~1)    4 154.3203  8.0033573
## 16            pi(~1)p(~time + sex)c()f0(~1)    9 154.5961  8.2792232
## 2                     pi(~1)p(~1)c(~1)f0(~1)    4 155.7349  9.4179473
## 12                  pi(~1)p(~sex)c(~1)f0(~1)    5 156.8823 10.5653954
## 4                pi(~1)p(~mixture)c(~1)f0(~1)    5 157.8258 11.5088454
## 5         pi(~1)p(~sex + mixture)c(~1)f0(~1)    6 158.9921 12.6752156
## 14                 pi(~1)p(~time)c(~1)f0(~1)    9 160.7129 14.3959432
## 15           pi(~1)p(~sex + time)c(~1)f0(~1)   10 162.1850 15.8680800
## 8        pi(~1)p(~mixture + time)c(~1)f0(~1)   10 162.9010 16.5840800
## 1                      pi(~1)p(~1)c()f0(~1)    3 163.7800 17.4630380
```

```
## 9  pi(~1)p(~sex + time + mixture)c(~1)f0(~1)   11 164.3934 18.0764773
## 13                   pi(~1)p(~time)c()f0(~1)    8 164.4985 18.1815394
##          weight  Deviance
## 10 4.810921e-01  92.14539
## 6  3.003823e-01 103.83095
## 7  1.297445e-01  96.95452
## 3  6.232391e-02 109.06727
## 11 8.796731e-03 112.98321
## 16 7.663335e-03 102.61275
## 2  4.336576e-03 114.39780
## 12 2.443328e-03 113.45435
## 4  1.524454e-03 114.39780
## 5  8.508249e-04 113.45435
## 14 3.599059e-04 108.72947
## 15 1.723925e-04 108.01347
## 8  1.205150e-04 108.72947
## 1  7.765649e-05 124.51511
## 9  5.714406e-05 108.01347
## 13 5.421971e-05 114.68323
```

Les noms des modèles.

```
names(mouse.results)
```

```
##  [1] "p.dot"              "p.dot.behav"        "p.h"
##  [4] "p.h.behav"          "p.h.behav.sex"      "p.h.sex"
##  [7] "p.h.time"           "p.h.time.behav"     "p.h.time.behav.sex"
## [10] "p.h.time.sex"       "p.sex"              "p.sex.behav"
## [13] "p.time"             "p.time.behav"       "p.time.behav.sex"
## [16] "p.time.sex"         "model.table"
```

On examine le meilleur modèle selon l'AIC (#9).

```
mouse.results$p.h.time.behav.sex$results$real
```

```
##                 estimate           se          lcl          ucl fixed note
## pi gF m1    6.094332e-07 0.000000e+00 6.094332e-07 6.094332e-07
## p gF t1 m1  6.012670e-01 0.000000e+00 6.012670e-01 6.012670e-01
## p gF t2 m1  5.668092e-01 0.000000e+00 5.668092e-01 5.668092e-01
## p gF t3 m1  6.261647e-01 0.000000e+00 6.261647e-01 6.261647e-01
## p gF t4 m1  5.354019e-01 0.000000e+00 5.354019e-01 5.354019e-01
## p gF t5 m1  6.897415e-01 0.000000e+00 6.897415e-01 6.897415e-01
## p gF t6 m1  1.000000e+00 6.573576e-11 1.000000e+00 1.000000e+00
## p gF t1 m2  3.456511e-01 9.479060e-02 1.885213e-01 5.456787e-01
## p gF t2 m2  3.142954e-01 1.027709e-01 1.525463e-01 5.385586e-01
## p gF t3 m2  3.697802e-01 1.284256e-01 1.661338e-01 6.334300e-01
## p gF t4 m2  2.875909e-01 1.549013e-01 8.401760e-02 6.398573e-01
## p gF t5 m2  4.378120e-01 2.145714e-01 1.236058e-01 8.113223e-01
## p gF t6 m2  1.000000e+00 1.916467e-10 1.000000e+00 1.000000e+00
## p gM t1 m1  6.868281e-01 0.000000e+00 6.868281e-01 6.868281e-01
## p gM t2 m1  6.555282e-01 0.000000e+00 6.555282e-01 6.555282e-01
## p gM t3 m1  7.089692e-01 0.000000e+00 7.089692e-01 7.089692e-01
```

```
## p gM t4 m1  6.263125e-01 0.000000e+00 6.263125e-01 6.263125e-01
## p gM t5 m1  7.637763e-01 0.000000e+00 7.637763e-01 7.637763e-01
## p gM t6 m1  1.000000e+00 4.572922e-11 1.000000e+00 1.000000e+00
## p gM t1 m2  4.344726e-01 9.417950e-02 2.660228e-01 6.195514e-01
## p gM t2 m2  3.999847e-01 1.223692e-01 1.970413e-01 6.442440e-01
## p gM t3 m2  4.604391e-01 1.498085e-01 2.074324e-01 7.356193e-01
## p gM t4 m2  3.699274e-01 1.708551e-01 1.224680e-01 7.118133e-01
## p gM t5 m2  5.310943e-01 2.073691e-01 1.813025e-01 8.527863e-01
## p gM t6 m2  1.000000e+00 1.315783e-10 1.000000e+00 1.000000e+00
## c gF t2 m1  6.119403e-01 4.209700e-02 5.269786e-01 6.906012e-01
## f0 gF a0 t1 6.874037e-12 1.004055e-07 1.286648e-15 3.672520e-08
```

```
mouse.results$p.h.time.behav.sex$results$derived
```

```
## $`N Population Size`
##   estimate lcl ucl
## 1       17  17  17
## 2       21  21  21
```

Et un autre modèle, le modèle #2 classé 13ème.

```
mouse.results$p.dot.behav$results$real
```

```
##              estimate          se           lcl       ucl fixed note
## pi gF m1    0.5000019 362.0416600 5.562728e-309 1.0000000
## p gF t1 m1  0.3697886   0.0723414  2.420372e-01 0.5188150
## c gF t2 m1  0.6119403   0.0420970  5.269786e-01 0.6906012
## f0 gF a0 t1 0.7301176   1.2610737  7.289130e-02 7.3132427
```

```
mouse.results$p.dot.behav$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 17.73012 17.07289 24.31324
## 2 21.73012 21.07289 28.31324
```

Exercice 2 : cigognes

Les données.

```
cigogne <- convert.inp("dat/cigognes-2002-3G.inp",
                   group.df = data.frame(bagues = c("metal","couleur", "darvic")),
                   covariates = NULL)
head(cigogne)
```

```
##                 ch freq bagues
## 1:1 00000000000010    1  metal
## 1:2 00000000000110    1  metal
## 1:3 00000000000100    1  metal
## 1:4 00000000000110    1  metal
## 1:8 00000000000100    1  metal
## 1:9 00000010101000    1  metal
```

```
tail(cigogne)
```

```
##                   ch freq bagues
## 3:36 00000000100010    1 darvic
## 3:38 00000000001011    1 darvic
## 3:42 00000101101111    1 darvic
## 3:43 00000000000101    1 darvic
## 3:45 01000000010111    1 darvic
## 3:46 11100001000101    1 darvic
```

On formate les données.

```
cigogne_secr <- unRMarkInput(cigogne) # on convertit au bon format
```

On fait les tests de fermeture.

```
closure.test(cigogne_secr, SB = TRUE)
```

```
## $Otis
##  statistic          p
##  -1.374711 0.08461054
##
## $Xc
##  statistic df        p
##    8.07373 16 0.946641
##
## $NRvsJS
##  statistic df         p
##   3.475137  4 0.4816688
##
## $NMvsJS
##  statistic df        p
##  0.3244725  3 0.955362
##
## $MtvsNR
##  statistic df         p
##   4.598593 12 0.9700621
##
## $MtvsNM
##  statistic df         p
##   7.749257 13 0.8595432
##
## $compNRvsJS
##    Occasion  Chisquare df         p
## 1         2         NA NA        NA
## 2         3         NA NA        NA
## 3         4         NA NA        NA
## 4         5         NA NA        NA
## 5         6         NA NA        NA
## 6         7         NA NA        NA
## 7         8         NA NA        NA
## 8         9 2.26149907  1 0.1326256
```

```
## 9        10         NA NA        NA
## 10       11 0.01238597  1 0.9113846
## 11       12 0.86498856  1 0.3523464
## 12       13 0.33626374  1 0.5619938
##
## $compNMvsJS
##    Occasion   Chisquare df         p
## 1         2          NA NA        NA
## 2         3          NA NA        NA
## 3         4          NA NA        NA
## 4         5          NA NA        NA
## 5         6          NA NA        NA
## 6         7          NA NA        NA
## 7         8          NA NA        NA
## 8         9          NA NA        NA
## 9        10          NA NA        NA
## 10       11 0.273944805  1 0.6006978
## 11       12 0.001124195  1 0.9732527
## 12       13 0.049403509  1 0.8241045
```

Les modèles maintenant. On sépare selon le type de bagues.

Couleur d'abord.

```
cigogne_bague <- cigogne[cigogne$bagues=="couleur",]
cigogne.proc <- process.data(cigogne_bague, begin.time = 1, model = "FullHet")
cigogne.ddl <- make.design.data(cigogne.proc)
```

Liste des modèles (pas d'effet comportement).

```
run.cigogne <- function() {

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  cigogne.model.list <- create.model.list("FullHet")
  cigogne.results <- mark.wrapper(cigogne.model.list,
                                  data = cigogne.proc,
                                  ddl = cigogne.ddl)
  return(cigogne.results)
}
```

On fait tourner.

```
cigogne.results <- run.cigogne()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  75.81818
```

```
## AICc :  81.99465  (unadjusted=79.90577)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept)  5.562098e-06 0.0000000  5.562098e-06  5.562098e-06
## p:(Intercept)  -2.129389e+00 0.3383852 -2.792624e+00 -1.466153e+00
## f0:(Intercept)  7.410868e-01 1.1789764 -1.569707e+00  3.051881e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000014
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##                    8         9        10        11        12        13        14
## mixture:1 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##                    9        10        11        12        13        14
## mixture:1 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
## mixture:2 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731 0.1062731
##
##
## Real Parameter f0
##
##         1
##  2.098215
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  75.81818
## AICc :  84.11447  (unadjusted=79.90577)
##
## Beta
##                     estimate         se           lcl          ucl
## pi:(Intercept) -16.5046470 9674.01000 -18977.565000 18944.555000
## p:(Intercept)   -2.5325452  643.69593  -1264.176600  1259.111500
## p:mixture2       0.4031616  643.69584  -1261.240700  1262.047000
## f0:(Intercept)   0.7410768    1.17898     -1.569725     3.051878
##
```

```
##
## Real Parameter pi
##
##
## mixture:1 6.793955e-08
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079
## mixture:2 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735
##                   8         9        10        11        12        13        14
## mixture:1 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079
## mixture:2 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079
## mixture:2 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735
##                   9        10        11        12        13        14
## mixture:1 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079 0.0736079
## mixture:2 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735 0.1062735
##
##
## Real Parameter f0
##
##         1
##  2.098194
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  17  (unadjusted=10)
## -2lnL:  42.22034
## AICc :  81.23674  (unadjusted=63.92577)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept) -16.050871   927.626640  -1834.199100  1802.097400
## p:(Intercept)   -8.267736     0.000000     -8.267736    -8.267736
## p:time2         19.734954     0.000000     19.734954    19.734954
## p:time3        -10.183157 13452.628000 -26377.335000 26356.968000
## p:time4        -10.183209     0.000000    -10.183209   -10.183209
## p:time5        -10.183183 12515.126000 -24539.830000 24519.463000
## p:time6         19.735049     0.000000     19.735049    19.735049
## p:time7         19.734950     0.000000     19.734950    19.734950
## p:time8         19.735020     0.000000     19.735020    19.735020
## p:time9        -10.183173 16401.774000 -32157.662000 32137.295000
## p:time10        19.734910     0.000000     19.734910    19.734910
## p:time11        19.734954     0.000000     19.734954    19.734954
## p:time12        21.863787     0.000000     21.863787    21.863787
```

```
## p:time13        19.734960     0.000000     19.734960    19.734960
## p:time14        22.232732     0.000000     22.232732    22.232732
## p:mixture2     -13.757131     0.000000    -13.757131   -13.757131
## f0:(Intercept)  -0.134818     1.918907     -3.895875     3.626239
##
##
## Real Parameter pi
##
##
## mixture:1 1.069535e-07
##
##
## Real Parameter p
##
##                       1         2            3            4           5
## mixture:1 2.565999e-04 0.9999895 9.702397e-09 9.701897e-09 9.702146e-09
## mixture:2 2.720958e-10 0.0919618 1.028568e-14 1.028515e-14 1.028541e-14
##                    6         7         8            9        10        11
## mixture:1 0.9999895 0.9999895 0.9999895 9.702240e-09 0.9999895 0.9999895
## mixture:2 0.0919698 0.0919615 0.0919673 1.028551e-14 0.0919581 0.0919619
##                   12        13        14
## mixture:1 0.9999988 0.9999895 0.9999991
## mixture:2 0.4598170 0.0919623 0.5517800
##
##
## Real Parameter c
##
##                    2            3            4            5         6         7
## mixture:1 0.9999895 9.702397e-09 9.701897e-09 9.702146e-09 0.9999895 0.9999895
## mixture:2 0.0919618 1.028568e-14 1.028515e-14 1.028541e-14 0.0919698 0.0919615
##                    8            9        10        11        12        13
## mixture:1 0.9999895 9.702240e-09 0.9999895 0.9999895 0.9999988 0.9999895
## mixture:2 0.0919673 1.028551e-14 0.0919581 0.0919619 0.4598170 0.0919623
##                   14
## mixture:1 0.9999991
## mixture:2 0.5517800
##
##
## Real Parameter f0
##
##          1
##  0.8738749
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  15  (unadjusted=10)
## -2lnL:  42.22034
## AICc :  76.09131  (unadjusted=63.925767)
##
## Beta
##                   estimate       se        lcl        ucl
## pi:(Intercept)   0.000000 0.000000   0.000000   0.000000
## p:(Intercept)  -21.065749 0.000000 -21.065749 -21.065749
```

```
## p:time2         18.775849 0.000000  18.775849  18.775849
## p:time3        -11.303547 0.000000 -11.303547 -11.303547
## p:time4        -11.303568 0.000000 -11.303568 -11.303568
## p:time5        -11.303563 0.000000 -11.303563 -11.303563
## p:time6         18.775857 0.000000  18.775857  18.775857
## p:time7         18.775861 0.000000  18.775861  18.775861
## p:time8         18.775856 0.000000  18.775856  18.775856
## p:time9        -11.303572 0.000000 -11.303572 -11.303572
## p:time10        18.775871 0.000000  18.775871  18.775871
## p:time11        18.775854 0.000000  18.775854  18.775854
## p:time12        20.904681 0.000000  20.904681  20.904681
## p:time13        18.775860 0.000000  18.775860  18.775860
## p:time14        21.273631 0.000000  21.273631  21.273631
## f0:(Intercept)  -0.134915 1.919109  -3.896368   3.626538
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## Real Parameter p
##
##                       1         2            3            4           5
## mixture:1 7.100048e-10 0.0919629 8.753729e-15 8.753547e-15 8.75359e-15
## mixture:2 7.100048e-10 0.0919629 8.753729e-15 8.753547e-15 8.75359e-15
##                   6         7         8            9        10        11
## mixture:1 0.0919635 0.0919638 0.0919635 8.753509e-15 0.0919647 0.0919633
## mixture:2 0.0919635 0.0919638 0.0919635 8.753509e-15 0.0919647 0.0919633
##                  12        13        14
## mixture:1 0.4598198 0.0919638 0.5517841
## mixture:2 0.4598198 0.0919638 0.5517841
##
##
## Real Parameter c
##
##                   2            3            4           5         6         7
## mixture:1 0.0919629 8.753729e-15 8.753547e-15 8.75359e-15 0.0919635 0.0919638
## mixture:2 0.0919629 8.753729e-15 8.753547e-15 8.75359e-15 0.0919635 0.0919638
##                   8            9        10        11        12        13
## mixture:1 0.0919635 8.753509e-15 0.0919647 0.0919633 0.4598198 0.0919638
## mixture:2 0.0919635 8.753509e-15 0.0919647 0.0919633 0.4598198 0.0919638
##                  14
## mixture:1 0.5517841
## mixture:2 0.5517841
##
##
## Real Parameter f0
##
##          1
##  0.8737902
```

Le classement des modèles.

```
cigogne.results
```

```
##                                model npar     AICc DeltaAICc     weight Deviance
## 4           pi(~1)p(~time)c()f0(~1)   15 76.09131  0.000000 0.87207892 34.69523
## 3 pi(~1)p(~time + mixture)c()f0(~1)   17 81.23674  5.145428 0.06656415 34.69523
## 1              pi(~1)p(~1)c()f0(~1)    3 81.99465  5.903340 0.04556820 68.29307
## 2        pi(~1)p(~mixture)c()f0(~1)    4 84.11447  8.023166 0.01578874 68.29307
```

Les noms.

```
names(cigogne.results)
```

```
## [1] "p.dot"       "p.h"         "p.h.time"    "p.time"      "model.table"
```

Les résultats selon le meilleur modèle.

```
(pcouleur <- cigogne.results$p.time$results$real)
```

```
##                 estimate        se          lcl          ucl fixed note
## pi g1 m1    5.000000e-01 0.0000000 5.000000e-01 5.000000e-01
## p g1 t1 m1  7.100048e-10 0.0000000 7.100048e-10 7.100048e-10
## p g1 t2 m1  9.196290e-02 0.0887731 1.244970e-02 4.486154e-01
## p g1 t3 m1  8.753729e-15 0.0000000 8.753729e-15 8.753729e-15
## p g1 t4 m1  8.753547e-15 0.0000000 8.753547e-15 8.753547e-15
## p g1 t5 m1  8.753590e-15 0.0000000 8.753590e-15 8.753590e-15
## p g1 t6 m1  9.196350e-02 0.0887734 1.244980e-02 4.486157e-01
## p g1 t7 m1  9.196380e-02 0.0887735 1.244990e-02 4.486159e-01
## p g1 t8 m1  9.196350e-02 0.0887734 1.244980e-02 4.486157e-01
## p g1 t9 m1  8.753509e-15 0.0000000 8.753509e-15 8.753509e-15
## p g1 t10 m1 9.196470e-02 0.0887739 1.245020e-02 4.486164e-01
## p g1 t11 m1 9.196330e-02 0.0887733 1.244980e-02 4.486156e-01
## p g1 t12 m1 4.598198e-01 0.1669456 1.856648e-01 7.606584e-01
## p g1 t13 m1 9.196380e-02 0.0887735 1.244990e-02 4.486159e-01
## p g1 t14 m1 5.517841e-01 0.1731623 2.378631e-01 8.292320e-01
## f0 g1 a0 t1 8.737902e-01 1.6768982 7.651140e-02 9.979030e+00
```

```
(Ncouleur <- cigogne.results$p.time$results$derived)
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 10.87379 10.07651 19.97903
```

Darvic ensuite.

```
cigogne_bague <- cigogne[cigogne$bagues=="darvic",]
cigogne.proc <- process.data(cigogne_bague, begin.time = 1, model = "FullHet")
cigogne.ddl <- make.design.data(cigogne.proc)
```

On appelle Mark.

```
cigogne.results <- run.cigogne()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=1)
## -2lnL:  144.0227
## AICc :  150.1576  (unadjusted=146.04496)
##
## Beta
##                     estimate          se          lcl         ucl
## pi:(Intercept)  -0.000223246 1784.393800 -3497.412200 3497.411700
## p:(Intercept)   -1.299283000    0.180649    -1.653355   -0.945211
## f0:(Intercept) -14.999834000 4098.627800 -8048.310400 8018.310700
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999442
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
## mixture:2 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
##                   8         9        10        11        12        13        14
## mixture:1 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
## mixture:2 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
## mixture:2 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
##                   9        10        11        12        13        14
## mixture:1 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
## mixture:2 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857 0.2142857
##
##
## Real Parameter f0
##
##            1
##  3.05953e-07
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  142.2156
```

```
## AICc :  150.4415
##
## Beta
##                   estimate        se       lcl        ucl
## pi:(Intercept) -1.4323800 1.0430929 -3.476842  0.6120821
## p:(Intercept)  -0.3699150 0.4896271 -1.329584  0.5897541
## p:mixture2     -1.2980383 0.5502856 -2.376598 -0.2194786
## f0:(Intercept) -0.7611865 2.8777638 -6.401604  4.8792306
##
##
## Real Parameter pi
##
##
## mixture:1 0.1927281
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615
## mixture:2 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972
##                    8         9        10        11        12        13        14
## mixture:1 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615
## mixture:2 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615
## mixture:2 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972
##                    9        10        11        12        13        14
## mixture:1 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615 0.4085615
## mixture:2 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972 0.1586972
##
##
## Real Parameter f0
##
##          1
##  0.4671119
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  17  (unadjusted=15)
## -2lnL:  91.16379
## AICc :  128.8955  (unadjusted=124.05535)
##
## Beta
##                      estimate         se         lcl         ucl
## pi:(Intercept) -1.296273e+00  0.7703675  -2.8061930   0.2136475
## p:(Intercept)  -1.231724e+00  1.1337532  -3.4538803   0.9904322
## p:time2         8.801843e-01  1.3701966  -1.8054011   3.5657696
## p:time3         3.527776e-06  1.5394077  -3.0172355   3.0172426
```

```
## p:time4        -1.963516e+01  0.0000000 -19.6351600 -19.6351600
## p:time5        -1.963520e+01  0.0000000 -19.6352000 -19.6352000
## p:time6         8.801847e-01  1.3701960  -1.8053996   3.5657689
## p:time7         8.801840e-01  1.3701965  -1.8054013   3.5657692
## p:time8         1.473604e+00  1.3121089  -1.0981298   4.0453370
## p:time9         8.801852e-01  1.3701966  -1.8054001   3.5657705
## p:time10        4.470539e-06  1.5394091  -3.0172374   3.0172464
## p:time11        8.801844e-01  1.3701961  -1.8054001   3.5657689
## p:time12        3.431842e+00  1.2763974   0.9301032   5.9335809
## p:time13        2.726654e+00  1.2674503   0.2424514   5.2108567
## p:time14        3.802122e+00  1.2938360   1.2662032   6.3380403
## p:mixture2     -2.057456e+00  0.5946384  -3.2229474  -0.8919648
## f0:(Intercept) -3.480471e+00 31.8851080 -65.9752840  59.0143430
##
##
## Real Parameter pi
##
##
## mixture:1 0.214793
##
##
## Real Parameter p
##
##                    1         2         3            4            5         6
## mixture:1 0.2258798 0.4130091 0.2258804 8.662181e-10 8.661834e-10 0.4130092
## mixture:2 0.0359442 0.0824893 0.0359444 1.106841e-10 1.106797e-10 0.0824893
##                    7         8         9        10        11        12        13
## mixture:1 0.4130090 0.5601768 0.4130093 0.2258806 0.4130091 0.9002601 0.8168171
## mixture:2 0.0824893 0.1399655 0.0824894 0.0359444 0.0824893 0.5356051 0.3629632
##                   14
## mixture:1 0.9289320
## mixture:2 0.6254958
##
##
## Real Parameter c
##
##                    2         3            4            5         6         7
## mixture:1 0.4130091 0.2258804 8.662181e-10 8.661834e-10 0.4130092 0.4130090
## mixture:2 0.0824893 0.0359444 1.106841e-10 1.106797e-10 0.0824893 0.0824893
##                    8         9        10        11        12        13        14
## mixture:1 0.5601768 0.4130093 0.2258806 0.4130091 0.9002601 0.8168171 0.9289320
## mixture:2 0.1399655 0.0824894 0.0359444 0.0824893 0.5356051 0.3629632 0.6254958
##
##
## Real Parameter f0
##
##          1
##  0.0307929
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  16  (unadjusted=12)
## -2lnL:  97.2221
```

```
## AICc :  132.5191  (unadjusted=123.06825)
##
## Beta
##                       estimate           se           lcl           ucl
## pi:(Intercept)  2.271269e-04  1896.510600 -3.717161e+03  3.717161e+03
## p:(Intercept)  -2.484879e+00     1.040820 -4.524886e+00 -4.448718e-01
## p:time2         7.801367e-01     1.293913 -1.755933e+00  3.316206e+00
## p:time3        -2.899089e-05     1.471953 -2.885056e+00  2.884998e+00
## p:time4        -4.764856e+01     0.000000 -4.764856e+01 -4.764856e+01
## p:time5        -4.764858e+01 92241.596000 -1.808412e+05  1.807459e+05
## p:time6         7.801342e-01     1.293914 -1.755937e+00  3.316206e+00
## p:time7         7.801133e-01     1.293917 -1.755964e+00  3.316191e+00
## p:time8         1.280906e+00     1.231519 -1.132871e+00  3.694684e+00
## p:time9         7.801347e-01     1.293914 -1.755937e+00  3.316206e+00
## p:time10       -2.844912e-05     1.471950 -2.885051e+00  2.884994e+00
## p:time11        7.801315e-01     1.293915 -1.755941e+00  3.316204e+00
## p:time12        2.954882e+00     1.186721  6.289092e-01  5.280854e+00
## p:time13        2.330727e+00     1.180182  1.757030e-02  4.643884e+00
## p:time14        3.295810e+00     1.201839  9.402052e-01  5.651414e+00
## f0:(Intercept) -1.818002e+01  9345.479900 -1.833532e+04  1.829896e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000568
##
##
## Real Parameter p
##
##                    1         2        3            4            5         6
## mixture:1 0.0769251 0.1538469 0.076923 1.687816e-22 1.687774e-22 0.1538466
## mixture:2 0.0769251 0.1538469 0.076923 1.687816e-22 1.687774e-22 0.1538466
##                    7         8         9       10        11        12        13
## mixture:1 0.1538439 0.2307693 0.1538467 0.076923 0.1538463 0.6153844 0.4615382
## mixture:2 0.1538439 0.2307693 0.1538467 0.076923 0.1538463 0.6153844 0.4615382
##                   14
## mixture:1 0.6923079
## mixture:2 0.6923079
##
##
## Real Parameter c
##
##                    2        3            4            5         6         7
## mixture:1 0.1538469 0.076923 1.687816e-22 1.687774e-22 0.1538466 0.1538439
## mixture:2 0.1538469 0.076923 1.687816e-22 1.687774e-22 0.1538466 0.1538439
##                    8         9       10        11        12        13        14
## mixture:1 0.2307693 0.1538467 0.076923 0.1538463 0.6153844 0.4615382 0.6923079
## mixture:2 0.2307693 0.1538467 0.076923 0.1538463 0.6153844 0.4615382 0.6923079
##
##
## Real Parameter f0
##
##             1
```

```
##  1.272096e-08
```

Les résultats.

```
cigogne.results
```

```
##                                model npar     AICc DeltaAICc       weight
## 3 pi(~1)p(~time + mixture)c()f0(~1)   17 128.8955   0.00000 8.595442e-01
## 4           pi(~1)p(~time)c()f0(~1)   16 132.5191   3.62357 1.404171e-01
## 1              pi(~1)p(~1)c()f0(~1)    3 150.1576  21.26207 2.076201e-05
## 2        pi(~1)p(~mixture)c()f0(~1)    4 150.4415  21.54604 1.801377e-05
##    Deviance
## 3  76.17111
## 4  82.22942
## 1 129.03005
## 2 127.22287
```

Les noms.

```
names(cigogne.results)
```

```
## [1] "p.dot"       "p.h"         "p.h.time"    "p.time"      "model.table"
```

Les résultats selon le meilleur modèle.

```
(pdarvic <- cigogne.results$p.h.time$results$real)
```

```
##                 estimate        se          lcl          ucl fixed note
## pi g1 m1    2.147930e-01 0.1299278 5.699040e-02 5.532096e-01
## p g1 t1 m1  2.258798e-01 0.1982460 3.065330e-02 7.291733e-01
## p g1 t2 m1  4.130091e-01 0.2205406 1.057839e-01 8.071302e-01
## p g1 t3 m1  2.258804e-01 0.1982450 3.065390e-02 7.291711e-01
## p g1 t4 m1  8.662181e-10 0.0000000 8.662181e-10 8.662181e-10
## p g1 t5 m1  8.661834e-10 0.0000000 8.661834e-10 8.661834e-10
## p g1 t6 m1  4.130092e-01 0.2205406 1.057840e-01 8.071302e-01
## p g1 t7 m1  4.130090e-01 0.2205406 1.057839e-01 8.071302e-01
## p g1 t8 m1  5.601768e-01 0.2062997 1.979300e-01 8.679601e-01
## p g1 t9 m1  4.130093e-01 0.2205406 1.057840e-01 8.071303e-01
## p g1 t10 m1 2.258806e-01 0.1982452 3.065390e-02 7.291715e-01
## p g1 t11 m1 4.130091e-01 0.2205406 1.057839e-01 8.071302e-01
## p g1 t12 m1 9.002601e-01 0.0730547 6.469045e-01 9.780066e-01
## p g1 t13 m1 8.168171e-01 0.1187963 4.847018e-01 9.548288e-01
## p g1 t14 m1 9.289320e-01 0.0556071 7.149338e-01 9.855332e-01
## p g1 t1 m2  3.594420e-02 0.0401843 3.826100e-03 2.657531e-01
## p g1 t2 m2  8.248930e-02 0.0681529 1.515810e-02 3.443322e-01
## p g1 t3 m2  3.594440e-02 0.0401842 3.826100e-03 2.657511e-01
## p g1 t4 m2  1.106841e-10 0.0000000 1.106841e-10 1.106841e-10
## p g1 t5 m2  1.106797e-10 0.0000000 1.106797e-10 1.106797e-10
## p g1 t6 m2  8.248930e-02 0.0681529 1.515810e-02 3.443321e-01
## p g1 t7 m2  8.248930e-02 0.0681529 1.515810e-02 3.443321e-01
## p g1 t8 m2  1.399655e-01 0.0942249 3.390210e-02 4.301190e-01
```

```
## p g1 t9 m2  8.248940e-02 0.0681530 1.515810e-02 3.443323e-01
## p g1 t10 m2 3.594440e-02 0.0401842 3.826100e-03 2.657514e-01
## p g1 t11 m2 8.248930e-02 0.0681530 1.515810e-02 3.443322e-01
## p g1 t12 m2 5.356051e-01 0.1610048 2.448910e-01 8.039824e-01
## p g1 t13 m2 3.629632e-01 0.1484664 1.393094e-01 6.672971e-01
## p g1 t14 m2 6.254958e-01 0.1602369 3.041153e-01 8.645563e-01
## f0 g1 a0 t1 3.079290e-02 0.9818355 1.771727e-04 5.351860e+00
```

```
(Ndarvic <- cigogne.results$p.h.time$results$derived)
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 13.03079 13.00018 18.35186
```

Metal enfin.

```
cigogne_bague <- cigogne[cigogne$bagues=="metal",]
cigogne.proc <- process.data(cigogne_bague, begin.time = 1, model = "FullHet")
cigogne.ddl <- make.design.data(cigogne.proc)
```

```
cigogne.results <- run.cigogne()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  2  (unadjusted=3)
## -2lnL:  189.3116
## AICc :  193.3462  (unadjusted=195.38094)
##
## Beta
##                  estimate        se        lcl       ucl
## pi:(Intercept)  0.0000000 0.0000000  0.0000000  0.000000
## p:(Intercept)  -1.7767185 0.1734308 -2.1166428 -1.436794
## f0:(Intercept)  0.9714288 0.8583849 -0.7110055  2.653863
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##                    8         9        10        11        12        13        14
## mixture:1 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##
```

```
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##                   9        10        11        12        13        14
## mixture:1 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
## mixture:2 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088 0.1447088
##
##
## Real Parameter f0
##
##         1
##  2.641716
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  189.3116
## AICc :  197.4275  (unadjusted=193.34616)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept) -12.6990510 1.754894e+04 -3.440863e+04 34383.230000
## p:(Intercept)   -1.7174682 8.152948e+02 -1.599695e+03  1596.260400
## p:mixture2      -0.0592471 8.152942e+02 -1.598036e+03  1597.917500
## f0:(Intercept)   0.9714347 8.583736e-01 -7.109776e-01     2.653847
##
##
## Real Parameter pi
##
##
## mixture:1 3.054013e-06
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976
## mixture:2 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092
##                   8         9        10        11        12        13        14
## mixture:1 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976
## mixture:2 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976
## mixture:2 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092
##                   9        10        11        12        13        14
## mixture:1 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976 0.1521976
```

```
## mixture:2 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092 0.1447092
##
##
## Real Parameter f0
##
##         1
##  2.641732
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  17  (unadjusted=11)
## -2lnL:  115.2832
## AICc :  151.1265  (unadjusted=138.06422)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept) -13.4377730   160.469200   -327.957410   301.081860
## p:(Intercept)  -21.1440000   258.138580   -527.095630   484.807630
## p:time2         37.7126780   161.799060   -279.413490   354.838850
## p:time3         -4.6207617  3477.936500  -6821.376400  6812.134900
## p:time4         36.9797160   161.800740   -280.149740   354.109180
## p:time5         38.1595380   161.798420   -278.965370   355.284440
## p:time6         37.7126580   161.799060   -279.413510   354.838830
## p:time7         38.4905470   161.798040   -278.633620   355.614710
## p:time8         -4.6207528 10328.487000 -20248.456000 20239.214000
## p:time9         38.7589050   161.797770   -278.364740   355.882550
## p:time10        -4.6205726  3598.908700  -7058.481700  7049.240500
## p:time11        39.3783310   161.797290   -277.744350   356.501020
## p:time12        39.7151070   161.797110   -277.407230   356.837450
## p:time13        40.1765900   161.797010   -276.945560   357.298740
## p:time14        39.3783070   161.797290   -277.744380   356.500990
## p:mixture2     -19.0789340   263.043870   -534.644930   496.487070
## f0:(Intercept)   0.4802789     1.113037     -1.701273     2.661831
##
##
## Real Parameter pi
##
##
## mixture:1 1.458978e-06
##
##
## Real Parameter p
##
##                       1         2            3         4         5         6
## mixture:1 6.565648e-10 0.9999999 6.464073e-12 0.9999999 1.0000000 0.9999999
## mixture:2 3.399397e-18 0.0751423 3.346806e-20 0.0375714 0.1127059 0.0751410
##                     7            8        9           10        11        12
## mixture:1 1.0000000 6.464131e-12 1.000000 6.465296e-12 1.0000000 1.0000000
## mixture:2 0.1502826 3.346836e-20 0.187852 3.347440e-20 0.3005663 0.3757031
##                    13        14
## mixture:1 1.0000000 1.0000000
## mixture:2 0.4884161 0.3005613
##
```

```
##
## Real Parameter c
##
##                    2            3         4         5         6         7
## mixture:1 0.9999999 6.464073e-12 0.9999999 1.0000000 0.9999999 1.0000000
## mixture:2 0.0751423 3.346806e-20 0.0375714 0.1127059 0.0751410 0.1502826
##                        8        9           10        11        12        13
## mixture:1 6.464131e-12 1.000000 6.465296e-12 1.0000000 1.0000000 1.0000000
## mixture:2 3.346836e-20 0.187852 3.347440e-20 0.3005663 0.3757031 0.4884161
##                   14
## mixture:1 1.0000000
## mixture:2 0.3005613
##
##
## Real Parameter f0
##
##         1
##  1.616525
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  16  (unadjusted=11)
## -2lnL:  115.2831
## AICc :  148.9167  (unadjusted=138.06414)
##
## Beta
##                      estimate          se          lcl         ucl
## pi:(Intercept)  -0.000348383  670.604790 -1314.385800 1314.385100
## p:(Intercept)  -23.450216000  205.689890  -426.602410  379.701980
## p:time2         20.939936000  205.691510  -382.215430  424.095310
## p:time3         -6.574437400    0.000000    -6.574437   -6.574437
## p:time4         20.206970000  205.692820  -382.950960  423.364900
## p:time5         21.386872000  205.691010  -381.767520  424.541260
## p:time6         20.939936000  205.691510  -382.215430  424.095300
## p:time7         21.717820000  205.690720  -381.436000  424.871640
## p:time8         -6.574450100 3664.119700 -7188.249100 7175.100200
## p:time9         21.986186000  205.690520  -381.167240  425.139610
## p:time10        -6.574522500 3583.347700 -7029.936100 7016.787100
## p:time11        22.605596000  205.690150  -380.547110  425.758310
## p:time12        22.942390000  205.690020  -380.210060  426.094840
## p:time13        23.403865000  205.689940  -379.748420  426.556150
## p:time14        22.605596000  205.690150  -380.547110  425.758310
## f0:(Intercept)   0.480415500    1.112868    -1.700805    2.661636
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999129
##
##
## Real Parameter p
##
```

```
##                     1         2            3         4        5         6
## mixture:1 6.54185e-11 0.0751407 9.129746e-14 0.0375703 0.112711 0.0751407
## mixture:2 6.54185e-11 0.0751407 9.129746e-14 0.0375703 0.112711 0.0751407
##                    7           8         9           10        11        12
## mixture:1 0.1502813 9.12963e-14 0.1878516 9.128968e-14 0.3005626 0.3757033
## mixture:2 0.1502813 9.12963e-14 0.1878516 9.128968e-14 0.3005626 0.3757033
##                   13        14
## mixture:1 0.4884143 0.3005626
## mixture:2 0.4884143 0.3005626
##
##
## Real Parameter c
##
##                    2            3         4        5         6         7
## mixture:1 0.0751407 9.129746e-14 0.0375703 0.112711 0.0751407 0.1502813
## mixture:2 0.0751407 9.129746e-14 0.0375703 0.112711 0.0751407 0.1502813
##                     8         9           10        11        12        13
## mixture:1 9.12963e-14 0.1878516 9.128968e-14 0.3005626 0.3757033 0.4884143
## mixture:2 9.12963e-14 0.1878516 9.128968e-14 0.3005626 0.3757033 0.4884143
##                   14
## mixture:1 0.3005626
## mixture:2 0.3005626
##
##
## Real Parameter f0
##
##         1
##  1.616746
```

```
cigogne.results
```

```
##                               model npar     AICc DeltaAICc       weight
## 4           pi(~1)p(~time)c()f0(~1)   16 148.9167   0.00000 7.511789e-01
## 3 pi(~1)p(~time + mixture)c()f0(~1)   17 151.1265   2.20982 2.488211e-01
## 1              pi(~1)p(~1)c()f0(~1)    2 193.3462  44.42946 1.690476e-10
## 2        pi(~1)p(~mixture)c()f0(~1)    4 197.4275  48.51082 2.196610e-11
##    Deviance
## 4  91.84761
## 3  91.84768
## 1 165.87611
## 2 165.87611
```

```
names(cigogne.results)
```

```
## [1] "p.dot"       "p.h"         "p.h.time"    "p.time"      "model.table"
```

```
(pmetal <- cigogne.results$p.time$results$real)
```

```
##                 estimate           se            lcl          ucl fixed note
## pi g1 m1    4.999129e-01 1.676512e+02  5.560747e-309 1.000000e+00
## p g1 t1 m1  6.541850e-11 1.345592e-08  -2.630819e-08 2.643903e-08
## p g1 t2 m1  7.514070e-02 5.134910e-02   1.873380e-02 2.569185e-01
```

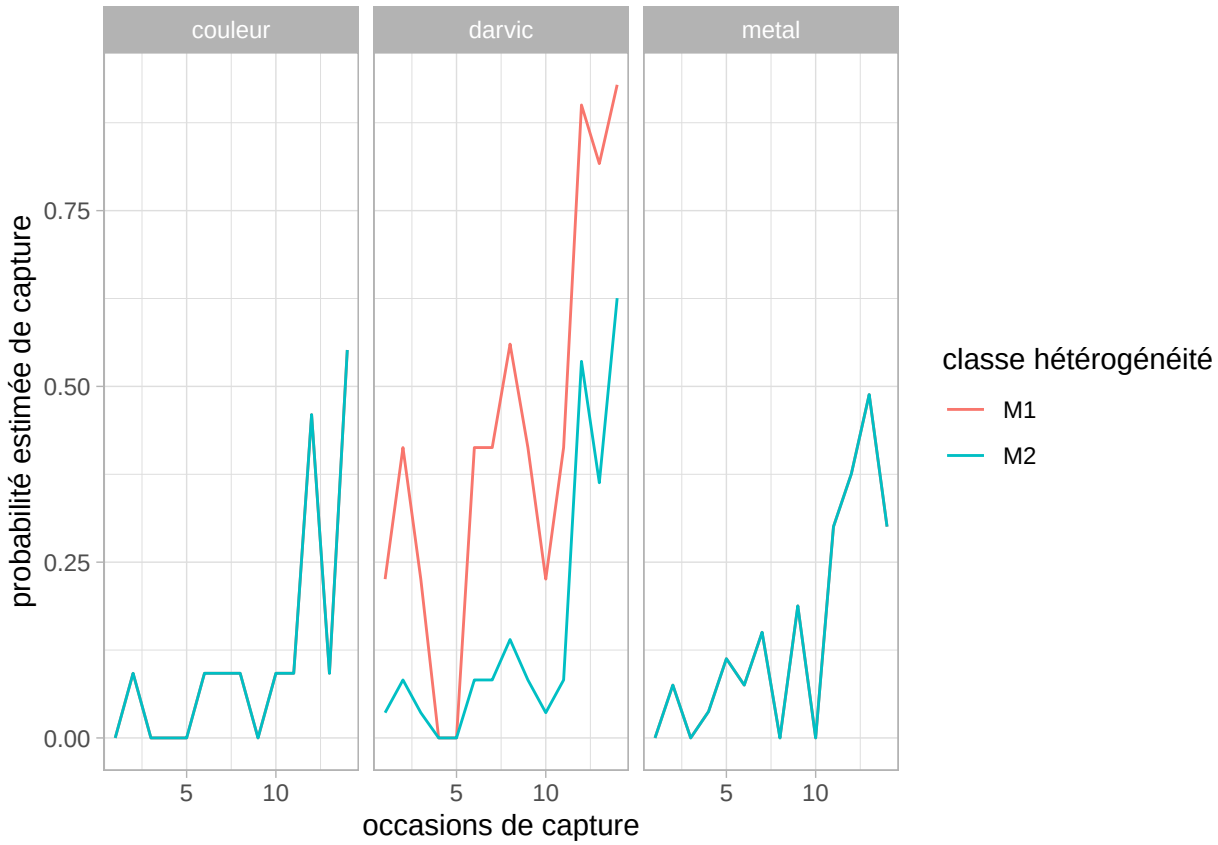
```
## p g1 t3 m1  9.129746e-14 0.000000e+00   9.129746e-14 9.129746e-14
## p g1 t4 m1  3.757030e-02 3.694520e-02   5.241600e-03 2.243283e-01
## p g1 t5 m1  1.127110e-01 6.176860e-02   3.647680e-02 2.988526e-01
## p g1 t6 m1  7.514070e-02 5.134910e-02   1.873380e-02 2.569185e-01
## p g1 t7 m1  1.502813e-01 7.000580e-02   5.695220e-02 3.412143e-01
## p g1 t8 m1  9.129630e-14 3.350724e-10  -6.566507e-10 6.568333e-10
## p g1 t9 m1  1.878516e-01 7.676660e-02   7.941960e-02 3.827714e-01
## p g1 t10 m1 9.128968e-14 3.276653e-10  -6.421327e-10 6.423153e-10
## p g1 t11 m1 3.005626e-01 9.116470e-02   1.551743e-01 5.013353e-01
## p g1 t12 m1 3.757033e-01 9.724780e-02   2.107403e-01 5.756195e-01
## p g1 t13 m1 4.884143e-01 1.023600e-01   2.995829e-01 6.806113e-01
## p g1 t14 m1 3.005626e-01 9.116470e-02   1.551743e-01 5.013353e-01
## f0 g1 a0 t1 1.616746e+00 1.799224e+00   2.783157e-01 9.391737e+00
```

```
(Nmetal <- cigogne.results$p.time$results$derived)
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 26.61675 25.27832 34.39174
```

On visualise les probabilités de détection.

```
p.estim <- data.frame(couleur = pcouleur[-c(1,16),1],
                      darvic = pdarvic[-c(1,30),1],
                      metal = pmetal[-c(1,16),1],
                      mixture = c(rep("M1", 14), rep("M2", 14)),
                      occ = c(1:14, 1:14))
# pivote les données
library(tidyr)
p.estim <- pivot_longer(p.estim,
                              cols = couleur:metal,
                              names_to = "type_bague",
                              values_to = "p_estim")
# visualise
library(ggplot2)
ggplot(data = p.estim,
       aes(x = occ, y = p_estim, color = mixture)) +
  geom_line() +
  facet_wrap(~type_bague) +
  theme_light() +
  labs(x = "occasions de capture",
       y = "probabilité estimée de capture",
       color = "classe hétérogénéité")
```



Exercice 3 : cistudes

Les données.

```
library(readr)
dat <- read_csv2("dat/BDD-CMR-Cistudes-Vigueirat.csv")
library(janitor)
dat <- clean_names(dat)
```

Quelles sont les années avec le plus de marquages et recaptures?

```
library(dplyr)
dat %>%
  count(action, mois, annee, sort = TRUE)
```

```
## # A tibble: 168 x 4
##    action     mois annee     n
##    <chr>     <dbl> <dbl> <int>
##  1 Recapture     4  2007   114
##  2 Recapture     6  2007    65
##  3 Marquage      6  1997    50
##  4 Recapture     7  2006    44
##  5 Recapture     5  2007    38
##  6 Recapture     3  2007    37
```

```
##  7 Marquage      7  2006    33
##  8 Recapture     8  2006    31
##  9 Marquage      4  2007    27
## 10 Marquage      9  2005    26
## # ... with 158 more rows
```

```
dat <- dat %>% select(id_ind, jour, mois, annee)
```

On extrait les mois de juin des années 1997 et 2007.

```
library(tibble)
dat1997 <- dat %>%
  filter(mois == 6, annee == 1997) %>%
  select(id_ind, jour) %>%
  add_column(det = 1) %>%
  arrange(id_ind)
dat2007 <- dat %>%
  filter(mois == 6, annee == 2007) %>%
  select(id_ind, jour) %>%
  add_column(det = 1) %>%
  arrange(id_ind)
```

On fait les histoires pour 1997.

```
histories1997 <- dat1997 %>%
  group_by(id_ind) %>%
  mutate(id2 = row_number()) %>%
  pivot_wider(values_from = det,
              names_from = jour) %>% # les jours en colonnes
  select(-id2) %>%
  group_by(id_ind) %>%
  summarise(across(everything(), sum, na.rm = TRUE)) %>% # on rassemble les evenements pour chaque ind
  select(-id_ind)
histories1997[is.na(histories1997)] <- 0 # les Na sont des non-détections = 0
histories1997[histories1997 > 1] <- 1 # les observations mens multiples = 1
(histories1997 <- as.matrix(histories1997))
```

```
##       7 13 10 12 25 27 3 6 11 29 14 15 16 17 18 19 20 26 30
##  [1,] 1  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [2,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [3,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [4,] 0  0  0  1  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [5,] 0  0  1  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [6,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
##  [7,] 0  0  0  0  0  0 1 0  0  0  0  0  0  0  0  0  0  0  0
##  [8,] 0  0  0  0  0  0 0 1  0  0  0  0  0  0  0  0  0  0  0
##  [9,] 0  0  0  0  0  0 0 1  0  0  0  0  0  0  0  0  0  0  0
## [10,] 0  0  0  0  0  0 0 1  0  0  0  0  0  0  0  0  0  0  0
## [11,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [12,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [13,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [14,] 0  0  1  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
```

```
## [15,] 0  0  0  0  0  0 0 0  1  1  0  0  0  0  0  0  0  0  0
## [16,] 0  0  0  1  0  0 0 0  1  0  0  0  0  0  0  0  0  0  0
## [17,] 0  0  0  0  0  0 0 0  1  0  0  0  0  0  0  0  0  0  0
## [18,] 0  0  0  0  0  0 0 0  1  0  0  0  0  0  0  0  0  0  0
## [19,] 0  1  0  0  0  0 0 0  1  0  0  0  0  0  0  0  0  0  0
## [20,] 0  0  0  1  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [21,] 0  0  0  1  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [22,] 0  0  0  1  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [23,] 0  0  0  1  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [24,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [25,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [26,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [27,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [28,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [29,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [30,] 0  1  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [31,] 0  0  0  0  0  0 0 0  0  0  1  0  0  0  0  0  0  0  0
## [32,] 0  0  0  0  0  0 0 0  0  0  1  0  0  0  0  0  0  0  0
## [33,] 0  0  0  0  0  0 0 0  0  0  1  0  0  0  0  0  0  0  0
## [34,] 0  0  0  0  0  0 0 0  0  0  0  1  0  0  0  0  0  0  0
## [35,] 0  0  0  0  0  0 0 0  0  0  0  0  1  0  0  0  0  0  0
## [36,] 0  0  0  0  0  0 0 0  0  0  0  0  1  0  0  0  0  0  0
## [37,] 0  0  0  0  0  0 0 0  0  0  0  0  0  1  0  0  0  0  0
## [38,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  1  0  0  0  0
## [39,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  1  0  0  0  0
## [40,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  1  0  0  0
## [41,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  1  0  0  0
## [42,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  1  0  0  0
## [43,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  1  0  0
## [44,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  1  0  0
## [45,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [46,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [47,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [48,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [49,] 0  0  0  0  1  0 0 0  0  0  0  0  0  0  0  0  0  0  0
## [50,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  1  0
## [51,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
## [52,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
## [53,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
## [54,] 0  0  0  0  0  1 0 0  0  0  0  0  0  0  0  0  0  0  0
## [55,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  1
## [56,] 0  0  0  0  0  0 0 0  0  0  0  0  0  0  0  0  0  0  1
```

Et pour 2007.

```
histories2007 <- dat2007 %>%
  group_by(id_ind) %>%
  mutate(id2 = row_number()) %>%
  pivot_wider(values_from = det,
              names_from = jour) %>% # les jours en colonnes
  select(-id2) %>%
  group_by(id_ind) %>%
  summarise(across(everything(), sum, na.rm = TRUE)) %>% # on rassemble les evenements pour chaque ind
  select(-id_ind)
```

```r
histories2007[is.na(histories2007)] <- 0 # les Na sont des non-détections = 0
histories2007[histories2007 > 1] <- 1 # les observations mens multiples = 1
(histories2007 <- as.matrix(histories2007))
```

```
##       18 13 16 25 28 20 26 4 8 11 22 14 12 21 27 5 6 24 1 19 29 7
##  [1,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [2,]  0  1  1  1  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [3,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [4,]  0  0  0  0  0  0  1 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [5,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [6,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [7,]  0  0  0  0  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
##  [8,]  0  0  0  0  0  0  0 0 1  1  0  0  0  0  0 0 0  0 0  0  0 0
##  [9,]  0  0  0  0  0  0  1 0 0  0  1  0  0  0  0 0 0  0 0  0  0 0
## [10,]  0  0  0  0  0  0  0 0 0  0  0  1  0  0  0 0 0  0 0  0  0 0
## [11,]  0  0  0  0  0  0  0 0 0  0  0  0  1  0  0 0 0  0 0  0  0 0
## [12,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [13,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [14,]  0  0  0  0  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [15,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  1 0 0  0 0  0  0 0
## [16,]  0  0  0  0  0  0  0 0 0  1  0  0  0  0  0 0 0  0 0  0  0 0
## [17,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [18,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [19,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [20,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 1  0 0  0  0 0
## [21,]  0  0  0  0  0  0  1 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [22,]  0  0  0  0  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [23,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [24,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [25,]  0  0  0  1  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [26,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [27,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [28,]  0  0  0  0  1  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [29,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  1 0  0  0 0
## [30,]  0  0  0  0  0  0  0 0 1  0  0  0  0  0  0 0 0  0 0  0  0 0
## [31,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [32,]  0  1  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [33,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [34,]  0  0  0  0  0  0  0 0 0  0  0  1  0  0  0 0 0  0 0  0  0 0
## [35,]  0  0  0  0  0  0  1 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [36,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [37,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [38,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 1  0  0 0
## [39,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  1 0 0  0 0  0  0 0
## [40,]  0  0  0  0  0  0  0 0 0  0  1  0  0  0  0 0 0  0 0  0  0 0
## [41,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  1  0 0
## [42,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  1 0
## [43,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [44,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [45,]  0  0  0  1  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [46,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [47,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 1
## [48,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 1  0 0  0  0 0
```

```
## [49,]  0  0  0  1  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [50,]  0  0  0  0  0  1  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [51,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [52,]  0  0  0  0  0  0  0 0 0  0  0  0  0  1  0 0 0  0 0  0  0 0
## [53,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 1  0 0  0  0 0
## [54,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [55,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 1  0  0 0
## [56,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 1  0  0 0
## [57,]  0  0  0  0  0  0  0 1 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [58,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [59,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [60,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [61,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 1 0  0 0  0  0 0
## [62,]  0  1  0  0  0  0  0 0 0  0  0  0  0  0  0 0 1  0 0  0  0 0
## [63,]  0  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 1
## [64,]  0  0  0  0  0  0  0 0 1  0  0  0  0  0  0 0 0  0 0  0  0 0
## [65,]  0  0  0  0  0  0  0 0 0  1  0  0  0  0  0 0 0  0 0  0  0 0
## [66,]  0  0  0  0  0  0  0 0 0  0  1  1  0  0  0 0 0  0 0  0  0 0
## [67,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [68,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  0  0 0
## [69,]  1  0  0  0  0  0  0 0 0  0  0  0  0  0  0 0 0  0 0  1  0 0
```

On fait les tests et l'ajustement pour 1997.

```
cistude <- data.frame(ch = collapseCH(histories1997),
                      freq = rep(1, nrow(histories1997)))
head(cistude)
```

```
##                     ch freq
## 1 1000000000000000000    1
## 2 0100000000000000000    1
## 3 0010000000000000000    1
## 4 0001100000000000000    1
## 5 0010100000000000000    1
## 6 0000010000000000000    1
```

```
tail(cistude)
```

```
##                      ch freq
## 51 0000010000000000000    1
## 52 0000010000000000000    1
## 53 0000010000000000000    1
## 54 0000010000000000000    1
## 55 0000000000000000001    1
## 56 0000000000000000001    1
```

On fait les tests de fermeture.

```
cistude_secr <- unRMarkInput(cistude) # on convertit au bon format
summary(cistude_secr) # resumes
```

```
## Object class       capthist
```

```
##
## Counts by occasion
##             1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 Total
## n           1  9  6  6  7  5  1  3  5  1  3  1  2  1  2  3  2  1  2    61
## u           1  9  6  6  5  5  1  3  3  0  3  1  2  1  2  3  2  1  2    56
## f          51  5  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0    56
## M(t+1)      1 10 16 22 27 32 33 36 39 39 42 43 45 46 48 51 53 54 56    56
## losses      0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0     0
## detections  1  9  6  6  7  5  1  3  5  1  3  1  2  1  2  3  2  1  2    61
```

```
closure.test(cistude_secr, SB = TRUE)
```

```
## $Otis
##  statistic          p
##  -1.783585 0.03724554
##
## $Xc
##  statistic df         p
##   7.130646 17 0.9817931
##
## $NRvsJS
##  statistic df p
##          0  0 1
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##  statistic df         p
##   7.130646 17 0.9817931
##
## $MtvsNM
##  statistic df         p
##   7.130646 17 0.9817931
##
## $compNRvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
## 16       17        NA NA NA
```

```
## 17       18        NA NA NA
##
## $compNMvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
## 16       17        NA NA NA
## 17       18        NA NA NA
```

On passe à l'ajustement des modèles.

```
cistude.proc <- process.data(cistude,
                             begin.time = 1,
                             model = "FullHet")
cistude.ddl <- make.design.data(cistude.proc)
```

```
run.cistude <- function() {

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ mixture + time)

  cistude.model.list <- create.model.list("FullHet")

  cistude.results <- mark.wrapper(cistude.model.list,
                              data = cistude.proc,
                              ddl = cistude.ddl)

  return(cistude.results)
}
```

```
cistude.results <- run.cistude()
```

```
##
## Output summary for FullHet model
```

```
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  46.99586
## AICc :  53.0185  (unadjusted=51.007166)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept) -0.0005172207 0.000000e+00 -0.0005172207 -0.0005172207
## p:(Intercept)  -4.6171068000 2.194446e-07 -4.6171072000 -4.6171063000
## f0:(Intercept)  5.6062372000 1.469847e-01  5.3181472000  5.8943273000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4998707
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##                    8         9        10        11        12        13        14
## mixture:1 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##                   15        16        17        18        19
## mixture:1 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##                    9        10        11        12        13        14        15
## mixture:1 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847 0.0097847
##                   16        17        18        19
## mixture:1 0.0097847 0.0097847 0.0097847 0.0097847
## mixture:2 0.0097847 0.0097847 0.0097847 0.0097847
##
##
## Real Parameter f0
##
##         1
##  272.1184
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4
```

```
## -2lnL:  37.00433
## AICc :  43.02698
##
## Beta
##                     estimate se           lcl           ucl
## pi:(Intercept)  0.0001205028  0  0.0001205028  0.0001205028
## p:(Intercept)  -2.3763337000  0 -2.3763337000 -2.3763337000
## c:(Intercept)  -4.8394517000  0 -4.8394517000 -4.8394517000
## f0:(Intercept)  2.5016956000  0  2.5016956000  2.5016956000
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000301
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
## mixture:2 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
##                   8         9        10        11        12        13        14
## mixture:1 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
## mixture:2 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
##                  15        16        17        18        19
## mixture:1 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
## mixture:2 0.0849953 0.0849953 0.0849953 0.0849953 0.0849953
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
## mixture:2 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
##                   9        10        11        12        13        14        15
## mixture:1 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
## mixture:2 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493 0.0078493
##                  16        17        18        19
## mixture:1 0.0078493 0.0078493 0.0078493 0.0078493
## mixture:2 0.0078493 0.0078493 0.0078493 0.0078493
##
##
## Real Parameter f0
##
##         1
##  12.20317
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  46.99586
## AICc :  55.03363  (unadjusted=51.007166)
```

```
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) -19.062969 4950.5221000 -9722.086400 9683.960500
## p:(Intercept)   -3.003695 1056.3791000 -2073.506700 2067.499300
## p:mixture2      -1.613396 1056.3784000 -2072.115200 2068.888400
## f0:(Intercept)   5.606219    0.5052688     4.615892    6.596546
##
##
## Real Parameter pi
##
##
## mixture:1 5.260875e-09
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592
## mixture:2 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848
##                    8         9        10        11        12        13        14
## mixture:1 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592
## mixture:2 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848
##                   15        16        17        18        19
## mixture:1 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592
## mixture:2 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592
## mixture:2 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848
##                    9        10        11        12        13        14        15
## mixture:1 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592 0.0472592
## mixture:2 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848 0.0097848
##                   16        17        18        19
## mixture:1 0.0472592 0.0472592 0.0472592 0.0472592
## mixture:2 0.0097848 0.0097848 0.0097848 0.0097848
##
##
## Real Parameter f0
##
##         1
##  272.1134
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=1)
## -2lnL:  1
## AICc :  NA  (unadjusted=Not a Number                 )
##
## Beta
```

```
##                estimate se  lcl  ucl
## pi:(Intercept)     -Inf  0 -Inf -Inf
## p:(Intercept)      -Inf  0 -Inf -Inf
## p:mixture2          Inf  0  Inf  Inf
## c:(Intercept)       Inf  0  Inf  Inf
## f0:(Intercept)      Inf  0  Inf  Inf
##
##
## Real Parameter pi
##
##
## mixture:1 5.562685e-309
##
##
## Real Parameter p
##
##                         1             2             3             4             5
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##                         6             7             8             9            10
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##                        11            12            13            14            15
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##                        16            17            18            19
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##
##
## Real Parameter c
##
##                         2             3             4             5             6
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##                         7             8             9            10            11
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##                        12            13            14            15            16
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309 5.562685e-309
##                        17            18            19
## mixture:1 5.562685e-309 5.562685e-309 5.562685e-309
## mixture:2 5.562685e-309 5.562685e-309 5.562685e-309
##
##
## Real Parameter f0
##
##   1
##  NA
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
```

```
## Npar :  22  (unadjusted=20)
## -2lnL:  16.12256
## AICc :  61.0947  (unadjusted=56.927927)
##
## Beta
##                       estimate        se         lcl        ucl
## pi:(Intercept) -2.038221e+01 0.0000000 -20.3822060 -20.382206
## p:(Intercept)  -3.964890e+00 0.0000000  -3.9648903  -3.964890
## p:time2         2.222485e+00 1.0570942   0.1505802   4.294389
## p:time3         1.807381e+00 1.0830057  -0.3153097   3.930073
## p:time4         1.807355e+00 1.0830059  -0.3153362   3.930047
## p:time5         1.964690e+00 1.0719733  -0.1363776   4.065758
## p:time6         1.621858e+00 1.0982763  -0.5307639   3.774479
## p:time7        -5.445342e-04 1.4164857  -2.7768565   2.775768
## p:time8         1.104644e+00 1.1573746  -1.1638106   3.373098
## p:time9         1.621854e+00 1.0982760  -0.5307669   3.774475
## p:time10       -3.055525e-04 1.4164228  -2.7764944   2.775883
## p:time11        1.104616e+00 1.1573780  -1.1638445   3.373077
## p:time12       -2.360654e-04 1.4163769  -2.7763348   2.775863
## p:time13        6.960161e-01 1.2272603  -1.7094140   3.101446
## p:time14       -2.078709e-04 1.4163930  -2.7763382   2.775922
## p:time15        6.960759e-01 1.2272509  -1.7093359   3.101488
## p:time16        1.104714e+00 1.1573644  -1.1637205   3.373148
## p:time17        6.959401e-01 1.2272788  -1.7095263   3.101407
## p:time18       -3.368502e-04 1.4164357  -2.7765510   2.775877
## p:time19        6.961051e-01 1.2272353  -1.7092761   3.101486
## p:mixture2     -1.795959e+00 0.0000000  -1.7959592  -1.795959
## f0:(Intercept)  5.571003e+00 0.5064197   4.5784208   6.563586
##
##
## Real Parameter pi
##
##
## mixture:1 1.406437e-09
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0186170 0.1490077 0.1036316 0.1036292 0.1191819 0.0876212 0.0186070
## mixture:2 0.0031386 0.0282401 0.0188268 0.0188263 0.0219636 0.0156888 0.0031369
##                    8         9        10        11        12        13        14
## mixture:1 0.0541541 0.0876209 0.0186114 0.0541527 0.0186126 0.0366546 0.0186132
## mixture:2 0.0094130 0.0156888 0.0031376 0.0094127 0.0031378 0.0062753 0.0031379
##                   15        16        17        18        19
## mixture:1 0.0366567 0.0541577 0.0366519 0.0186108 0.0366577
## mixture:2 0.0062757 0.0094137 0.0062749 0.0031375 0.0062759
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1490077 0.1036316 0.1036292 0.1191819 0.0876212 0.0186070 0.0541541
## mixture:2 0.0282401 0.0188268 0.0188263 0.0219636 0.0156888 0.0031369 0.0094130
```

```
##                    9        10        11        12        13        14        15
## mixture:1 0.0876209 0.0186114 0.0541527 0.0186126 0.0366546 0.0186132 0.0366567
## mixture:2 0.0156888 0.0031376 0.0094127 0.0031378 0.0062753 0.0031379 0.0062757
##                   16        17        18        19
## mixture:1 0.0541577 0.0366519 0.0186108 0.0366577
## mixture:2 0.0094137 0.0062749 0.0031375 0.0062759
##
##
## Real Parameter f0
##
##         1
##  262.6976
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  23  (unadjusted=18)
## -2lnL:  12.36969
## AICc :  59.43123  (unadjusted=49.024232)
##
## Beta
##                    estimate           se           lcl           ucl
## pi:(Intercept)   -4.358797 0.000000e+00 -4.358797e+00     -4.358797
## p:(Intercept)    10.421973 0.000000e+00  1.042197e+01     10.421973
## p:mixture2      -15.658092 0.000000e+00 -1.565809e+01    -15.658092
## p:time2           3.604684 0.000000e+00  3.604684e+00      3.604684
## p:time3           3.338982 0.000000e+00  3.338982e+00      3.338982
## p:time4           3.501531 0.000000e+00  3.501531e+00      3.501531
## p:time5           3.478254 0.000000e+00  3.478254e+00      3.478254
## p:time6           3.667518 0.000000e+00  3.667518e+00      3.667518
## p:time7           2.100661 0.000000e+00  2.100661e+00      2.100661
## p:time8           3.339056 0.000000e+00  3.339056e+00      3.339056
## p:time9           3.501542 0.000000e+00  3.501542e+00      3.501542
## p:time10        -11.705996 1.161014e+03 -2.287293e+03   2263.881200
## p:time11          3.695673 0.000000e+00  3.695673e+00      3.695673
## p:time12          2.671337 0.000000e+00  2.671337e+00      2.671337
## p:time13          3.531426 0.000000e+00  3.531426e+00      3.531426
## p:time14          2.933502 0.000000e+00  2.933502e+00      2.933502
## p:time15          3.849867 0.000000e+00  3.849867e+00      3.849867
## p:time16          4.725316 0.000000e+00  4.725316e+00      4.725316
## p:time17          4.830688 0.000000e+00  4.830688e+00      4.830688
## p:time18          4.542940 0.000000e+00  4.542940e+00      4.542940
## p:time19         80.186876 5.260014e+04 -1.030161e+05 103176.460000
## c:(Intercept)    -4.839341 4.489549e-01 -5.719293e+00     -3.959390
## f0:(Intercept) -70.932346 0.000000e+00 -7.093235e+01    -70.932346
##
##
## Real Parameter pi
##
##
## mixture:1 0.0126322
##
##
## Real Parameter p
```

```
##
##                    1         2         3         4         5         6         7
## mixture:1 0.9999702 0.9999992 0.9999989 0.9999991 0.9999991 0.9999992 0.9999964
## mixture:2 0.0052927 0.1636338 0.1304329 0.1500017 0.1470579 0.1724160 0.0416681
##                    8         9        10        11        12        13
## mixture:1 0.9999989 0.9999991 2.168662e-01 0.9999993 0.9999979 0.9999991
## mixture:2 0.1304413 0.1500030 4.386649e-08 0.1764705 0.0714397 0.1538534
##                   14        15        16        17        18 19
## mixture:1 0.9999984 0.9999994 0.9999997 0.9999998 0.9999997  1
## mixture:2 0.0909065 0.2000068 0.3750054 0.4000081 0.3333262  1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502
## mixture:2 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502
##                    9        10        11        12        13        14        15
## mixture:1 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502
## mixture:2 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502 0.0078502
##                   16        17        18        19
## mixture:1 0.0078502 0.0078502 0.0078502 0.0078502
## mixture:2 0.0078502 0.0078502 0.0078502 0.0078502
##
##
## Real Parameter f0
##
##             1
##  1.564853e-31
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  21
## -2lnL:  16.12256
## AICc :  56.92793
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept)  2.003320e-06  0  2.003320e-06  2.003320e-06
## p:(Intercept)  -5.761068e+00  0 -5.761068e+00 -5.761068e+00
## p:time2         2.222718e+00  0  2.222718e+00  2.222718e+00
## p:time3         1.807610e+00  0  1.807610e+00  1.807610e+00
## p:time4         1.807610e+00  0  1.807610e+00  1.807610e+00
## p:time5         1.964966e+00  0  1.964966e+00  1.964966e+00
## p:time6         1.622094e+00  0  1.622094e+00  1.622094e+00
## p:time7        -2.256188e-05  0 -2.256188e-05 -2.256188e-05
## p:time8         1.104919e+00  0  1.104919e+00  1.104919e+00
## p:time9         1.622095e+00  0  1.622095e+00  1.622095e+00
## p:time10       -1.480593e-05  0 -1.480593e-05 -1.480593e-05
## p:time11        1.104915e+00  0  1.104915e+00  1.104915e+00
## p:time12       -1.239915e-05  0 -1.239915e-05 -1.239915e-05
## p:time13        6.962821e-01  0  6.962821e-01  6.962821e-01
## p:time14       -1.075511e-05  0 -1.075511e-05 -1.075511e-05
```

```
## p:time15        6.962885e-01  0  6.962885e-01  6.962885e-01
## p:time16        1.104918e+00  0  1.104918e+00  1.104918e+00
## p:time17        6.962912e-01  0  6.962912e-01  6.962912e-01
## p:time18       -6.936615e-06  0 -6.936615e-06 -6.936615e-06
## p:time19        6.962844e-01  0  6.962844e-01  6.962844e-01
## f0:(Intercept)  5.570979e+00  0  5.570979e+00  5.570979e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000005
##
##
## Real Parameter p
##
##                    1         2        3        4         5         6         7
## mixture:1 0.0031379 0.0282405 0.018827 0.018827 0.0219649 0.0156891 0.0031378
## mixture:2 0.0031379 0.0282405 0.018827 0.018827 0.0219649 0.0156891 0.0031378
##                    8         9        10        11        12        13        14
## mixture:1 0.0094135 0.0156891 0.0031378 0.0094135 0.0031378 0.0062756 0.0031378
## mixture:2 0.0094135 0.0156891 0.0031378 0.0094135 0.0031378 0.0062756 0.0031378
##                   15        16        17        18        19
## mixture:1 0.0062757 0.0094135 0.0062757 0.0031378 0.0062756
## mixture:2 0.0062757 0.0094135 0.0062757 0.0031378 0.0062756
##
##
## Real Parameter c
##
##                    2        3        4         5         6         7         8
## mixture:1 0.0282405 0.018827 0.018827 0.0219649 0.0156891 0.0031378 0.0094135
## mixture:2 0.0282405 0.018827 0.018827 0.0219649 0.0156891 0.0031378 0.0094135
##                    9        10        11        12        13        14        15
## mixture:1 0.0156891 0.0031378 0.0094135 0.0031378 0.0062756 0.0031378 0.0062757
## mixture:2 0.0156891 0.0031378 0.0094135 0.0031378 0.0062756 0.0031378 0.0062757
##                   16        17        18        19
## mixture:1 0.0094135 0.0062757 0.0031378 0.0062756
## mixture:2 0.0094135 0.0062757 0.0031378 0.0062756
##
##
## Real Parameter f0
##
##         1
##  262.6911
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  22  (unadjusted=18)
## -2lnL:  12.36969
## AICc :  57.34183  (unadjusted=49.024231)
##
## Beta
##                     estimate           se           lcl           ucl
```

```
## pi:(Intercept)  1.699829e-04    0.0000000  1.699829e-04  1.699829e-04
## p:(Intercept)  -4.007429e+00    1.0090928 -5.985251e+00 -2.029608e+00
## p:time2         2.376005e+00    1.0729022  2.731167e-01  4.478893e+00
## p:time3         2.110294e+00    1.0999713 -4.564950e-02  4.266238e+00
## p:time4         2.272809e+00    1.1019750  1.129380e-01  4.432680e+00
## p:time5         2.249580e+00    1.1192629  5.582430e-02  4.443335e+00
## p:time6         2.438793e+00    1.1224693  2.387532e-01  4.638833e+00
## p:time7         8.719884e-01    1.4358560 -1.942289e+00  3.686266e+00
## p:time8         2.110307e+00    1.1838929 -2.101227e-01  4.430738e+00
## p:time9         2.272818e+00    1.1876139 -5.490570e-02  4.600541e+00
## p:time10       -1.823765e+01   23.8714110 -6.502562e+01  2.855031e+01
## p:time11        2.466975e+00    1.1929093  1.288722e-01  4.805077e+00
## p:time12        1.442462e+00    1.4474834 -1.394606e+00  4.279529e+00
## p:time13        2.302628e+00    1.2685421 -1.837150e-01  4.788970e+00
## p:time14        1.704809e+00    1.4554373 -1.147848e+00  4.557467e+00
## p:time15        2.621088e+00    1.2819076  1.085492e-01  5.133627e+00
## p:time16        3.496586e+00    1.2456339  1.055144e+00  5.938029e+00
## p:time17        3.601929e+00    1.3607377  9.348825e-01  6.268974e+00
## p:time18        3.314421e+00    1.5868832  2.041300e-01  6.424712e+00
## p:time19        2.302426e+01 8542.6475000 -1.672056e+04  1.676661e+04
## c:(Intercept)  -4.839442e+00    0.4489772 -5.719438e+00 -3.959447e+00
## f0:(Intercept) -1.977177e+01 4278.6597000 -8.405945e+03  8.366401e+03
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000425
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0178555 0.1636354 0.1304331 0.1499976 0.1470599 0.1724109 0.0416688
## mixture:2 0.0178555 0.1636354 0.1304331 0.1499976 0.1470599 0.1724109 0.0416688
##                    8         9           10        11        12        13
## mixture:1 0.1304346 0.1499986 2.183152e-10 0.1764692 0.0714274 0.1538392
## mixture:2 0.1304346 0.1499986 2.183152e-10 0.1764692 0.0714274 0.1538392
##                   14        15        16        17        18 19
## mixture:1 0.0909062 0.1999925 0.3749959 0.3999914 0.3333642  1
## mixture:2 0.0909062 0.1999925 0.3749959 0.3999914 0.3333642  1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494
## mixture:2 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494
##                    9        10        11        12        13        14        15
## mixture:1 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494
## mixture:2 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494 0.0078494
##                   16        17        18        19
## mixture:1 0.0078494 0.0078494 0.0078494 0.0078494
## mixture:2 0.0078494 0.0078494 0.0078494 0.0078494
```

```
##
##
## Real Parameter f0
##
##             1
##  2.589588e-09
```

```
cistude.results
```

```
##                                 model npar     AICc DeltaAICc weight Deviance
## 1               pi(~1)p(~1)c()f0(~1)    3 53.01850        NA     NA 67.14458
## 2             pi(~1)p(~1)c(~1)f0(~1)    4 45.04211        NA     NA 57.15306
## 3          pi(~1)p(~mixture)c()f0(~1)    4 55.03363        NA     NA 67.14458
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5       NA        NA     NA  2.00000
## 5   pi(~1)p(~time + mixture)c()f0(~1)   22 61.09470        NA     NA 36.27128
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   23 59.43123        NA     NA 32.51841
## 7             pi(~1)p(~time)c()f0(~1)   21 59.00931        NA     NA 36.27128
## 8           pi(~1)p(~time)c(~1)f0(~1)   22 57.34183        NA     NA 32.51841
```

```
names(cistude.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

```
cistude.results$p.dot.behav$results$real
```

```
##               estimate se        lcl        ucl fixed note
## pi g1 m1     0.5000301  0  0.5000301  0.5000301
## p g1 t1 m1   0.0849953  0  0.0849953  0.0849953
## c g1 t2 m1   0.0078493  0  0.0078493  0.0078493
## f0 g1 a0 t1 12.2031680  0 12.2031680 12.2031680
```

```
cistude.results$p.dot.behav$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 68.20317 68.20317 68.20317
```

Idem avec 2007.

```
cistude <- data.frame(ch = collapseCH(histories2007), freq = rep(1, nrow(histories2007)))
head(cistude)
```

```
##                       ch freq
## 1 10000000000000000000    1
## 2 01111000000000000000    1
## 3 00000100000000000000    1
## 4 00000010000000000000    1
## 5 00000001000000000000    1
## 6 00000100000000000000    1
```

```r
tail(cistude)
```

```
##                          ch freq
## 64 00000000100000000000000    1
## 65 00000000010000000000000    1
## 66 00000000001100000000000    1
## 67 10000000000000000000000    1
## 68 10000000000000000000000    1
## 69 10000000000000000000100    1
```

```r
cistude_secr <- unRMarkInput(cistude) # on convertit au bon format
summary(cistude_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##              1  2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 18 19 20 21 22
## n            7  3  1  4  5  6  4  8  3  3  3  3  1  6  2  7  4  1  3  2  1  2
## u            7  3  0  3  4  6  4  8  3  2  2  2  1  5  2  6  3  1  3  1  1  2
## f           61  7  0  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
## M(t+1)       7 10 10 13 17 23 27 35 38 40 42 44 45 50 52 58 61 62 65 66 67 69
## losses       0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0
## detections   7  3  1  4  5  6  4  8  3  3  3  3  1  6  2  7  4  1  3  2  1  2
##             Total
## n              79
## u              69
## f              69
## M(t+1)         69
## losses          0
## detections     79
```

```r
closure.test(cistude_secr, SB = TRUE)
```

```
## $Otis
##  statistic          p
##  -2.169297 0.01503008
##
## $Xc
##  statistic df         p
##   25.54082 20 0.1815182
##
## $NRvsJS
##  statistic df p
##          0  0 1
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##  statistic df         p
##   25.54082 20 0.1815182
```

```
##
## $MtvsNM
##  statistic df         p
##   25.54082 20 0.1815182
##
## $compNRvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
## 16       17        NA NA NA
## 17       18        NA NA NA
## 18       19        NA NA NA
## 19       20        NA NA NA
## 20       21        NA NA NA
##
## $compNMvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
## 16       17        NA NA NA
## 17       18        NA NA NA
## 18       19        NA NA NA
## 19       20        NA NA NA
## 20       21        NA NA NA
```

```
cistude.proc <- process.data(cistude, begin.time = 1, model = "FullHet")
cistude.ddl <- make.design.data(cistude.proc)
```

```
run.cistude <- function() {

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ mixture + time)

  cistude.model.list <- create.model.list("FullHet")

  cistude.results <- mark.wrapper(cistude.model.list,
                              data = cistude.proc,
                              ddl = cistude.ddl)

  return(cistude.results)
}
```

```
cistude.results <- run.cistude()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  85.99303
## AICc :  92.00888  (unadjusted=90.000953)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept) -3.860164e-05 0.0000000 -3.860164e-05 -3.860164e-05
## p:(Intercept)  -4.304988e+00 0.3096315 -4.911865e+00 -3.698110e+00
## f0:(Intercept)  5.301131e+00 0.3677725  4.580296e+00  6.021965e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999903
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##                    8         9        10        11        12        13        14
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##                   15        16        17        18        19        20        21
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
```

```
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##                  22
## mixture:1 0.0133212
## mixture:2 0.0133212
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##                   9        10        11        12        13        14        15
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##                  16        17        18        19        20        21        22
## mixture:1 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
## mixture:2 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212 0.0133212
##
##
## Real Parameter f0
##
##         1
##  200.5634
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  83.46629
## AICc :  91.49273  (unadjusted=89.48214)
##
## Beta
##                      estimate           se          lcl         ucl
## pi:(Intercept)  9.886374e-07 1773.6218000 -3476.298900 3476.298900
## p:(Intercept)  -3.117356e+00    0.4578072    -4.014658   -2.220054
## c:(Intercept)  -4.409155e+00    0.3181455    -5.032720   -3.785590
## f0:(Intercept)  3.756404e+00    0.7299592     2.325684    5.187124
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000002
##
##
## Real Parameter p
##
##                   1        2        3        4        5        6        7
## mixture:1 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
## mixture:2 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
##                   8        9       10       11       12       13       14
## mixture:1 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
## mixture:2 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
##                  15       16       17       18       19       20       21
```

```
## mixture:1 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
## mixture:2 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397 0.042397
##                22
## mixture:1 0.042397
## mixture:2 0.042397
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                   9        10        11        12        13        14        15
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                  16        17        18        19        20        21        22
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##
##
## Real Parameter f0
##
##         1
##  42.79425
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4
## -2lnL:  83.21729
## AICc :  91.24373
##
## Beta
##                  estimate        se       lcl        ucl
## pi:(Intercept) -5.259816 1.6096079 -8.414648 -2.1049846
## p:(Intercept)  -1.956470 1.0035319 -3.923393  0.0104523
## p:mixture2     -2.720599 0.9669111 -4.615745 -0.8254532
## f0:(Intercept)  5.693509 0.4901409  4.732833  6.6541851
##
##
## Real Parameter pi
##
##
## mixture:1 0.0051694
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                   8         9        10        11        12        13        14
## mixture:1 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
```

```
##                  15        16        17        18        19        20        21
## mixture:1 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                  22
## mixture:1 0.1238496
## mixture:2 0.0092204
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                   9        10        11        12        13        14        15
## mixture:1 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##                  16        17        18        19        20        21        22
## mixture:1 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496 0.1238496
## mixture:2 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204 0.0092204
##
##
## Real Parameter f0
##
##         1
##  296.9337
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5
## -2lnL:  82.24349
## AICc :  92.28317
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept)  -3.795306 0.9936918  -5.742942  -1.847670
## p:(Intercept)   17.690328 0.0000000  17.690328  17.690328
## p:mixture2     -21.062349 0.0000000 -21.062349 -21.062349
## c:(Intercept)   -4.409155 0.3181455  -5.032721  -3.785590
## f0:(Intercept)   4.087588 0.9024328   2.318820   5.856357
##
##
## Real Parameter pi
##
##
## mixture:1 0.021982
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0331814 0.0331814 0.0331814 0.0331814 0.0331814 0.0331814 0.0331814
##                   8         9        10        11        12        13        14
```

```
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0331814 0.0331814 0.0331814 0.0331814 0.0331814 0.0331814 0.0331814
##                  15        16        17        18        19        20        21
## mixture:1 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000 1.0000000
## mixture:2 0.0331814 0.0331814 0.0331814 0.0331814 0.0331814 0.0331814 0.0331814
##                  22
## mixture:1 1.0000000
## mixture:2 0.0331814
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                   9        10        11        12        13        14        15
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                  16        17        18        19        20        21        22
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##
##
## Real Parameter f0
##
##         1
##  59.59599
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  25
## -2lnL:  56.76562
## AICc :  107.6369
##
## Beta
##                       estimate        se        lcl        ucl
## pi:(Intercept) -5.283649e+00 1.5634277 -8.3479673 -2.2193308
## p:(Intercept)  -1.205615e+00 1.0757038 -3.3139941  0.9027649
## p:time2        -8.664624e-01 0.6970411 -2.2326629  0.4997382
## p:time3        -1.975412e+00 1.0737490 -4.0799596  0.1291366
## p:time4        -5.738176e-01 0.6343283 -1.8171010  0.6694658
## p:time5        -3.458329e-01 0.5934943 -1.5090818  0.8174161
## p:time6        -1.587822e-01 0.5646107 -1.2654192  0.9478548
## p:time7        -5.738165e-01 0.6343280 -1.8170995  0.6694664
## p:time8         1.380633e-01 0.5262442 -0.8933753  1.1695019
## p:time9        -8.664620e-01 0.6970405 -2.2326615  0.4997375
## p:time10       -8.664615e-01 0.6970411 -2.2326621  0.4997390
## p:time11       -8.664613e-01 0.6970408 -2.2326614  0.4997387
## p:time12       -8.664617e-01 0.6970412 -2.2326626  0.4997391
## p:time13       -1.975412e+00 1.0737500 -4.0799617  0.1291383
## p:time14       -1.587820e-01 0.5646101 -1.2654179  0.9478538
## p:time15       -1.277021e+00 0.8079114 -2.8605275  0.3064853
## p:time16       -2.999288e-06 0.5430228 -1.0643278  1.0643218
```

```
## p:time17       -5.738185e-01 0.6343280 -1.8171015  0.6694645
## p:time18       -1.975411e+00 1.0737499 -4.0799606  0.1291390
## p:time19       -8.664615e-01 0.6970404 -2.2326607  0.4997377
## p:time20       -1.277022e+00 0.8079112 -2.8605279  0.3064839
## p:time21       -1.975412e+00 1.0737509 -4.0799638  0.1291396
## p:time22       -1.277022e+00 0.8079104 -2.8605267  0.3064821
## p:mixture2     -2.772607e+00 0.9754465 -4.6844822 -0.8607320
## f0:(Intercept)  5.673248e+00 0.4870535  4.7186229  6.6278725
##
##
## Real Parameter pi
##
##
## mixture:1 0.0050483
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.2304779 0.1118406 0.0398860 0.1443733 0.1748773 0.2035266 0.1443734
## mixture:2 0.0183749 0.0078086 0.0025897 0.0104356 0.0130729 0.0157196 0.0104356
##                    8         9        10        11        12        13        14
## mixture:1 0.2558690 0.1118406 0.1118406 0.1118407 0.1118406 0.0398860 0.2035267
## mixture:2 0.0210381 0.0078087 0.0078087 0.0078087 0.0078087 0.0025897 0.0157196
##                   15        16        17        18        19        20        21
## mixture:1 0.0770845 0.2304774 0.1443732 0.0398860 0.1118406 0.0770844 0.0398860
## mixture:2 0.0051930 0.0183749 0.0104356 0.0025897 0.0078087 0.0051930 0.0025897
##                   22
## mixture:1 0.0770844
## mixture:2 0.0051930
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1118406 0.0398860 0.1443733 0.1748773 0.2035266 0.1443734 0.2558690
## mixture:2 0.0078086 0.0025897 0.0104356 0.0130729 0.0157196 0.0104356 0.0210381
##                    9        10        11        12        13        14        15
## mixture:1 0.1118406 0.1118406 0.1118407 0.1118406 0.0398860 0.2035267 0.0770845
## mixture:2 0.0078087 0.0078087 0.0078087 0.0078087 0.0025897 0.0157196 0.0051930
##                   16        17        18        19        20        21        22
## mixture:1 0.2304774 0.1443732 0.0398860 0.1118406 0.0770844 0.0398860 0.0770844
## mixture:2 0.0183749 0.0104356 0.0025897 0.0078087 0.0051930 0.0025897 0.0051930
##
##
## Real Parameter f0
##
##        1
##  290.978
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  26  (unadjusted=21)
```

```
## -2lnL:  51.61744
## AICc :  104.5591  (unadjusted=94.235083)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept)  -5.5328250    0.0000000    -5.5328250   -5.5328250
## p:(Intercept)    7.2618740    0.0000000     7.2618740    7.2618740
## p:mixture2      -9.4826852    0.0000000    -9.4826852   -9.4826852
## p:time2         -0.7581205    0.0000000    -0.7581205   -0.7581205
## p:time3        -17.4446960 2450.5896000 -4820.6005000 4785.7111000
## p:time4         -0.7059100    0.0000000    -0.7059100   -0.7059100
## p:time5         -0.3441518    0.0000000    -0.3441518   -0.3441518
## p:time6          0.1839071    0.0000000     0.1839071    0.1839071
## p:time7         -0.1305918    0.0000000    -0.1305918   -0.1305918
## p:time8          0.7738887    0.0000000     0.7738887    0.7738887
## p:time9         -0.1144871    0.0000000    -0.1144871   -0.1144871
## p:time10        -0.4533522    0.0000000    -0.4533522   -0.4533522
## p:time11        -0.3819313    0.0000000    -0.3819313   -0.3819313
## p:time12        -0.3048974    0.0000000    -0.3048974   -0.3048974
## p:time13        -0.9572761    0.0000000    -0.9572761   -0.9572761
## p:time14         0.8858162    0.0000000     0.8858162    0.8858162
## p:time15         0.0806615    0.0000000     0.0806615    0.0806615
## p:time16         1.6146651    0.0000000     1.6146651    1.6146651
## p:time17         1.2399940    0.0000000     1.2399940    1.2399940
## p:time18         0.2747981    0.0000000     0.2747981    0.2747981
## p:time19         1.9331020    0.0000000     1.9331020    1.9331020
## p:time20         1.1222112    0.0000000     1.1222112    1.1222112
## p:time21         1.5276868    0.0000000     1.5276868    1.5276868
## p:time22        27.4597500    0.0000000    27.4597500   27.4597500
## c:(Intercept)   -4.4091612    0.3181464    -5.0327282   -3.7855943
## f0:(Intercept) -29.1079170    0.0000000   -29.1079170  -29.1079170
##
##
## Real Parameter pi
##
##
## mixture:1 0.0039392
##
##
## Real Parameter p
##
##                    1         2            3         4         5         6
## mixture:1 0.9992987 0.9985044 3.781292e-05 0.9985804 0.9990109 0.9994164
## mixture:2 0.0978971 0.0483868 2.879909e-09 0.0508483 0.0714277 0.1153823
##                    7         8         9        10        11        12        13
## mixture:1 0.9992009 0.9996764 0.9992137 0.9988969 0.9989729 0.9990489 0.9981755
## mixture:2 0.0869543 0.1904757 0.0882415 0.0645152 0.0689621 0.0740754 0.0399987
##                   14        15        16        17        18        19        20
## mixture:1 0.9997107 0.9993530 0.9998604 0.9997970 0.9994671 0.9998985 0.9997716
## mixture:2 0.2083343 0.1052553 0.3529388 0.2727297 0.1249887 0.4285648 0.2500023
##                   21 22
## mixture:1 0.9998477  1
## mixture:2 0.3333384  1
##
```

```
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                    9        10        11        12        13        14        15
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##                   16        17        18        19        20        21        22
## mixture:1 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
## mixture:2 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192 0.0120192
##
##
## Real Parameter f0
##
##             1
##  2.283455e-13
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  24  (unadjusted=23)
## -2lnL:  59.63505
## AICc :  108.4388  (unadjusted=106.374)
##
## Beta
##                       estimate        se           lcl           ucl
## pi:(Intercept)  2.175571e-05 0.0000000  2.175571e-05  2.175571e-05
## p:(Intercept)  -3.609593e+00 0.4354648 -4.463104e+00 -2.756082e+00
## p:time2        -8.626437e-01 0.6585576 -2.153417e+00  4.281292e-01
## p:time3        -1.968840e+00 1.0490079 -4.024895e+00  8.721550e-02
## p:time4        -5.711455e-01 0.5019317 -1.554932e+00  4.126407e-01
## p:time5        -3.441740e-01 0.4576319 -1.241133e+00  5.527845e-01
## p:time6        -1.580069e-01 0.5166861 -1.170712e+00  8.546979e-01
## p:time7        -5.711455e-01 0.5918956 -1.731261e+00  5.889700e-01
## p:time8         1.374069e-01 0.4746204 -7.928492e-01  1.067663e+00
## p:time9        -8.626437e-01 0.6942771 -2.223427e+00  4.981395e-01
## p:time10       -8.626411e-01 0.6942750 -2.223420e+00  4.981380e-01
## p:time11       -8.626429e-01 0.6585578 -2.153416e+00  4.281303e-01
## p:time12       -8.626415e-01 0.6585573 -2.153414e+00  4.281309e-01
## p:time13       -1.968841e+00 1.0490093 -4.024899e+00  8.721750e-02
## p:time14       -1.580084e-01 0.5166861 -1.170713e+00  8.546964e-01
## p:time15       -1.271907e+00 0.6723477 -2.589708e+00  4.589500e-02
## p:time16        1.030313e-06 0.3948121 -7.738307e-01  7.738327e-01
## p:time17       -5.711469e-01 0.5918953 -1.731262e+00  5.889679e-01
## p:time18       -1.968841e+00 1.0490095 -4.024899e+00  8.721800e-02
## p:time19       -8.626416e-01 0.6585572 -2.153414e+00  4.281306e-01
## p:time20       -1.271907e+00 0.7748492 -2.790611e+00  2.467975e-01
## p:time21       -1.968839e+00 1.0490079 -4.024894e+00  8.721690e-02
## p:time22       -1.271906e+00 0.7748484 -2.790609e+00  2.467966e-01
## f0:(Intercept)  5.281460e+00 0.3836890  4.529429e+00  6.033490e+00
##
##
```

```
## Real Parameter pi
##
##
## mixture:1 0.5000054
##
##
## Real Parameter p
##
##                   1         2         3        4         5         6        7
## mixture:1 0.0263498 0.0112928 0.0037643 0.015057 0.0188213 0.0225856 0.015057
## mixture:2 0.0263498 0.0112928 0.0037643 0.015057 0.0188213 0.0225856 0.015057
##                   8         9        10        11        12        13        14
## mixture:1 0.0301141 0.0112928 0.0112928 0.0112928 0.0112928 0.0037643 0.0225855
## mixture:2 0.0301141 0.0112928 0.0112928 0.0112928 0.0112928 0.0037643 0.0225855
##                  15        16       17        18        19        20        21
## mixture:1 0.0075285 0.0263498 0.015057 0.0037643 0.0112928 0.0075285 0.0037643
## mixture:2 0.0075285 0.0263498 0.015057 0.0037643 0.0112928 0.0075285 0.0037643
##                  22
## mixture:1 0.0075285
## mixture:2 0.0075285
##
##
## Real Parameter c
##
##                   2         3        4         5         6        7         8
## mixture:1 0.0112928 0.0037643 0.015057 0.0188213 0.0225856 0.015057 0.0301141
## mixture:2 0.0112928 0.0037643 0.015057 0.0188213 0.0225856 0.015057 0.0301141
##                   9        10        11        12        13        14        15
## mixture:1 0.0112928 0.0112928 0.0112928 0.0112928 0.0037643 0.0225855 0.0075285
## mixture:2 0.0112928 0.0112928 0.0112928 0.0112928 0.0037643 0.0225855 0.0075285
##                  16       17        18        19        20        21        22
## mixture:1 0.0263498 0.015057 0.0037643 0.0112928 0.0075285 0.0037643 0.0075285
## mixture:2 0.0263498 0.015057 0.0037643 0.0112928 0.0075285 0.0037643 0.0075285
##
##
## Real Parameter f0
##
##         1
##  196.6567
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  25  (unadjusted=21)
## -2lnL:  51.61744
## AICc :  102.4887  (unadjusted=94.235083)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept) -8.771919e-04 0.000000e+00 -8.771919e-04 -8.771919e-04
## p:(Intercept)  -2.181244e+00 3.987327e-01 -2.962760e+00 -1.399728e+00
## p:time2        -7.976736e-01 7.136296e-01 -2.196388e+00  6.010404e-01
## p:time3        -1.794144e+01 2.902579e+03 -5.706996e+03  5.671113e+03
## p:time4        -7.455022e-01 7.142692e-01 -2.145470e+00  6.544654e-01
```

```
## p:time5        -3.837212e-01 6.543868e-01 -1.666319e+00  8.988769e-01
## p:time6         1.443502e-01 5.894024e-01 -1.010879e+00  1.299579e+00
## p:time7        -1.701517e-01 6.578761e-01 -1.459589e+00  1.119285e+00
## p:time8         7.343033e-01 5.598226e-01 -3.629491e-01  1.831556e+00
## p:time9        -1.541503e-01 7.242823e-01 -1.573744e+00  1.265443e+00
## p:time10       -4.929195e-01 8.327524e-01 -2.125114e+00  1.139275e+00
## p:time11       -4.214564e-01 8.342833e-01 -2.056652e+00  1.213739e+00
## p:time12       -3.445614e-01 8.360737e-01 -1.983266e+00  1.294143e+00
## p:time13       -9.969157e-01 1.095790e+00 -3.144663e+00  1.150832e+00
## p:time14        8.462341e-01 6.415763e-01 -4.112556e-01  2.103724e+00
## p:time15        4.118050e-02 8.472362e-01 -1.619402e+00  1.701763e+00
## p:time16        1.575102e+00 6.454177e-01  3.100834e-01  2.840121e+00
## p:time17        1.200417e+00 7.856973e-01 -3.395496e-01  2.740384e+00
## p:time18        2.353346e-01 1.140983e+00 -2.000993e+00  2.471662e+00
## p:time19        1.893581e+00 8.615799e-01  2.048840e-01  3.582277e+00
## p:time20        1.082645e+00 1.221602e+00 -1.311696e+00  3.476985e+00
## p:time21        1.488084e+00 1.288019e+00 -1.036433e+00  4.012601e+00
## p:time22        2.315993e+01 1.014343e+04 -1.985797e+04  1.990429e+04
## c:(Intercept)  -4.409179e+00 3.181492e-01 -5.032752e+00 -3.785607e+00
## f0:(Intercept) -1.999985e+01 4.891316e+03 -9.606980e+03  9.566980e+03
##
##
## Real Parameter pi
##
##
## mixture:1 0.4997807
##
##
## Real Parameter p
##
##                    1         2            3         4         5         6
## mixture:1 0.1014474 0.0483874 1.823183e-09 0.0508471 0.0714275 0.1153834
## mixture:2 0.1014474 0.0483874 1.823183e-09 0.0508471 0.0714275 0.1153834
##                    7         8         9        10        11        12        13
## mixture:1 0.0869549 0.1904728 0.0882337 0.0645152 0.0689648 0.0740688 0.0399959
## mixture:2 0.0869549 0.1904728 0.0882337 0.0645152 0.0689648 0.0740688 0.0399959
##                   14        15        16        17    18        19        20
## mixture:1 0.2083318 0.1052634 0.3529397 0.2727277 0.125 0.4285759 0.2500023
## mixture:2 0.2083318 0.1052634 0.3529397 0.2727277 0.125 0.4285759 0.2500023
##                   21 22
## mixture:1 0.3333304  1
## mixture:2 0.3333304  1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189
## mixture:2 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189
##                    9        10        11        12        13        14        15
## mixture:1 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189
## mixture:2 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189
##                   16        17        18        19        20        21        22
## mixture:1 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189
```

```
## mixture:2 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189 0.0120189
##
##
## Real Parameter f0
##
##             1
##  2.061457e-09
```

```
cistude.results
```

```
##                                 model npar      AICc  DeltaAICc       weight
## 3          pi(~1)p(~mixture)c()f0(~1)    4  91.24373  0.0000000 3.159467e-01
## 2              pi(~1)p(~1)c(~1)f0(~1)    4  91.49273  0.2489940 2.789623e-01
## 1                pi(~1)p(~1)c()f0(~1)    3  92.00888  0.7651525 2.155079e-01
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5  92.28317  1.0394370 1.878897e-01
## 8           pi(~1)p(~time)c(~1)f0(~1)   25 102.48875 11.2450181 1.142324e-03
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   26 104.55909 13.3153544 4.057153e-04
## 5   pi(~1)p(~time + mixture)c()f0(~1)   25 107.63693 16.3932001 8.707143e-05
## 7             pi(~1)p(~time)c()f0(~1)   24 108.43880 17.1950653 5.831132e-05
##    Deviance
## 3 112.66139
## 2 112.91038
## 1 115.43712
## 4 111.68758
## 8  81.06153
## 6  81.06153
## 5  86.20971
## 7  89.07914
```

```
names(cistude.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

```
cistude.results$p.h$results$real
```

```
##                estimate          se          lcl         ucl fixed note
## pi g1 m1      0.0051694   0.0082777 2.215485e-04   0.1086133
## p g1 t1 m1    0.1238496   0.1088941 1.939050e-02   0.5026130
## p g1 t1 m2    0.0092204   0.0040212 3.911900e-03   0.0215766
## f0 g1 a0 t1 296.9337200 145.5393500 1.195881e+02 737.2776000
```

```
cistude.results$p.h$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 365.9337 188.5881 806.2776
```

Exercice 4 : iguanes

Données 2006

Les données.

```
iguane <- convert.inp("dat/iguanes-2006-2sexes-FM.inp",
                      group.df = data.frame(sex = c("F","M")),
                      covariates = NULL)
head(iguane)
```

```
##                     ch freq sex
## 1:1 00000000000001000    1   F
## 1:2 00000000000001000    1   F
## 1:3 00000000000010000    1   F
## 1:4 00010000000000000    1   F
## 1:5 00001000000000000    1   F
## 1:6 00000000000010000    1   F
```

```
tail(iguane)
```

```
##                       ch freq sex
## 2:156 00000010000010000    1   M
## 2:157 00000001000000010    1   M
## 2:158 00000100100000000    1   M
## 2:159 00000010000000100    1   M
## 2:160 01000000100000000    1   M
## 2:161 01100000100000000    1   M
```

On sépare mâles et femelles.

```
iguaneM <- iguane[iguane$sex == "M", ]
iguaneF <- iguane[iguane$sex == "F", ]
```

On formate les données.

```
iguane_secr <- unRMarkInput(iguane) # on convertit au bon format
iguaneM_secr <- unRMarkInput(iguaneM) # on convertit au bon format
iguaneF_secr <- unRMarkInput(iguaneF) # on convertit au bon format
summary(iguane_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##              1  2  3  4  5  6  7  8  9 10 11  12  13  14  15  16  17 Total
## n            1 10  4 11 12 11 13 10 10  4 18  17  16  11  12  19   1   180
## u            1 10  3 11 12 10 12 10  7  3 16  16  14  11   8  16   1   161
## f          145 13  3  0  0  0  0  0  0  0  0   0   0   0   0   0   0   161
## M(t+1)       1 11 14 25 37 47 59 69 76 79 95 111 125 136 144 160 161   161
## losses       0  0  0  0  0  0  0  0  0  0  0   0   0   0   0   0   0     0
## detections   1 10  4 11 12 11 13 10 10  4 18  17  16  11  12  19   1   180
```

```
##
## Individual covariates
##  sex
##  F:89
##  M:72
```

```
summary(iguaneM_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##             1 2  3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 Total
## n           0 9  3  4  8  6  6  2  5  1  5  5  9  4  6  9  1    83
## u           0 9  2  4  8  5  5  2  2  1  5  5  8  4  4  7  1    72
## f          62 9  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0    72
## M(t+1)      0 9 11 15 23 28 33 35 37 38 43 48 56 60 64 71 72    72
## losses      0 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0  0     0
## detections  0 9  3  4  8  6  6  2  5  1  5  5  9  4  6  9  1    83
##
## Individual covariates
##  sex
##  M:72
```

```
summary(iguaneF_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##             1 2 3  4  5  6  7  8  9 10 11 12 13 14 15 16 17 Total
## n           1 1 1  7  4  5  7  8  5  3 13 12  7  7  6 10  0    97
## u           1 1 1  7  4  5  7  8  5  2 11 11  6  7  4  9  0    89
## f          83 4 2  0  0  0  0  0  0  0  0  0  0  0  0  0  0    89
## M(t+1)      1 2 3 10 14 19 26 34 39 41 52 63 69 76 80 89 89    89
## losses      0 0 0  0  0  0  0  0  0  0  0  0  0  0  0  0  0     0
## detections  1 1 1  7  4  5  7  8  5  3 13 12  7  7  6 10  0    97
##
## Individual covariates
##  sex
##  F:89
```

Les deux sexes ensemble.

```
closure.test(iguane_secr, SB = TRUE)
```

```
## $Otis
##  statistic          p
##  -1.894954 0.02904928
##
## $Xc
##  statistic df         p
##   10.06825 16 0.8630401
##
```

```
## $NRvsJS
##  statistic df        p
##   1.475048  1 0.224551
##
## $NMvsJS
##   statistic df         p
##  0.04058442  1 0.8403422
##
## $MtvsNR
##  statistic df         p
##   8.593198 15 0.8978099
##
## $MtvsNM
##  statistic df         p
##   10.02766 15 0.8179963
##
## $compNRvsJS
##    Occasion Chisquare df        p
## 1         2        NA NA       NA
## 2         3        NA NA       NA
## 3         4        NA NA       NA
## 4         5        NA NA       NA
## 5         6        NA NA       NA
## 6         7        NA NA       NA
## 7         8        NA NA       NA
## 8         9        NA NA       NA
## 9        10        NA NA       NA
## 10       11        NA NA       NA
## 11       12        NA NA       NA
## 12       13        NA NA       NA
## 13       14        NA NA       NA
## 14       15  1.475048  1 0.224551
## 15       16        NA NA       NA
##
## $compNMvsJS
##    Occasion  Chisquare df         p
## 1         2         NA NA        NA
## 2         3         NA NA        NA
## 3         4 0.04058442  1 0.8403422
## 4         5         NA NA        NA
## 5         6         NA NA        NA
## 6         7         NA NA        NA
## 7         8         NA NA        NA
## 8         9         NA NA        NA
## 9        10         NA NA        NA
## 10       11         NA NA        NA
## 11       12         NA NA        NA
## 12       13         NA NA        NA
## 13       14         NA NA        NA
## 14       15         NA NA        NA
## 15       16         NA NA        NA
```

On fait les tests de fermeture, mâles d'abord.

```
closure.test(iguaneM_secr, SB = TRUE)
```

```
## $Otis
##   statistic        p
##  -0.5883371 0.278153
##
## $Xc
##  statistic df  p
##          0 NA NA
##
## $NRvsJS
##  statistic df p
##          0  0 1
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##  statistic df  p
##         NA NA NA
##
## $MtvsNM
##  statistic df  p
##         NA NA NA
##
## $compNRvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
##
## $compNMvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
```

```
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
```

Femelles ensuite.

```
closure.test(iguaneF_secr, SB = TRUE)
```

```
## $Otis
##  statistic          p
##  -1.813781 0.03485574
##
## $Xc
##  statistic df  p
##          0 NA NA
##
## $NRvsJS
##  statistic df p
##          0  0 1
##
## $NMvsJS
##  statistic df p
##          0  0 1
##
## $MtvsNR
##  statistic df  p
##         NA NA NA
##
## $MtvsNM
##  statistic df  p
##         NA NA NA
##
## $compNRvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
```

```
## 15       16        NA NA NA
##
## $compNMvsJS
##    Occasion Chisquare df  p
## 1         2        NA NA NA
## 2         3        NA NA NA
## 3         4        NA NA NA
## 4         5        NA NA NA
## 5         6        NA NA NA
## 6         7        NA NA NA
## 7         8        NA NA NA
## 8         9        NA NA NA
## 9        10        NA NA NA
## 10       11        NA NA NA
## 11       12        NA NA NA
## 12       13        NA NA NA
## 13       14        NA NA NA
## 14       15        NA NA NA
## 15       16        NA NA NA
```

Les modèles maintenant. On commence par le jeu de données avec les deux sexes ensemble.

```
iguane.proc <- process.data(iguane,
                            begin.time = 1,
                            model = "FullHet")
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

```
run.iguane <- function() {

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ mixture + time)

  iguane.model.list <- create.model.list("FullHet")

  iguane.results <- mark.wrapper(iguane.model.list,
                                 data = iguane.proc,
                                 ddl = iguane.ddl)

  return(iguane.results)
}
```

```
iguane.results <- run.iguane()
```

```
##
```

```
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3
## -2lnL:  -203.4014
## AICc :  -199.397
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept) -9.196487e-05  0 -9.196487e-05 -9.196487e-05
## p:(Intercept)  -4.237790e+00  0 -4.237790e+00 -4.237790e+00
## f0:(Intercept)  6.367969e+00  0  6.367969e+00  6.367969e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.499977
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
##                    8         9        10        11        12        13        14
## mixture:1 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
##                   15        16        17
## mixture:1 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
##                    9        10        11        12        13        14        15
## mixture:1 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339 0.0142339
##                   16        17
## mixture:1 0.0142339 0.0142339
## mixture:2 0.0142339 0.0142339
##
##
## Real Parameter f0
##
##         1
##  582.8726
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
```

```
## Npar :  4  (unadjusted=2)
## -2lnL:  -207.0354
## AICc :  -199.0208  (unadjusted=-203.03102)
##
## Beta
##                   estimate se         lcl         ucl
## pi:(Intercept)   0.0039535  0   0.0039535   0.0039535
## p:(Intercept)  -11.0325750  0 -11.0325750 -11.0325750
## c:(Intercept)   -4.1185466  0  -4.1185466  -4.1185466
## f0:(Intercept)  13.2812380  0  13.2812380  13.2812380
##
##
## Real Parameter pi
##
##
## mixture:1 0.5009884
##
##
## Real Parameter p
##
##                        1            2            3            4            5
## mixture:1 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05
## mixture:2 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05
##                        6            7            8            9           10
## mixture:1 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05
## mixture:2 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05
##                       11           12           13           14           15
## mixture:1 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05
## mixture:2 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05 1.616615e-05
##                       16           17
## mixture:1 1.616615e-05 1.616615e-05
## mixture:2 1.616615e-05 1.616615e-05
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077
## mixture:2 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077
##                    9        10        11        12        13        14        15
## mixture:1 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077
## mixture:2 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077 0.0160077
##                   16        17
## mixture:1 0.0160077 0.0160077
## mixture:2 0.0160077 0.0160077
##
##
## Real Parameter f0
##
##         1
##  586095.7
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
```

```
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -205.2279
## AICc :  -197.2132  (unadjusted=-199.2191)
##
## Beta
##                  estimate         se         lcl        ucl
## pi:(Intercept) -5.980995 49.2766100 -102.563150  90.601162
## p:(Intercept)  -3.346651  0.5943484   -4.511573  -2.181728
## p:mixture2     -5.833965 49.9432080 -103.722650  92.054724
## f0:(Intercept) 10.933390 49.8430420  -86.758974 108.625750
##
##
## Real Parameter pi
##
##
## mixture:1 0.0025199
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 0.0340050000 0.0340050000 0.0340050000 0.0340050000 0.0340050000
## mixture:2 0.0001030065 0.0001030065 0.0001030065 0.0001030065 0.0001030065
##                       6            7            8            9           10
## mixture:1 0.0340050000 0.0340050000 0.0340050000 0.0340050000 0.0340050000
## mixture:2 0.0001030065 0.0001030065 0.0001030065 0.0001030065 0.0001030065
##                      11           12           13           14           15
## mixture:1 0.0340050000 0.0340050000 0.0340050000 0.0340050000 0.0340050000
## mixture:2 0.0001030065 0.0001030065 0.0001030065 0.0001030065 0.0001030065
##                      16           17
## mixture:1 0.0340050000 0.0340050000
## mixture:2 0.0001030065 0.0001030065
##
##
## Real Parameter c
##
##                       2            3            4            5            6
## mixture:1 0.0340050000 0.0340050000 0.0340050000 0.0340050000 0.0340050000
## mixture:2 0.0001030065 0.0001030065 0.0001030065 0.0001030065 0.0001030065
##                       7            8            9           10           11
## mixture:1 0.0340050000 0.0340050000 0.0340050000 0.0340050000 0.0340050000
## mixture:2 0.0001030065 0.0001030065 0.0001030065 0.0001030065 0.0001030065
##                      12           13           14           15           16
## mixture:1 0.0340050000 0.0340050000 0.0340050000 0.0340050000 0.0340050000
## mixture:2 0.0001030065 0.0001030065 0.0001030065 0.0001030065 0.0001030065
##                      17
## mixture:1 0.0340050000
## mixture:2 0.0001030065
##
##
## Real Parameter f0
##
##         1
```

```
##  56015.86
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=2)
## -2lnL:  -207.0273
## AICc :  -197.0053  (unadjusted=-203.02291)
##
## Beta
##                   estimate        se        lcl        ucl
## pi:(Intercept) -19.261442 0.0000000 -19.261442 -19.261442
## p:(Intercept)    1.338626 0.0000000   1.338626   1.338626
## p:mixture2     -13.290926 0.0000000 -13.290926 -13.290926
## c:(Intercept)   -4.113635 0.2305367  -4.565487  -3.661783
## f0:(Intercept)  14.200555 0.0000000  14.200555  14.200555
##
##
## Real Parameter pi
##
##
## mixture:1 4.31382e-09
##
##
## Real Parameter p
##
##                        1            2            3            4            5
## mixture:1 7.922639e-01 7.922639e-01 7.922639e-01 7.922639e-01 7.922639e-01
## mixture:2 6.444356e-06 6.444356e-06 6.444356e-06 6.444356e-06 6.444356e-06
##                        6            7            8            9           10
## mixture:1 7.922639e-01 7.922639e-01 7.922639e-01 7.922639e-01 7.922639e-01
## mixture:2 6.444356e-06 6.444356e-06 6.444356e-06 6.444356e-06 6.444356e-06
##                       11           12           13           14           15
## mixture:1 7.922639e-01 7.922639e-01 7.922639e-01 7.922639e-01 7.922639e-01
## mixture:2 6.444356e-06 6.444356e-06 6.444356e-06 6.444356e-06 6.444356e-06
##                       16           17
## mixture:1 7.922639e-01 7.922639e-01
## mixture:2 6.444356e-06 6.444356e-06
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853
## mixture:2 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853
##                    9        10        11        12        13        14        15
## mixture:1 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853
## mixture:2 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853 0.0160853
##                   16        17
## mixture:1 0.0160853 0.0160853
## mixture:2 0.0160853 0.0160853
##
##
## Real Parameter f0
```

```
##
##        1
##  1469679
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  20  (unadjusted=18)
## -2lnL:  -260.1053
## AICc :  -219.7961  (unadjusted=-223.85369)
##
## Beta
##                      estimate           se           lcl         ucl
## pi:(Intercept) -2.113951e+01 1395.2561000 -2755.8415000 2713.562500
## p:(Intercept)  -2.509063e+00    0.0000000    -2.5090631   -2.509063
## p:time2         2.314958e+00    1.0501448     0.2566747    4.373242
## p:time3         1.390402e+00    1.1192823    -0.8033913    3.584195
## p:time4         2.411653e+00    1.0458092     0.3618665    4.461439
## p:time5         2.500051e+00    1.0421819     0.4573741    4.542727
## p:time6         2.411652e+00    1.0458092     0.3618661    4.461438
## p:time7         2.581481e+00    1.0391041     0.5448365    4.618125
## p:time8         2.314958e+00    1.0501445     0.2566749    4.373242
## p:time9         2.314959e+00    1.0501448     0.2566750    4.373243
## p:time10        1.390403e+00    1.1192806    -0.8033864    3.584193
## p:time11        2.913872e+00    1.0287822     0.8974584    4.930285
## p:time12        2.855316e+00    1.0303672     0.8357964    4.874836
## p:time13        2.793296e+00    1.0321470     0.7702879    4.816304
## p:time14        2.411653e+00    1.0458086     0.3618683    4.461438
## p:time15        2.500051e+00    1.0421822     0.4573736    4.542728
## p:time16        2.969340e+00    1.0273625     0.9557091    4.982970
## p:time17        2.753606e-05    1.4151811    -2.7737274    2.773782
## p:mixture2     -4.086735e+00    0.0000000    -4.0867351   -4.086735
## f0:(Intercept)  6.349158e+00    0.2691009     5.8217205    6.876596
##
##
## Real Parameter pi
##
##
## mixture:1 6.595201e-10
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0752253 0.4516256 0.2462597 0.4756666 0.4977469 0.4756665 0.5180965
## mixture:2 0.0013642 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351
##                    8         9        10        11        12        13        14
## mixture:1 0.4516256 0.4516258 0.2462600 0.5998424 0.5857087 0.5705837 0.4756668
## mixture:2 0.0136424 0.0136424 0.0054569 0.0245562 0.0231920 0.0218278 0.0150066
##                   15        16        17
## mixture:1 0.4977469 0.6130798 0.0752272
## mixture:2 0.0163708 0.0259205 0.0013643
##
##
```

```
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.4516256 0.2462597 0.4756666 0.4977469 0.4756665 0.5180965 0.4516256
## mixture:2 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351 0.0136424
##                    9        10        11        12        13        14        15
## mixture:1 0.4516258 0.2462600 0.5998424 0.5857087 0.5705837 0.4756668 0.4977469
## mixture:2 0.0136424 0.0054569 0.0245562 0.0231920 0.0218278 0.0150066 0.0163708
##                   16        17
## mixture:1 0.6130798 0.0752272
## mixture:2 0.0259205 0.0013643
##
##
## Real Parameter f0
##
##        1
##  572.011
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  21  (unadjusted=17)
## -2lnL:  -266.7386
## AICc :  -224.3982  (unadjusted=-232.51347)
##
## Beta
##                     estimate           se           lcl          ucl
## pi:(Intercept)  -4.7414617    0.0000000    -4.7414617   -4.7414617
## p:(Intercept)   -0.4220988    0.0000000    -0.4220988   -0.4220988
## p:mixture2      -5.4497344    0.0000000    -5.4497344   -5.4497344
## p:time2          3.0822678    0.0000000     3.0822678    3.0822678
## p:time3          1.9648620    0.0000000     1.9648620    1.9648620
## p:time4          3.3562406    0.0000000     3.3562406    3.3562406
## p:time5          3.5364194    0.0000000     3.5364194    3.5364194
## p:time6          3.4382185    0.0000000     3.4382185    3.4382185
## p:time7          3.7317676    0.0000000     3.7317676    3.7317676
## p:time8          3.6526298    0.0000000     3.6526298    3.6526298
## p:time9          3.3750916    0.0000000     3.3750916    3.3750916
## p:time10         2.5637247    0.0000000     2.5637247    2.5637247
## p:time11         4.4547671    0.0000000     4.4547671    4.4547671
## p:time12         4.7323988    0.0000000     4.7323988    4.7323988
## p:time13         4.9273709    0.0000000     4.9273709    4.9273709
## p:time14         5.0508521    0.0000000     5.0508521    5.0508521
## p:time15         5.1180606    0.0000000     5.1180606    5.1180606
## p:time16         8.6444182    0.0000000     8.6444182    8.6444182
## p:time17        21.4003260 2222.0818000 -4333.8800000 4376.6806000
## c:(Intercept)   -4.1203211    0.2312711    -4.5736125   -3.6670297
## f0:(Intercept) -17.6564520 1832.3482000 -3609.0590000 3573.7460000
##
##
## Real Parameter pi
##
##
## mixture:1 0.0086504
```

```
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.3960146 0.9346350 0.8238660 0.9495086 0.9574796 0.9532971 0.9647590
## mixture:2 0.0028098 0.0578907 0.0197052 0.0747723 0.0882322 0.0806451 0.1052632
##                    8         9        10        11        12        13        14
## mixture:1 0.9619672 0.9504047 0.8948836 0.9825818 0.9867484 0.9890702 0.9903275
## mixture:2 0.0980392 0.0760869 0.0352941 0.1951219 0.2424242 0.2799999 0.3055554
##                   15        16        17
## mixture:1 0.9909506 0.9997315 1.0000000
## mixture:2 0.3199998 0.9411763 0.9999998
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
##                    9        10        11        12        13        14        15
## mixture:1 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
##                   16        17
## mixture:1 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798
##
##
## Real Parameter f0
##
##             1
##  2.147337e-08
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  19  (unadjusted=18)
## -2lnL:  -260.1053
## AICc :  -221.8256  (unadjusted=-223.85369)
##
## Beta
##                       estimate        se           lcl           ucl
## pi:(Intercept) -1.482761e-04 0.0000000 -0.0001482761 -0.0001482761
## p:(Intercept)  -6.595761e+00 0.9191568 -8.3973085000 -4.7942139000
## p:time2         2.314922e+00 0.9528255  0.4473836000  4.1824596000
## p:time3         1.390365e+00 1.0284982 -0.6254919000  3.4062211000
## p:time4         2.411615e+00 0.9480485  0.5534404000  4.2697904000
## p:time5         2.500013e+00 0.9440510  0.6496733000  4.3503535000
## p:time6         2.411616e+00 0.9480487  0.5534401000  4.2697910000
## p:time7         2.581444e+00 0.9316713  0.7553679000  4.4075193000
## p:time8         2.314921e+00 0.9644885  0.4245238000  4.2053189000
## p:time9         2.314922e+00 0.9528254  0.4473838000  4.1824594000
## p:time10        1.390368e+00 1.0625431 -0.6922169000  3.4729521000
## p:time11        2.913835e+00 0.9170537  1.1164094000  4.7112600000
```

```
## p:time12        2.855279e+00 0.9245752  1.0431111000  4.6674462000
## p:time13        2.793258e+00 0.9460451  0.9390099000  4.6475069000
## p:time14        2.411616e+00 0.9480490  0.5534395000  4.2697917000
## p:time15        2.500013e+00 0.9534378  0.6312750000  4.3687512000
## p:time16        2.969301e+00 0.9276957  1.1510176000  4.7875848000
## p:time17       -3.847196e-05 0.5680978 -1.1135102000  1.1134332000
## f0:(Intercept)  6.349158e+00 0.2689722  5.8219728000  6.8763439000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999629
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0013643 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351
## mixture:2 0.0013643 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351
##                    8         9        10        11        12        13        14
## mixture:1 0.0136424 0.0136424 0.0054569 0.0245562 0.023192 0.0218278 0.0150066
## mixture:2 0.0136424 0.0136424 0.0054569 0.0245562 0.023192 0.0218278 0.0150066
##                   15        16        17
## mixture:1 0.0163708 0.0259205 0.0013642
## mixture:2 0.0163708 0.0259205 0.0013642
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351 0.0136424
## mixture:2 0.0136424 0.0054569 0.0150066 0.0163708 0.0150066 0.0177351 0.0136424
##                    9        10        11        12        13        14        15
## mixture:1 0.0136424 0.0054569 0.0245562 0.023192 0.0218278 0.0150066 0.0163708
## mixture:2 0.0136424 0.0054569 0.0245562 0.023192 0.0218278 0.0150066 0.0163708
##                   16        17
## mixture:1 0.0259205 0.0013642
## mixture:2 0.0259205 0.0013642
##
##
## Real Parameter f0
##
##         1
##  572.0111
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  20  (unadjusted=17)
## -2lnL:  -266.7386
## AICc :  -226.4293  (unadjusted=-232.51348)
##
## Beta
```

```
##                      estimate          se           lcl           ucl
## pi:(Intercept) -9.953858e-04    0.000000 -9.953858e-04 -9.953858e-04
## p:(Intercept)  -5.075188e+00    1.003118 -7.041299e+00 -3.109076e+00
## p:time2         2.367138e+00    1.054947  2.994417e-01  4.434834e+00
## p:time3         1.183367e+00    1.160337 -1.090894e+00  3.457629e+00
## p:time4         2.560428e+00    1.050956  5.005548e-01  4.620302e+00
## p:time5         2.739813e+00    1.047685  6.863504e-01  4.793275e+00
## p:time6         2.641575e+00    1.055944  5.719243e-01  4.711225e+00
## p:time7         2.935122e+00    1.048515  8.800328e-01  4.990211e+00
## p:time8         2.855985e+00    1.056937  7.843885e-01  4.927581e+00
## p:time9         2.578447e+00    1.077434  4.666763e-01  4.690217e+00
## p:time10        1.767081e+00    1.162659 -5.117295e-01  4.045892e+00
## p:time11        3.658122e+00    1.041104  1.617558e+00  5.698686e+00
## p:time12        3.935754e+00    1.043430  1.890631e+00  5.980876e+00
## p:time13        4.130726e+00    1.051405  2.069973e+00  6.191480e+00
## p:time14        4.254207e+00    1.066375  2.164113e+00  6.344302e+00
## p:time15        4.321416e+00    1.090903  2.183246e+00  6.459586e+00
## p:time16        7.847776e+00    1.438313  5.028682e+00  1.066687e+01
## p:time17        2.240042e+01 4699.341600 -9.188309e+03  9.233110e+03
## c:(Intercept)  -4.120320e+00    0.231271 -4.573611e+00 -3.667029e+00
## f0:(Intercept) -1.898604e+01   12.398652 -4.328740e+01  5.315321e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4997512
##
##
## Real Parameter p
##
##                    1      2    3         4         5         6         7
## mixture:1 0.0062111 0.0625 0.02 0.0748299 0.0882353 0.0806452 0.1052632
## mixture:2 0.0062111 0.0625 0.02 0.0748299 0.0882353 0.0806452 0.1052632
##                    8        9        10       11        12   13        14   15
## mixture:1 0.0980392 0.076087 0.0352941 0.195122 0.2424242 0.28 0.3055556 0.32
## mixture:2 0.0980392 0.076087 0.0352941 0.195122 0.2424242 0.28 0.3055556 0.32
##                   16 17
## mixture:1 0.9411765  1
## mixture:2 0.9411765  1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
##                    9        10        11        12        13        14        15
## mixture:1 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798 0.0159798
##                   16        17
## mixture:1 0.0159798 0.0159798
## mixture:2 0.0159798 0.0159798
##
```

```
##
## Real Parameter f0
##
##             1
##  5.681571e-09
```

```
iguane.results
```

```
##                                 model npar      AICc DeltaAICc       weight
## 8           pi(~1)p(~time)c(~1)f0(~1)   20 -226.4293  0.000000 6.673047e-01
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   21 -224.3982  2.031053 2.417055e-01
## 7             pi(~1)p(~time)c()f0(~1)   19 -221.8256  4.603652 6.678114e-02
## 5   pi(~1)p(~time + mixture)c()f0(~1)   20 -219.7961  6.633210 2.420700e-02
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 -199.0208 27.408513 7.458323e-07
## 1                pi(~1)p(~1)c()f0(~1)    3 -197.3926 29.036673 3.304385e-07
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -197.2132 29.216043 3.020933e-07
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -197.0053 29.423952 2.722665e-07
##    Deviance
## 8  92.83873
## 6  92.83873
## 7  99.47194
## 5  99.47194
## 2 152.54188
## 1 156.17590
## 3 154.34941
## 4 152.54998
```

```
names(iguane.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

examine the output from top-ranked model (#8)

```
iguane.results$p.time$results$real
```

```
##                estimate           se          lcl         ucl fixed note
## pi g1 m1      0.4999629 0.000000e+00 4.999629e-01   0.4999629
## p g1 t1 m1    0.0013643 1.252300e-03 2.254226e-04   0.0082095
## p g1 t2 m1    0.0136424 5.153300e-03 6.486900e-03   0.0284645
## p g1 t3 m1    0.0054569 2.952300e-03 1.885700e-03   0.0156857
## p g1 t4 m1    0.0150066 5.485100e-03 7.307900e-03   0.0305660
## p g1 t5 m1    0.0163708 5.811600e-03 8.137300e-03   0.0326610
## p g1 t6 m1    0.0150066 5.485100e-03 7.307900e-03   0.0305660
## p g1 t7 m1    0.0177351 6.131200e-03 8.976300e-03   0.0347406
## p g1 t8 m1    0.0136424 5.135300e-03 6.503900e-03   0.0283919
## p g1 t9 m1    0.0136424 5.153300e-03 6.486900e-03   0.0284645
## p g1 t10 m1   0.0054569 2.905900e-03 1.917500e-03   0.0154290
## p g1 t11 m1   0.0245562 7.686300e-03 1.324410e-02   0.0450888
## p g1 t12 m1   0.0231920 7.389300e-03 1.237300e-02   0.0430589
## p g1 t13 m1   0.0218278 7.040400e-03 1.155750e-02   0.0408473
```

```
## p g1 t14 m1   0.0150066 5.485100e-03 7.307900e-03   0.0305660
## p g1 t15 m1   0.0163708 5.796000e-03 8.152700e-03   0.0326009
## p g1 t16 m1   0.0259205 8.002800e-03 1.409550e-02   0.0471907
## p g1 t17 m1   0.0013642 7.781875e-04 4.457284e-04   0.0041676
## f0 g1 a0 t1 572.0110800 1.538551e+02 3.407508e+02 960.2228300
```

```
iguane.results$p.time$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 733.0111 501.7508 1121.223
```

En séparant les sexes. Femelles, puis mâles.

```
iguane.proc <- process.data(iguaneF,
                            begin.time = 1,
                            model = "FullHet")
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

```
run.iguane <- function() {

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ mixture + time)

  iguane.model.list <- create.model.list("FullHet")

  iguane.results <- mark.wrapper(iguane.model.list,
                              data = iguane.proc,
                              ddl = iguane.ddl)

  return(iguane.results)
}
```

```
iguane.results <- run.iguane()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3
## -2lnL:  -28.86054
## AICc :  -24.8526
##
## Beta
```

```
##                      estimate se           lcl           ucl
## pi:(Intercept) -0.0008356589  0 -0.0008356589 -0.0008356589
## p:(Intercept)  -4.4985790000  0 -4.4985790000 -4.4985790000
## f0:(Intercept)  6.0628632000  0  6.0628632000  6.0628632000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4997911
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
##                    8         9        10        11        12        13        14
## mixture:1 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
##                   15        16        17
## mixture:1 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
##                    9        10        11        12        13        14        15
## mixture:1 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024 0.0110024
##                   16        17
## mixture:1 0.0110024 0.0110024
## mixture:2 0.0110024 0.0110024
##
##
## Real Parameter f0
##
##         1
##  429.6037
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -31.21619
## AICc :  -23.18967  (unadjusted=-25.200288)
##
## Beta
##                    estimate se         lcl         ucl
## pi:(Intercept)  -0.0029455  0  -0.0029455  -0.0029455
## p:(Intercept)  -18.0571870  0 -18.0571870 -18.0571870
```

```
## c:(Intercept)   -4.3272764  0  -4.3272764  -4.3272764
## f0:(Intercept)  19.7128030  0  19.7128030  19.7128030
##
##
## Real Parameter pi
##
##
## mixture:1 0.4992636
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08
## mixture:2 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08
##                       6            7            8            9           10
## mixture:1 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08
## mixture:2 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08
##                      11           12           13           14           15
## mixture:1 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08
## mixture:2 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08 1.438345e-08
##                      16           17
## mixture:1 1.438345e-08 1.438345e-08
## mixture:2 1.438345e-08 1.438345e-08
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314
## mixture:2 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314
##                    9        10        11        12        13        14        15
## mixture:1 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314
## mixture:2 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314 0.0130314
##                   16        17
## mixture:1 0.0130314 0.0130314
## mixture:2 0.0130314 0.0130314
##
##
## Real Parameter f0
##
##          1
##  364050500
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -32.69514
## AICc :  -24.66861  (unadjusted=-26.679231)
##
## Beta
##                  estimate         se        lcl       ucl
## pi:(Intercept) -9.762713 17.1993080 -43.473357 23.947932
```

```
## p:(Intercept)  -2.818996  0.6740447  -4.140123 -1.497868
## p:mixture2     -8.660456 17.2159080 -42.403637 25.082724
## f0:(Intercept) 12.947952 17.2271240 -20.817211 46.713115
##
##
## Real Parameter pi
##
##
## mixture:1 5.755496e-05
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02
## mixture:2 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05
##                       6            7            8            9           10
## mixture:1 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02
## mixture:2 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05
##                      11           12           13           14           15
## mixture:1 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02
## mixture:2 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05
##                      16           17
## mixture:1 5.630630e-02 5.630630e-02
## mixture:2 1.034029e-05 1.034029e-05
##
##
## Real Parameter c
##
##                       2            3            4            5            6
## mixture:1 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02
## mixture:2 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05
##                       7            8            9           10           11
## mixture:1 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02
## mixture:2 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05
##                      12           13           14           15           16
## mixture:1 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02 5.630630e-02
## mixture:2 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05 1.034029e-05
##                      17
## mixture:1 5.630630e-02
## mixture:2 1.034029e-05
##
##
## Real Parameter f0
##
##         1
##  419975.7
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=3)
## -2lnL:  -31.5
## AICc :  -21.46019  (unadjusted=-25.484095)
```

```
##
## Beta
##                   estimate se        lcl        ucl
## pi:(Intercept) -44.794708  0 -44.794708 -44.794708
## p:(Intercept)   -0.612373  0  -0.612373  -0.612373
## p:mixture2     -29.037554  0 -29.037554 -29.037554
## c:(Intercept)   -4.407022  0  -4.407022  -4.407022
## f0:(Intercept)  31.300230  0  31.300230  31.300230
##
##
## Real Parameter pi
##
##
## mixture:1 3.514839e-20
##
##
## Real Parameter p
##
##                        1            2            3            4            5
## mixture:1 3.515181e-01 3.515181e-01 3.515181e-01 3.515181e-01 3.515181e-01
## mixture:2 1.328007e-13 1.328007e-13 1.328007e-13 1.328007e-13 1.328007e-13
##                        6            7            8            9           10
## mixture:1 3.515181e-01 3.515181e-01 3.515181e-01 3.515181e-01 3.515181e-01
## mixture:2 1.328007e-13 1.328007e-13 1.328007e-13 1.328007e-13 1.328007e-13
##                       11           12           13           14           15
## mixture:1 3.515181e-01 3.515181e-01 3.515181e-01 3.515181e-01 3.515181e-01
## mixture:2 1.328007e-13 1.328007e-13 1.328007e-13 1.328007e-13 1.328007e-13
##                       16           17
## mixture:1 3.515181e-01 3.515181e-01
## mixture:2 1.328007e-13 1.328007e-13
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446
## mixture:2 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446
##                    9        10        11        12        13        14        15
## mixture:1 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446
## mixture:2 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446 0.0120446
##                   16        17
## mixture:1 0.0120446 0.0120446
## mixture:2 0.0120446 0.0120446
##
##
## Real Parameter f0
##
##             1
##  3.922085e+13
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  20  (unadjusted=18)
```

```
## -2lnL:  -81.40937
## AICc :  -40.84636  (unadjusted=-47.000001)
##
## Beta
##                    estimate           se           lcl           ucl
## pi:(Intercept)  -9.8094860 0.000000e+00 -9.809486e+00 -9.809486e+00
## p:(Intercept)   -4.5166463 1.277419e+00 -7.020387e+00 -2.012906e+00
## p:time2          0.0245455 1.561175e+00 -3.035357e+00  3.084448e+00
## p:time3          0.0072234 1.589120e+00 -3.107452e+00  3.121899e+00
## p:time4          1.9713495 1.158636e+00 -2.995768e-01  4.242276e+00
## p:time5          1.4055329 1.205356e+00 -9.569650e-01  3.768031e+00
## p:time6          1.6310344 1.186414e+00 -6.943375e-01  3.956406e+00
## p:time7          1.9707290 1.159120e+00 -3.011465e-01  4.242604e+00
## p:time8          2.1059793 1.150779e+00 -1.495474e-01  4.361506e+00
## p:time9          1.6308774 1.181735e+00 -6.853235e-01  3.947078e+00
## p:time10         1.1100600 1.238119e+00 -1.316654e+00  3.536774e+00
## p:time11         2.6041819 1.130423e+00  3.885532e-01  4.819811e+00
## p:time12         2.5212727 1.132749e+00  3.010838e-01  4.741462e+00
## p:time13         1.9695351 1.158620e+00 -3.013600e-01  4.240430e+00
## p:time14         1.9715444 1.158730e+00 -2.995663e-01  4.242655e+00
## p:time15         1.8127050 1.170519e+00 -4.815116e-01  4.106922e+00
## p:time16         2.3345199 1.140550e+00  9.904100e-02  4.569999e+00
## p:time17       -39.9122590 1.877296e+08 -3.679501e+08  3.679500e+08
## p:mixture2      -8.7087865 0.000000e+00 -8.708787e+00 -8.708787e+00
## f0:(Intercept)  12.9310970 0.000000e+00  1.293110e+01  1.293110e+01
##
##
## Real Parameter pi
##
##
## mixture:1 5.492505e-05
##
##
## Real Parameter p
##
##                         1            2            3            4           5
## mixture:1 1.080750e-02 1.107310e-02 1.088500e-02 7.274310e-02 4.26512e-02
## mixture:2 1.804125e-06 1.848957e-06 1.817205e-06 1.295413e-05 7.35664e-06
##                         6            7            8            9           10
## mixture:1 5.286940e-02 7.270120e-02 8.236290e-02 5.286160e-02 3.209030e-02
## mixture:2 9.217492e-06 1.294609e-05 1.482096e-05 9.216045e-06 5.474672e-06
##                        11           12           13           14           15
## mixture:1 1.287042e-01 1.196895e-01 7.262080e-02 7.275620e-02 6.274120e-02
## mixture:2 2.439151e-05 2.245084e-05 1.293064e-05 1.295665e-05 1.105377e-05
##                        16           17
## mixture:1 1.013671e-01 5.067240e-20
## mixture:2 1.862638e-05 8.367458e-24
##
##
## Real Parameter c
##
##                         2            3            4           5            6
## mixture:1 1.107310e-02 1.088500e-02 7.274310e-02 4.26512e-02 5.286940e-02
## mixture:2 1.848957e-06 1.817205e-06 1.295413e-05 7.35664e-06 9.217492e-06
```

```
##                       7            8            9           10           11
## mixture:1 7.270120e-02 8.236290e-02 5.286160e-02 3.209030e-02 1.287042e-01
## mixture:2 1.294609e-05 1.482096e-05 9.216045e-06 5.474672e-06 2.439151e-05
##                      12           13           14           15           16
## mixture:1 1.196895e-01 7.262080e-02 7.275620e-02 6.274120e-02 1.013671e-01
## mixture:2 2.245084e-05 1.293064e-05 1.295665e-05 1.105377e-05 1.862638e-05
##                      17
## mixture:1 5.067240e-20
## mixture:2 8.367458e-24
##
##
## Real Parameter f0
##
##         1
##  412956.2
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  21  (unadjusted=17)
## -2lnL:  -81.57954
## AICc :  -38.95982  (unadjusted=-47.170176)
##
## Beta
##                    estimate           se          lcl         ucl
## pi:(Intercept)  -6.3374244  257.2448900  -510.537410  497.862560
## p:(Intercept)    0.4561884   15.6494900   -30.216812   31.129189
## p:mixture2      -5.0338628   30.0773710   -63.985511   53.917785
## p:time2          0.0729655   16.7117530   -32.682071   32.828002
## p:time3          0.1089380   23.4054080   -45.765663   45.983539
## p:time4          2.1530463   26.8443740   -50.461927   54.768020
## p:time5          1.6463597   27.0751610   -51.420958   54.713677
## p:time6          1.9386066   27.0986100   -51.174670   55.051883
## p:time7          2.3804446   27.0995740   -50.734722   55.495611
## p:time8          2.6497822   27.0994040   -50.465051   55.764615
## p:time9          2.2750857   27.1008190   -50.842521   55.392692
## p:time10         1.3996300   27.1063450   -51.728808   54.528068
## p:time11         3.3646484   27.0989370   -49.749270   56.478567
## p:time12         3.7174730   27.0991500   -49.396862   56.831808
## p:time13         3.3736947   27.1007640   -49.743805   56.491194
## p:time14         3.9586503   27.1008120   -49.158943   57.076244
## p:time15         3.7667597   27.1034270   -49.355958   56.889477
## p:time16        36.5693820  413.4567700  -773.805900  846.944660
## p:time17        -0.5385709  759.3431300 -1488.851100 1487.774000
## c:(Intercept)   -4.3339934    0.3558601    -5.031479   -3.636508
## f0:(Intercept) -18.9900090 2336.5868000 -4598.700100 4560.720100
##
##
## Real Parameter pi
##
##
## mixture:1 0.0017657
##
##
```

```
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.6121096 0.6292857 0.6376378 0.9314535 0.8911506 0.9164295 0.9446236
## mixture:2 0.0101742 0.0109359 0.0113319 0.0813139 0.0506271 0.0666660 0.0999995
##                   8         9        10        11        12        13        14
## mixture:1 0.9571384 0.9388470 0.8648088 0.9785603 0.9848376 0.9787492 0.9880481
## mixture:2 0.1269841 0.0909088 0.0400004 0.2291661 0.2972973 0.2307680 0.3500034
##                  15 16        17
## mixture:1 0.9855563  1 0.4794160
## mixture:2 0.3076956  1 0.0059627
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453
## mixture:2 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453
##                   9        10        11        12        13        14        15
## mixture:1 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453
## mixture:2 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453 0.0129453
##                  16        17
## mixture:1 0.0129453 0.0129453
## mixture:2 0.0129453 0.0129453
##
##
## Real Parameter f0
##
##             1
##  5.659052e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  19  (unadjusted=17)
## -2lnL:  -77.46358
## AICc :  -38.95454  (unadjusted=-43.054215)
##
## Beta
##                       estimate           se           lcl          ucl
## pi:(Intercept)  2.538200e-03    0.0000000     0.0025382    0.0025382
## p:(Intercept)  -6.223695e+00    1.0542475    -8.2900199   -4.1573697
## p:time2         3.337725e-05    1.4157723    -2.7748804    2.7749472
## p:time3         1.905127e-05    1.4157602    -2.7748710    2.7749091
## p:time4         1.957894e+00    1.0710306    -0.1413261    4.0571139
## p:time5         1.392277e+00    1.1199227    -0.8027711    3.5873258
## p:time6         1.617417e+00    1.0973770    -0.5334418    3.7682760
## p:time7         1.957896e+00    1.0710294    -0.1413223    4.0571132
## p:time8         2.093435e+00    1.0626657     0.0106099    4.1762596
## p:time9         1.617421e+00    1.0973721    -0.5334286    3.7682700
## p:time10        1.102608e+00    1.1565263    -1.1641839    3.3693991
## p:time11        2.589043e+00    1.0398284     0.5509787    4.6271062
## p:time12        2.506971e+00    1.0428996     0.4628876    4.5510542
## p:time13        1.957897e+00    1.0710295    -0.1413205    4.0571152
```

```
## p:time14        1.957895e+00    1.0710299    -0.1413236    4.0571137
## p:time15        1.801740e+00    1.0820844    -0.3191457    3.9226253
## p:time16        2.320605e+00    1.0508468     0.2609452    4.3802646
## p:time17       -1.488615e+01 2123.8466000 -4177.6256000 4147.8533000
## f0:(Intercept)  6.032013e+00    0.4002801     5.2474644    6.8165624
##
##
## Real Parameter pi
##
##
## mixture:1 0.5006345
##
##
## Real Parameter p
##
##                  1         2        3         4         5         6         7
## mixture:1 0.001978 0.0019781 0.001978 0.0138462 0.0079121 0.0098901 0.0138462
## mixture:2 0.001978 0.0019781 0.001978 0.0138462 0.0079121 0.0098901 0.0138462
##                   8         9        10        11        12        13        14
## mixture:1 0.0158243 0.0098902 0.0059341 0.0257144 0.0237364 0.0138463 0.0138462
## mixture:2 0.0158243 0.0098902 0.0059341 0.0257144 0.0237364 0.0138463 0.0138462
##                  15        16           17
## mixture:1 0.0118682 0.0197803 6.793776e-10
## mixture:2 0.0118682 0.0197803 6.793776e-10
##
##
## Real Parameter c
##
##                   2        3         4         5         6         7         8
## mixture:1 0.0019781 0.001978 0.0138462 0.0079121 0.0098901 0.0138462 0.0158243
## mixture:2 0.0019781 0.001978 0.0138462 0.0079121 0.0098901 0.0138462 0.0158243
##                   9        10        11        12        13        14        15
## mixture:1 0.0098902 0.0059341 0.0257144 0.0237364 0.0138463 0.0138462 0.0118682
## mixture:2 0.0098902 0.0059341 0.0257144 0.0237364 0.0138463 0.0138462 0.0118682
##                  16           17
## mixture:1 0.0197803 6.793776e-10
## mixture:2 0.0197803 6.793776e-10
##
##
## Real Parameter f0
##
##         1
##  416.5529
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  20  (unadjusted=16)
## -2lnL:  -81.57954
## AICc :  -41.01654  (unadjusted=-49.215904)
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept)  7.308943e-05  0  7.308943e-05  7.308943e-05
```

```
## p:(Intercept)  -4.477316e+00  0 -4.477316e+00 -4.477316e+00
## p:time2         1.140500e-02  0  1.140500e-02  1.140500e-02
## p:time3         2.295770e-02  0  2.295770e-02  2.295770e-02
## p:time4         2.053777e+00  0  2.053777e+00  2.053777e+00
## p:time5         1.546121e+00  0  1.546121e+00  1.546121e+00
## p:time6         1.838259e+00  0  1.838259e+00  1.838259e+00
## p:time7         2.280092e+00  0  2.280092e+00  2.280092e+00
## p:time8         2.549423e+00  0  2.549423e+00  2.549423e+00
## p:time9         2.174731e+00  0  2.174731e+00  2.174731e+00
## p:time10        1.299260e+00  0  1.299260e+00  1.299260e+00
## p:time11        3.264294e+00  0  3.264294e+00  3.264294e+00
## p:time12        3.617114e+00  0  3.617114e+00  3.617114e+00
## p:time13        3.273343e+00  0  3.273343e+00  3.273343e+00
## p:time14        3.858275e+00  0  3.858275e+00  3.858275e+00
## p:time15        3.666386e+00  0  3.666386e+00  3.666386e+00
## p:time16        2.360859e+01  0  2.360859e+01  2.360859e+01
## p:time17        4.431137e+00  0  4.431137e+00  4.431137e+00
## c:(Intercept)  -4.334018e+00  0 -4.334018e+00 -4.334018e+00
## f0:(Intercept) -2.161458e+01  0 -2.161458e+01 -2.161458e+01
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000183
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6   7
## mixture:1 0.0112362 0.0113636 0.0114941 0.0813953 0.0506329 0.0666667 0.1
## mixture:2 0.0112362 0.0113636 0.0114941 0.0813953 0.0506329 0.0666667 0.1
##                    8         9        10        11        12        13        14
## mixture:1 0.126984 0.0909091 0.0399999 0.2291667 0.2972971 0.2307692 0.3499996
## mixture:2 0.126984 0.0909091 0.0399999 0.2291667 0.2972971 0.2307692 0.3499996
##                   15 16        17
## mixture:1 0.3076923  1 0.4884574
## mixture:2 0.3076923  1 0.4884574
##
##
## Real Parameter c
##
##                    2        3        4        5        6        7        8
## mixture:1 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945
## mixture:2 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945
##                    9       10       11       12       13       14       15
## mixture:1 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945
## mixture:2 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945 0.012945
##                   16       17
## mixture:1 0.012945 0.012945
## mixture:2 0.012945 0.012945
##
##
## Real Parameter f0
```

```
##
##             1
##  4.101179e-10
```

```
iguane.results
```

```
##                                 model npar      AICc DeltaAICc       weight
## 8           pi(~1)p(~time)c(~1)f0(~1)   20 -41.01654  0.000000 3.797571e-01
## 5   pi(~1)p(~time + mixture)c()f0(~1)   20 -40.84636  0.170175 3.487811e-01
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   21 -38.95982  2.056717 1.357987e-01
## 7             pi(~1)p(~time)c()f0(~1)   19 -38.95454  2.062001 1.354404e-01
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -24.66861 16.347928 1.070529e-04
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 -23.18967 17.826872 5.110342e-05
## 1                pi(~1)p(~1)c()f0(~1)    3 -22.84464 18.171899 4.300592e-05
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -21.46019 19.556353 2.152276e-05
##    Deviance
## 8  53.45855
## 5  53.62873
## 6  53.45855
## 7  57.57451
## 3 102.34296
## 2 103.82190
## 1 106.17755
## 4 103.53810
```

```
names(iguane.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

```
iguane.results$p.h.time$results$real
```

```
##                 estimate           se           lcl          ucl fixed note
## pi g1 m1    5.492505e-05 0.000000e+00  5.492505e-05 5.492505e-05
## p g1 t1 m1  1.080750e-02 1.365650e-02  8.926822e-04 1.178545e-01
## p g1 t2 m1  1.107310e-02 1.345360e-02  1.006700e-03 1.106537e-01
## p g1 t3 m1  1.088500e-02 1.343230e-02  9.532246e-04 1.126314e-01
## p g1 t4 m1  7.274310e-02 5.190570e-02  1.706410e-02 2.617241e-01
## p g1 t5 m1  4.265120e-02 3.406320e-02  8.609900e-03 1.860280e-01
## p g1 t6 m1  5.286940e-02 4.027380e-02  1.140760e-02 2.126173e-01
## p g1 t7 m1  7.270120e-02 5.187450e-02  1.705550e-02 2.615837e-01
## p g1 t8 m1  8.236290e-02 5.732980e-02  1.989090e-02 2.841578e-01
## p g1 t9 m1  5.286160e-02 4.025830e-02  1.141020e-02 2.125267e-01
## p g1 t10 m1 3.209030e-02 2.742130e-02  5.841300e-03 1.575952e-01
## p g1 t11 m1 1.287042e-01 8.177010e-02  3.416930e-02 3.814810e-01
## p g1 t12 m1 1.196895e-01 7.723320e-02  3.130780e-02 3.638558e-01
## p g1 t13 m1 7.262080e-02 5.182740e-02  1.703260e-02 2.613860e-01
## p g1 t14 m1 7.275620e-02 5.190030e-02  1.707420e-02 2.616833e-01
## p g1 t15 m1 6.274120e-02 4.611770e-02  1.418790e-02 2.374325e-01
## p g1 t16 m1 1.013671e-01 6.768740e-02  2.561720e-02 3.261364e-01
## p g1 t17 m1 5.067240e-20 9.512711e-12 -1.864491e-11 1.864491e-11
```

```
## p g1 t1 m2  1.804125e-06 0.000000e+00  1.804125e-06 1.804125e-06
## p g1 t2 m2  1.848957e-06 0.000000e+00  1.848957e-06 1.848957e-06
## p g1 t3 m2  1.817205e-06 0.000000e+00  1.817205e-06 1.817205e-06
## p g1 t4 m2  1.295413e-05 0.000000e+00  1.295413e-05 1.295413e-05
## p g1 t5 m2  7.356640e-06 0.000000e+00  7.356640e-06 7.356640e-06
## p g1 t6 m2  9.217492e-06 0.000000e+00  9.217492e-06 9.217492e-06
## p g1 t7 m2  1.294609e-05 0.000000e+00  1.294609e-05 1.294609e-05
## p g1 t8 m2  1.482096e-05 0.000000e+00  1.482096e-05 1.482096e-05
## p g1 t9 m2  9.216045e-06 0.000000e+00  9.216045e-06 9.216045e-06
## p g1 t10 m2 5.474672e-06 0.000000e+00  5.474672e-06 5.474672e-06
## p g1 t11 m2 2.439151e-05 0.000000e+00  2.439151e-05 2.439151e-05
## p g1 t12 m2 2.245084e-05 0.000000e+00  2.245084e-05 2.245084e-05
## p g1 t13 m2 1.293064e-05 0.000000e+00  1.293064e-05 1.293064e-05
## p g1 t14 m2 1.295665e-05 0.000000e+00  1.295665e-05 1.295665e-05
## p g1 t15 m2 1.105377e-05 0.000000e+00  1.105377e-05 1.105377e-05
## p g1 t16 m2 1.862638e-05 0.000000e+00  1.862638e-05 1.862638e-05
## p g1 t17 m2 8.367458e-24 1.570820e-15 -3.078807e-15 3.078807e-15
## f0 g1 a0 t1 4.129562e+05 0.000000e+00  4.129562e+05 4.129562e+05
```

```
iguane.results$p.h.time$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 413045.2 413045.2 413045.2
```

```
iguane.results$p.time$results$real
```

```
##                 estimate           se           lcl          ucl fixed note
## pi g1 m1    5.006345e-01 0.000000e+00  5.006345e-01 5.006345e-01
## p g1 t1 m1  1.978000e-03 2.081200e-03  2.509465e-04 1.540760e-02
## p g1 t2 m1  1.978100e-03 2.081100e-03  2.509993e-04 1.540540e-02
## p g1 t3 m1  1.978000e-03 2.081000e-03  2.509956e-04 1.540520e-02
## p g1 t4 m1  1.384620e-02 6.918300e-03  5.174200e-03 3.651880e-02
## p g1 t5 m1  7.912100e-03 4.726100e-03  2.444400e-03 2.530010e-02
## p g1 t6 m1  9.890100e-03 5.478100e-03  3.325700e-03 2.903470e-02
## p g1 t7 m1  1.384620e-02 6.918300e-03  5.174200e-03 3.651890e-02
## p g1 t8 m1  1.582430e-02 7.618700e-03  6.125900e-03 4.025490e-02
## p g1 t9 m1  9.890200e-03 5.478100e-03  3.325700e-03 2.903470e-02
## p g1 t10 m1 5.934100e-03 3.936800e-03  1.611200e-03 2.160450e-02
## p g1 t11 m1 2.571440e-02 1.102190e-02  1.102030e-02 5.883570e-02
## p g1 t12 m1 2.373640e-02 1.035000e-02  1.002950e-02 5.513260e-02
## p g1 t13 m1 1.384630e-02 6.918400e-03  5.174300e-03 3.651890e-02
## p g1 t14 m1 1.384620e-02 6.918300e-03  5.174200e-03 3.651880e-02
## p g1 t15 m1 1.186820e-02 6.206300e-03  4.238800e-03 3.277760e-02
## p g1 t16 m1 1.978030e-02 8.995100e-03  8.062900e-03 4.770710e-02
## p g1 t17 m1 6.793776e-10 1.442894e-06 -2.827393e-06 2.828752e-06
## f0 g1 a0 t1 4.165529e+02 1.667378e+02  1.956693e+02 8.867836e+02
```

```
iguane.results$p.time$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 505.5529 284.6693 975.7836
```

Les mâles maintenant.

```
iguane.proc <- process.data(iguaneM, begin.time = 1, model = "FullHet")
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

```
run.iguane <- function() {

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ mixture + time)

  iguane.model.list <- create.model.list("FullHet")

  iguane.results <- mark.wrapper(iguane.model.list,
                              data = iguane.proc,
                              ddl = iguane.ddl)

  return(iguane.results)
}
```

```
iguane.results <- run.iguane()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  2  (unadjusted=3)
## -2lnL:  45.30694
## AICc :  49.31676  (unadjusted=49.316764)
##
## Beta
##                 estimate se       lcl       ucl
## pi:(Intercept)  0.000000  0  0.000000  0.000000
## p:(Intercept)  -3.979588  0 -3.979588 -3.979588
## f0:(Intercept)  5.268187  0  5.268187  5.268187
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
```

```
## mixture:1 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                   8         9        10        11        12        13        14
## mixture:1 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                  15        16        17
## mixture:1 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                   9        10        11        12        13        14        15
## mixture:1 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503 0.0183503
##                  16        17
## mixture:1 0.0183503 0.0183503
## mixture:2 0.0183503 0.0183503
##
##
## Real Parameter f0
##
##         1
##  194.0638
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  44.81129
## AICc :  52.84411  (unadjusted=50.830966)
##
## Beta
##                   estimate           se        lcl        ucl
## pi:(Intercept)  0.0012318 0.000000e+00  0.0012318  0.0012318
## p:(Intercept)  -6.2002746 1.179706e-01 -6.4314971 -5.9690522
## c:(Intercept)  -3.9300418 3.044583e-01 -4.5267802 -3.3333035
## f0:(Intercept)  7.6272200 3.769729e-07  7.6272192  7.6272207
##
##
## Real Parameter pi
##
##
## mixture:1 0.500308
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248
## mixture:2 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248
```

```
##                    8         9        10        11        12        13        14
## mixture:1 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248
## mixture:2 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248 0.0020248
##                   15        16        17
## mixture:1 0.0020248 0.0020248 0.0020248
## mixture:2 0.0020248 0.0020248 0.0020248
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644
## mixture:2 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644
##                    9        10        11        12        13        14        15
## mixture:1 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644
## mixture:2 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644 0.0192644
##                   16        17
## mixture:1 0.0192644 0.0192644
## mixture:2 0.0192644 0.0192644
##
##
## Real Parameter f0
##
##         1
##  2053.334
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  45.30694
## AICc :  53.33975  (unadjusted=49.316765)
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) -16.345557 2860.6659000 -5623.250800 5590.559700
## p:(Intercept)   -2.485574  988.6254700 -1940.191500 1935.220400
## p:mixture2      -1.494075  988.6245100 -1939.198200 1936.210000
## f0:(Intercept)   5.268254    0.3701149     4.542829    5.993679
##
##
## Real Parameter pi
##
##
## mixture:1 7.965529e-08
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757
## mixture:2 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492
##                    8         9        10        11        12        13        14
## mixture:1 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757
```

```
## mixture:2 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492
##                  15        16        17
## mixture:1 0.0768757 0.0768757 0.0768757
## mixture:2 0.0183492 0.0183492 0.0183492
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757
## mixture:2 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492
##                   9        10        11        12        13        14        15
## mixture:1 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757 0.0768757
## mixture:2 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492 0.0183492
##                  16        17
## mixture:1 0.0768757 0.0768757
## mixture:2 0.0183492 0.0183492
##
##
## Real Parameter f0
##
##         1
##  194.0768
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=2)
## -2lnL:  44.81837
## AICc :  54.86763  (unadjusted=48.828199)
##
## Beta
##                    estimate         se         lcl        ucl
## pi:(Intercept) -19.360533 45.6202860 -108.776300  70.055230
## p:(Intercept)    1.937015 24.9547670  -46.974329  50.848359
## p:mixture2     -11.636548  0.0000000  -11.636548 -11.636548
## c:(Intercept)   -3.929965  0.3044472   -4.526681  -3.333248
## f0:(Intercept)  11.142453  0.0000000   11.142453  11.142453
##
##
## Real Parameter pi
##
##
## mixture:1 3.906854e-09
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 8.740239e-01 8.740239e-01 8.740239e-01 8.740239e-01 8.740239e-01
## mixture:2 6.130841e-05 6.130841e-05 6.130841e-05 6.130841e-05 6.130841e-05
##                       6            7            8            9           10
## mixture:1 8.740239e-01 8.740239e-01 8.740239e-01 8.740239e-01 8.740239e-01
## mixture:2 6.130841e-05 6.130841e-05 6.130841e-05 6.130841e-05 6.130841e-05
```

```
##                      11           12           13           14           15
## mixture:1 8.740239e-01 8.740239e-01 8.740239e-01 8.740239e-01 8.740239e-01
## mixture:2 6.130841e-05 6.130841e-05 6.130841e-05 6.130841e-05 6.130841e-05
##                      16           17
## mixture:1 8.740239e-01 8.740239e-01
## mixture:2 6.130841e-05 6.130841e-05
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659
## mixture:2 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659
##                   9        10        11        12        13        14        15
## mixture:1 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659
## mixture:2 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659 0.0192659
##                  16        17
## mixture:1 0.0192659 0.0192659
## mixture:2 0.0192659 0.0192659
##
##
## Real Parameter f0
##
##         1
##  69040.79
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  20  (unadjusted=17)
## -2lnL:  11.75915
## AICc :  52.45741  (unadjusted=46.266617)
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) -18.758816 1432.4705000 -2826.401000 2788.883400
## p:(Intercept)  -18.298576    0.0000000   -18.298576  -18.298576
## p:time2         17.330161    0.0000000    17.330161   17.330161
## p:time3         16.207977    0.0000000    16.207977   16.207977
## p:time4         16.499559    0.0000000    16.499559   16.499559
## p:time5         17.208399    0.0000000    17.208399   17.208399
## p:time6         16.912848    0.0000000    16.912848   16.912848
## p:time7         16.912837    0.0000000    16.912837   16.912837
## p:time8         15.798610    0.0000000    15.798610   15.798610
## p:time9         16.726600    0.0000000    16.726600   16.726600
## p:time10        15.101573    0.0000000    15.101573   15.101573
## p:time11        16.726614    0.0000000    16.726614   16.726614
## p:time12        16.726641    0.0000000    16.726641   16.726641
## p:time13        17.330153    0.0000000    17.330153   17.330153
## p:time14        16.499570    0.0000000    16.499570   16.499570
## p:time15        16.912864    0.0000000    16.912864   16.912864
## p:time16        17.330148    0.0000000    17.330148   17.330148
## p:time17        15.101536    0.0000000    15.101536   15.101536
## p:mixture2      -2.364167    0.0000000    -2.364167   -2.364167
```

```
## f0:(Intercept)   5.242273    0.3710667     4.514982    5.969564
##
##
## Real Parameter pi
##
##
## mixture:1 7.130988e-09
##
##
## Real Parameter p
##
##                      1         2         3         4         5         6
## mixture:1 1.129872e-08 0.2751966 0.1100139 0.1419708 0.2515850 0.2000906
## mixture:2 1.062392e-09 0.0344702 0.0114895 0.0153196 0.0306396 0.0229797
##                    7         8         9        10        11        12        13
## mixture:1 0.2000889 0.0758605 0.1719349 0.0392787 0.1719369 0.1719407 0.2751948
## mixture:2 0.0229795 0.0076594 0.0191495 0.0038296 0.0191498 0.0191503 0.0344699
##                   14        15        16        17
## mixture:1 0.1419721 0.2000932 0.2751939 0.0392773
## mixture:2 0.0153198 0.0229801 0.0344698 0.0038294
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.2751966 0.1100139 0.1419708 0.2515850 0.2000906 0.2000889 0.0758605
## mixture:2 0.0344702 0.0114895 0.0153196 0.0306396 0.0229797 0.0229795 0.0076594
##                    9        10        11        12        13        14        15
## mixture:1 0.1719349 0.0392787 0.1719369 0.1719407 0.2751948 0.1419721 0.2000932
## mixture:2 0.0191495 0.0038296 0.0191498 0.0191503 0.0344699 0.0153198 0.0229801
##                   16        17
## mixture:1 0.2751939 0.0392773
## mixture:2 0.0344698 0.0038294
##
##
## Real Parameter f0
##
##         1
##  189.0994
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  21  (unadjusted=16)
## -2lnL:  7.257465
## AICc :  50.02618  (unadjusted=39.70817)
##
## Beta
##                   estimate           se           lcl          ucl
## pi:(Intercept) -15.570463 5.190720e+03 -10189.382000 10158.241000
## p:(Intercept)  -12.850880 0.000000e+00    -12.850880   -12.850880
## p:mixture2      -6.146203 0.000000e+00     -6.146203    -6.146203
## p:time2         17.051159 0.000000e+00     17.051159    17.051159
## p:time3         15.579431 0.000000e+00     15.579431    15.579431
```

```
## p:time4         16.340357 0.000000e+00     16.340357    16.340357
## p:time5         17.184707 0.000000e+00     17.184707    17.184707
## p:time6         16.822351 0.000000e+00     16.822351    16.822351
## p:time7         16.942989 0.000000e+00     16.942989    16.942989
## p:time8         16.079356 0.000000e+00     16.079356    16.079356
## p:time9         16.134905 0.000000e+00     16.134905    16.134905
## p:time10        15.470831 0.000000e+00     15.470831    15.470831
## p:time11        17.239224 0.000000e+00     17.239224    17.239224
## p:time12        17.428457 0.000000e+00     17.428457    17.428457
## p:time13        18.303929 0.000000e+00     18.303929    18.303929
## p:time14        17.898461 0.000000e+00     17.898461    17.898461
## p:time15        18.303939 0.000000e+00     18.303939    18.303939
## p:time16        20.942937 0.000000e+00     20.942937    20.942937
## p:time17        41.453801 2.016877e+04 -39489.338000 39572.246000
## c:(Intercept)   -3.930013 3.044541e-01     -4.526743    -3.333283
## f0:(Intercept) -22.257993 0.000000e+00    -22.257993   -22.257993
##
##
## Real Parameter pi
##
##
## mixture:1 1.729155e-07
##
##
## Real Parameter p
##
##                        1         2         3         4         5         6
## mixture:1 2.623812e-06 0.9852300 0.9386905 0.9703869 0.9870526 0.9815029
## mixture:2 5.619167e-09 0.1249985 0.0317483 0.0655757 0.1403513 0.1020427
##                     7         8         9        10        11        12        13
## mixture:1 0.9835705 0.9618919 0.9638767 0.9321346 0.9877311 0.9898248 0.9957350
## mixture:2 0.1136394 0.0512842 0.0540552 0.0285745 0.1470588 0.1724125 0.3333319
##                    14        15        16 17
## mixture:1 0.9936162 0.9957351 0.9996941  1
## mixture:2 0.2499983 0.3333341 0.8749939  1
##
##
## Real Parameter c
##
##                    2        3        4        5        6        7        8
## mixture:1 0.019265 0.019265 0.019265 0.019265 0.019265 0.019265 0.019265
## mixture:2 0.019265 0.019265 0.019265 0.019265 0.019265 0.019265 0.019265
##                    9       10       11       12       13       14       15
## mixture:1 0.019265 0.019265 0.019265 0.019265 0.019265 0.019265 0.019265
## mixture:2 0.019265 0.019265 0.019265 0.019265 0.019265 0.019265 0.019265
##                   16       17
## mixture:1 0.019265 0.019265
## mixture:2 0.019265 0.019265
##
##
## Real Parameter f0
##
##             1
##  2.155146e-10
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  19  (unadjusted=18)
## -2lnL:  11.75915
## AICc :  50.39038  (unadjusted=48.32679)
##
## Beta
##                    estimate           se          lcl          ucl
## pi:(Intercept)   0.0041394 2.029811e+04 -39784.29800 39784.307000
## p:(Intercept)  -19.2627430 5.801141e-01    -20.39977   -18.125719
## p:time2         15.9301280 7.387428e-01     14.48219    17.378064
## p:time3         14.8079950 8.740273e-01     13.09490    16.521089
## p:time4         15.0995590 8.253756e-01     13.48182    16.717296
## p:time5         15.8083870 7.476212e-01     14.34305    17.273724
## p:time6         15.5128340 7.741077e-01     13.99558    17.030085
## p:time7         15.5128340 7.741077e-01     13.99558    17.030085
## p:time8         14.3986630 5.182178e-01     13.38296    15.414370
## p:time9         15.3266000 7.949256e-01     13.76855    16.884654
## p:time10        13.7016630 1.195535e+00     11.35842    16.044912
## p:time11        15.3266000 7.949256e-01     13.76855    16.884654
## p:time12        15.3266000 7.949256e-01     13.76855    16.884654
## p:time13        15.9301280 7.387429e-01     14.48219    17.378064
## p:time14        15.0995600 8.253756e-01     13.48182    16.717296
## p:time15        15.5128330 7.741077e-01     13.99558    17.030085
## p:time16        15.9301280 7.387429e-01     14.48219    17.378064
## p:time17        13.7016600 8.597784e-01     12.01649    15.386826
## f0:(Intercept)   5.2422931 3.710681e-01      4.51500     5.969587
##
##
## Real Parameter pi
##
##
## mixture:1 0.5010349
##
##
## Real Parameter p
##
##                        1         2         3         4         5         6
## mixture:1 4.308213e-09 0.0344691 0.0114897 0.0153196 0.0306392 0.0229794
## mixture:2 4.308213e-09 0.0344691 0.0114897 0.0153196 0.0306392 0.0229794
##                     7         8         9        10        11        12        13
## mixture:1 0.0229794 0.0076598 0.0191495 0.0038299 0.0191495 0.0191495 0.0344691
## mixture:2 0.0229794 0.0076598 0.0191495 0.0038299 0.0191495 0.0191495 0.0344691
##                    14        15        16        17
## mixture:1 0.0153196 0.0229794 0.0344691 0.0038299
## mixture:2 0.0153196 0.0229794 0.0344691 0.0038299
##
##
## Real Parameter c
##
##                     2         3         4         5         6         7         8
## mixture:1 0.0344691 0.0114897 0.0153196 0.0306392 0.0229794 0.0229794 0.0076598
```

```
## mixture:2 0.0344691 0.0114897 0.0153196 0.0306392 0.0229794 0.0229794 0.0076598
##                   9        10        11        12        13        14        15
## mixture:1 0.0191495 0.0038299 0.0191495 0.0191495 0.0344691 0.0153196 0.0229794
## mixture:2 0.0191495 0.0038299 0.0191495 0.0191495 0.0344691 0.0153196 0.0229794
##                  16        17
## mixture:1 0.0344691 0.0038299
## mixture:2 0.0344691 0.0038299
##
##
## Real Parameter f0
##
##         1
##  189.1032
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  20  (unadjusted=18)
## -2lnL:  7.257573
## AICc :  47.95583  (unadjusted=43.825208)
##
## Beta
##                       estimate        se           lcl           ucl
## pi:(Intercept) -5.793201e-04 0.0000000 -5.793201e-04 -5.793201e-04
## p:(Intercept)  -4.492421e+01 0.0989162 -4.511808e+01 -4.473033e+01
## p:time2         4.297855e+01 0.3697905  4.225376e+01  4.370334e+01
## p:time3         4.150645e+01 0.7253917  4.008468e+01  4.292822e+01
## p:time4         4.226739e+01 0.5266331  4.123519e+01  4.329959e+01
## p:time5         4.311187e+01 0.3951691  4.233733e+01  4.388640e+01
## p:time6         4.274957e+01 0.4821739  4.180451e+01  4.369463e+01
## p:time7         4.287011e+01 0.4432057  4.200143e+01  4.373879e+01
## p:time8         4.200678e+01 0.7325629  4.057096e+01  4.344260e+01
## p:time9         4.206232e+01 0.7336256  4.062442e+01  4.350023e+01
## p:time10        4.139919e+01 0.9267352  3.958279e+01  4.321560e+01
## p:time11        4.316635e+01 0.4930295  4.220002e+01  4.413269e+01
## p:time12        4.335551e+01 0.4565591  4.246065e+01  4.425036e+01
## p:time13        4.423077e+01 0.4124716  4.342232e+01  4.503921e+01
## p:time14        4.382533e+01 0.5188607  4.280837e+01  4.484230e+01
## p:time15        4.423101e+01 0.5980178  4.305889e+01  4.540312e+01
## p:time16        4.686967e+01 0.9891262  4.493099e+01  4.880836e+01
## p:time17        8.166084e+01 0.1679120  8.133173e+01  8.198995e+01
## c:(Intercept)  -3.929585e+00 0.3043914 -4.526192e+00 -3.332978e+00
## f0:(Intercept) -1.344955e+01 0.0000000 -1.344955e+01 -1.344955e+01
##
##
## Real Parameter pi
##
##
## mixture:1 0.4998552
##
##
## Real Parameter p
##
##                      1         2         3         4         5         6
```

```
## mixture:1 3.087918e-20 0.1250275 0.0317451 0.0655702 0.1403555 0.1020514
## mixture:2 3.087918e-20 0.1250275 0.0317451 0.0655702 0.1403555 0.1020514
##                   7         8         9        10        11        12        13
## mixture:1 0.1136392 0.0512989 0.0540703 0.0286089 0.1470596 0.1724022 0.3332689
## mixture:2 0.1136392 0.0512989 0.0540703 0.0286089 0.1470596 0.1724022 0.3332689
##                  14        15        16 17
## mixture:1 0.2499515 0.3333222 0.8749517  1
## mixture:2 0.2499515 0.3333222 0.8749517  1
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731
## mixture:2 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731
##                   9        10        11        12        13        14        15
## mixture:1 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731
## mixture:2 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731 0.0192731
##                  16        17
## mixture:1 0.0192731 0.0192731
## mixture:2 0.0192731 0.0192731
##
##
## Real Parameter f0
##
##             1
##  1.441894e-06
```

```
iguane.results
```

```
##                                 model npar     AICc DeltaAICc     weight
## 8           pi(~1)p(~time)c(~1)f0(~1)   20 47.95583  0.000000 0.40832980
## 1                pi(~1)p(~1)c()f0(~1)    2 49.31676  1.360937 0.20676993
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   21 50.02618  2.070357 0.14502362
## 7             pi(~1)p(~time)c()f0(~1)   19 50.39038  2.434557 0.12087979
## 5   pi(~1)p(~time + mixture)c()f0(~1)   20 52.45741  4.501581 0.04300363
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 52.84411  4.888280 0.03544334
## 3          pi(~1)p(~mixture)c()f0(~1)    4 53.33975  5.383924 0.02766349
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 54.86763  6.911805 0.01288640
##   Deviance
## 8 56.79212
## 1 94.84148
## 6 56.79201
## 7 61.29370
## 5 61.29370
## 2 94.34584
## 3 94.84148
## 4 94.35292
```

```
names(iguane.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

```
iguane.results$p.time$results$real
```

```
##                  estimate           se            lcl          ucl fixed note
## pi g1 m1    5.010349e-01 5.074507e+03  5.585759e-309 1.000000e+00
## p g1 t1 m1  4.308213e-09 2.499255e-09  -5.903273e-10 9.206753e-09
## p g1 t2 m1  3.446910e-02 1.460390e-02   1.488110e-02 7.780470e-02
## p g1 t3 m1  1.148970e-02 7.282400e-03   3.296900e-03 3.924030e-02
## p g1 t4 m1  1.531960e-02 8.644300e-03   5.034700e-03 4.565030e-02
## p g1 t5 m1  3.063920e-02 1.347410e-02   1.282390e-02 7.141390e-02
## p g1 t6 m1  2.297940e-02 1.114110e-02   8.814300e-03 5.856370e-02
## p g1 t7 m1  2.297940e-02 1.114110e-02   8.814300e-03 5.856380e-02
## p g1 t8 m1  7.659800e-03 5.775000e-03   1.738200e-03 3.308700e-02
## p g1 t9 m1  1.914950e-02 9.920700e-03   6.885800e-03 5.210880e-02
## p g1 t10 m1 3.829900e-03 3.958700e-03   5.028145e-04 2.854340e-02
## p g1 t11 m1 1.914950e-02 9.920700e-03   6.885800e-03 5.210880e-02
## p g1 t12 m1 1.914950e-02 9.920700e-03   6.885800e-03 5.210880e-02
## p g1 t13 m1 3.446910e-02 1.460390e-02   1.488110e-02 7.780470e-02
## p g1 t14 m1 1.531960e-02 8.644300e-03   5.034700e-03 4.565030e-02
## p g1 t15 m1 2.297940e-02 1.114110e-02   8.814300e-03 5.856370e-02
## p g1 t16 m1 3.446910e-02 1.460390e-02   1.488100e-02 7.780470e-02
## p g1 t17 m1 3.829900e-03 3.958700e-03   5.028014e-04 2.854390e-02
## f0 g1 a0 t1 1.891032e+02 7.017017e+01   9.353400e+01 3.823212e+02
```

```
iguane.results$p.time$results$derived
```

```
## $`N Population Size`
##   estimate     lcl      ucl
## 1 261.1032 165.534 454.3212
```

Données 2010

Les données

```
iguane <- convert.inp("dat/iguanes-2010-2sexes-FM.inp",
                      group.df = data.frame(sex = c("F","M")),
                      covariates = NULL)
head(iguane)
```

```
##           ch freq sex
## 1:1 00000010    1   F
## 1:2 00000010    1   F
## 1:3 00000001    1   F
## 1:4 01000000    1   F
## 1:5 00010000    1   F
## 1:6 00100000    1   F
```

```
tail(iguane)
```

```
##             ch freq sex
## 2:119 00000010    1   M
```

```
## 2:120 10010000    1   M
## 2:121 01000000    1   M
## 2:122 00000100    1   M
## 2:123 01000000    1   M
## 2:124 00000001    1   M
```

On sépare mâles et femelles.

```
iguaneM <- iguane[iguane$sex == "M", ]
iguaneF <- iguane[iguane$sex == "F", ]
```

On formate les données.

```
iguane_secr <- unRMarkInput(iguane) # on convertit au bon format
summary(iguane_secr) # resumes
```

```
## Object class       capthist
##
## Counts by occasion
##               1  2  3  4  5  6   7   8 Total
## n            14 17 18 22 21 14  16  14   136
## u            14 17 18 16 19 13  15  12   124
## f           113 10  1  0  0  0   0   0   124
## M(t+1)       14 31 49 65 84 97 112 124   124
## losses        0  0  0  0  0  0   0   0     0
## detections   14 17 18 22 21 14  16  14   136
##
## Individual covariates
##  sex
##  F:50
##  M:74
```

Les deux sexes ensemble.

```
closure.test(iguane_secr, SB = TRUE)
```

```
## $Otis
##   statistic         p
##  -0.5636019 0.2865126
##
## $Xc
##  statistic df          p
##   13.61476  7 0.05847307
##
## $NRvsJS
##  statistic df           p
##   8.542874  1 0.003468775
##
## $NMvsJS
##  statistic df       p
##   3.203634  2 0.20153
##
```

```
## $MtvsNR
##  statistic df         p
##   5.071888  6 0.5346266
##
## $MtvsNM
##  statistic df          p
##   10.41113  5 0.06438979
##
## $compNRvsJS
##   Occasion Chisquare df           p
## 1        2        NA NA          NA
## 2        3        NA NA          NA
## 3        4  8.542874  1 0.003468775
## 4        5        NA NA          NA
## 5        6        NA NA          NA
## 6        7        NA NA          NA
##
## $compNMvsJS
##   Occasion Chisquare df          p
## 1        2 2.9216548  1 0.08739819
## 2        3 0.2819793  1 0.59540684
## 3        4        NA NA         NA
## 4        5        NA NA         NA
## 5        6        NA NA         NA
## 6        7        NA NA         NA
```

Les modèles maintenant. On commence par le jeu de données avec les deux sexes ensemble.

```
iguane.proc <- process.data(iguane,
                            begin.time = 1,
                            model = "FullHet")
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

```
run.iguane <- function() {

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ mixture + time)

  iguane.model.list <- create.model.list("FullHet")

  iguane.results <- mark.wrapper(iguane.model.list,
                              data = iguane.proc,
                              ddl = iguane.ddl)

  return(iguane.results)
}
```

```
iguane.results <- run.iguane()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  -321.6732
## AICc :  -315.6489  (unadjusted=-317.66102)
##
## Beta
##                     estimate        se           lcl           ucl
## pi:(Intercept) -0.0000139197 0.0000000 -0.0000139197 -0.0000139197
## p:(Intercept)  -3.5919851000 0.2869478 -4.1544029000 -3.0295674000
## f0:(Intercept)  6.2348095000 0.3308172  5.5864078000  6.8832112000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999965
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
## mixture:2 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
##                    8
## mixture:1 0.0268053
## mixture:2 0.0268053
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
## mixture:2 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053 0.0268053
##
##
## Real Parameter f0
##
##         1
##  510.2034
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4
## -2lnL:  -321.7031
## AICc :  -315.6788
##
## Beta
```

```
##                      estimate se           lcl           ucl
## pi:(Intercept) -0.0001908345  0 -0.0001908345 -0.0001908345
## p:(Intercept)  -3.3691854000  0 -3.3691854000 -3.3691854000
## c:(Intercept)  -3.6018681000  0 -3.6018681000 -3.6018681000
## f0:(Intercept)  5.9873313000  0  5.9873313000  5.9873313000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999523
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0332725 0.0332725 0.0332725 0.0332725 0.0332725 0.0332725 0.0332725
## mixture:2 0.0332725 0.0332725 0.0332725 0.0332725 0.0332725 0.0332725 0.0332725
##                   8
## mixture:1 0.0332725
## mixture:2 0.0332725
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
## mixture:2 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
##
##
## Real Parameter f0
##
##         1
##  398.3501
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -321.6732
## AICc :  -313.6326  (unadjusted=-317.66102)
##
## Beta
##                    estimate           se           lcl         ucl
## pi:(Intercept) -21.8688180 1976.2260000 -3895.271900 3851.534200
## p:(Intercept)    0.2917086  337.4530100  -661.116210  661.699630
## p:mixture2      -3.8836766  337.4534800  -665.292500  657.525150
## f0:(Intercept)   6.2347948    0.3308144     5.586399    6.883191
##
##
## Real Parameter pi
##
##
## mixture:1 3.180484e-10
```

```
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.5724144 0.5724144 0.5724144 0.5724144 0.5724144 0.5724144 0.5724144
## mixture:2 0.0268057 0.0268057 0.0268057 0.0268057 0.0268057 0.0268057 0.0268057
##                   8
## mixture:1 0.5724144
## mixture:2 0.0268057
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.5724144 0.5724144 0.5724144 0.5724144 0.5724144 0.5724144 0.5724144
## mixture:2 0.0268057 0.0268057 0.0268057 0.0268057 0.0268057 0.0268057 0.0268057
##
##
## Real Parameter f0
##
##         1
##  510.1959
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=3)
## -2lnL:  -321.7031
## AICc :  -311.6423  (unadjusted=-315.67884)
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) 12.6325200 1826.8960000 -3568.083600 3593.348700
## p:(Intercept)  -3.3692522    1.1802804    -5.682602   -1.055902
## p:mixture2      0.6336764  360.4528600  -705.853950  707.121300
## c:(Intercept)  -3.6018494    0.2925825    -4.175311   -3.028388
## f0:(Intercept)  5.9874089    1.3303192     3.379983    8.594835
##
##
## Real Parameter pi
##
##
## mixture:1 0.9999967
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0332704 0.0332704 0.0332704 0.0332704 0.0332704 0.0332704 0.0332704
## mixture:2 0.0609065 0.0609065 0.0609065 0.0609065 0.0609065 0.0609065 0.0609065
##                   8
## mixture:1 0.0332704
## mixture:2 0.0609065
```

```
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0265492 0.0265492 0.0265492 0.0265492 0.0265492 0.0265492 0.0265492
## mixture:2 0.0265492 0.0265492 0.0265492 0.0265492 0.0265492 0.0265492 0.0265492
##
##
## Real Parameter f0
##
##        1
##  398.381
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  11
## -2lnL:  -325.9341
## AICc :  -303.6647
##
## Beta
##                      estimate        se         lcl        ucl
## pi:(Intercept) -2.514495e+00 9.8168337 -21.7554900 16.7264990
## p:(Intercept)  -2.898999e+00 3.2459602  -9.2610814  3.4630829
## p:time2         1.991641e-01 0.3655085  -0.5172326  0.9155609
## p:time3         2.579926e-01 0.3610132  -0.4495933  0.9655786
## p:time4         4.653422e-01 0.3467581  -0.2143037  1.1449882
## p:time5         4.171530e-01 0.3498597  -0.2685720  1.1028779
## p:time6        -2.600136e-06 0.3823619  -0.7494320  0.7494268
## p:time7         1.368697e-01 0.3705015  -0.5893132  0.8630526
## p:time8        -2.178889e-06 0.3823614  -0.7494306  0.7494262
## p:mixture2     -1.357601e+00 1.9230315  -5.1267426  2.4115409
## f0:(Intercept)  6.561959e+00 1.8508069   2.9343774 10.1895400
##
##
## Real Parameter pi
##
##
## mixture:1 0.0748482
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0522031 0.0629831 0.0665455 0.0806419 0.0771407 0.0522029 0.0594053
## mixture:2 0.0139724 0.0169993 0.0180108 0.0220692 0.0210527 0.0139724 0.0159891
##                   8
## mixture:1 0.0522029
## mixture:2 0.0139724
##
##
## Real Parameter c
##
```

```
##                   2         3         4         5         6         7         8
## mixture:1 0.0629831 0.0665455 0.0806419 0.0771407 0.0522029 0.0594053 0.0522029
## mixture:2 0.0169993 0.0180108 0.0220692 0.0210527 0.0139724 0.0159891 0.0139724
##
##
## Real Parameter f0
##
##         1
##  707.6566
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  12  (unadjusted=8)
## -2lnL:  -330.346
## AICc :  -306.0273  (unadjusted=-314.19955)
##
## Beta
##                     estimate          se           lcl          ucl
## pi:(Intercept)   1.1041787    0.000000      1.104179     1.104179
## p:(Intercept)   -2.9940285    0.000000     -2.994029    -2.994029
## p:mixture2       2.1921106  346.766350   -677.469950   681.854170
## p:time2          0.5999181   98.740021   -192.930530   194.130360
## p:time3          1.1520407  171.084630   -334.173850   336.477930
## p:time4          1.4915579  107.556110   -209.318430   212.301540
## p:time5          2.1871011    0.000000      2.187101     2.187101
## p:time6          2.2450548    0.000000      2.245055     2.245055
## p:time7          3.2138002    0.000000      3.213800     3.213800
## p:time8         21.3792290 2825.805000  -5517.198700  5559.957100
## c:(Intercept)   -3.6018669    0.292585     -4.175333    -3.028400
## f0:(Intercept) -21.9239360 7556.681400 -14833.020000 14789.172000
##
##
## Real Parameter pi
##
##
## mixture:1 0.7510423
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.0476964 0.0836229 0.1368164 0.1820573 0.3085456 0.3210450 0.5547228
## mixture:2 0.3096154 0.4496711 0.5866474 0.6658868 0.7998222 0.8089399 0.9177289
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
## mixture:2 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
```

```
##
##
## Real Parameter f0
##
##             1
##  3.009925e-10
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  10
## -2lnL:  -325.815
## AICc :  -307.6317
##
## Beta
##                       estimate se           lcl           ucl
## pi:(Intercept) -9.004216e-05  0 -9.004216e-05 -9.004216e-05
## p:(Intercept)  -3.786754e+00  0 -3.786754e+00 -3.786754e+00
## p:time2         1.990239e-01  0  1.990239e-01  1.990239e-01
## p:time3         2.578111e-01  0  2.578111e-01  2.578111e-01
## p:time4         4.650222e-01  0  4.650222e-01  4.650222e-01
## p:time5         4.168626e-01  0  4.168626e-01  4.168626e-01
## p:time6        -1.120060e-06  0 -1.120060e-06 -1.120060e-06
## p:time7         1.367735e-01  0  1.367735e-01  1.367735e-01
## p:time8        -1.531175e-06  0 -1.531175e-06 -1.531175e-06
## f0:(Intercept)  6.229660e+00  0  6.229660e+00  6.229660e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999775
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0221666 0.0269165 0.0284998 0.0348331 0.0332498 0.0221665 0.0253332
## mixture:2 0.0221666 0.0269165 0.0284998 0.0348331 0.0332498 0.0221665 0.0253332
##                    8
## mixture:1 0.0221665
## mixture:2 0.0221665
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0269165 0.0284998 0.0348331 0.0332498 0.0221665 0.0253332 0.0221665
## mixture:2 0.0269165 0.0284998 0.0348331 0.0332498 0.0221665 0.0253332 0.0221665
##
##
## Real Parameter f0
##
##         1
```

```
##  507.5827
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  11  (unadjusted=8)
## -2lnL:  -330.346
## AICc :  -308.0767  (unadjusted=-314.19955)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept)  2.304559e-04    0.0000000  2.304559e-04  2.304559e-04
## p:(Intercept)  -2.061423e+00    0.2837597 -2.617592e+00 -1.505254e+00
## p:time2         3.620367e-01    0.3874220 -3.973104e-01  1.121384e+00
## p:time3         6.343064e-01    0.3865340 -1.233002e-01  1.391913e+00
## p:time4         7.564742e-01    0.3999610 -2.744930e-02  1.540398e+00
## p:time5         1.316982e+00    0.3976823  5.375252e-01  2.096440e+00
## p:time6         1.330535e+00    0.4409985  4.661782e-01  2.194892e+00
## p:time7         2.284566e+00    0.4801246  1.343522e+00  3.225611e+00
## p:time8         2.274618e+01    0.0000000  2.274618e+01  2.274618e+01
## c:(Intercept)  -3.601868e+00    0.2925851 -4.175335e+00 -3.028401e+00
## f0:(Intercept) -2.373926e+01 5151.6646000 -1.012100e+04  1.007352e+04
##
##
## Real Parameter pi
##
##
## mixture:1 0.5000576
##
##
## Real Parameter p
##
##                    1         2         3         4         5     6         7 8
## mixture:1 0.1129032 0.1545454 0.1935484 0.2133333 0.3220339 0.325 0.5555555 1
## mixture:2 0.1129032 0.1545454 0.1935484 0.2133333 0.3220339 0.325 0.5555555 1
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
## mixture:2 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487 0.0265487
##
##
## Real Parameter f0
##
##             1
##  4.899693e-11
```

```
iguane.results
```

```
##                                 model npar      AICc DeltaAICc      weight
## 1               pi(~1)p(~1)c()f0(~1)    3 -315.6489  0.000000 0.523537268
## 2             pi(~1)p(~1)c(~1)f0(~1)    4 -313.6626  1.986245 0.193927726
```

```
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -313.6326  2.016235 0.191041473
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -311.6423  4.006570 0.070620679
## 8          pi(~1)p(~time)c(~1)f0(~1)   11 -308.0767  7.572206 0.011875828
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   12 -306.0273  9.621511 0.004262487
## 7            pi(~1)p(~time)c()f0(~1)   10 -305.5907 10.058149 0.003426480
## 5   pi(~1)p(~time + mixture)c()f0(~1)   11 -303.6647 11.984126 0.001308060
##   Deviance
## 1 48.31201
## 2 48.28202
## 3 48.31201
## 4 48.28202
## 8 39.63912
## 6 39.63912
## 7 44.17018
## 5 44.05104
```

```
names(iguane.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

```
iguane.results$p.dot$results$real
```

```
##                estimate          se         lcl         ucl fixed note
## pi g1 m1      0.4999965   0.0000000   0.4999965   0.4999965
## p g1 t1 m1    0.0268053   0.0074855   0.0154526   0.0461079
## f0 g1 a0 t1 510.2034100 168.7840500 271.2845000 959.5370100
```

```
iguane.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 634.2034 395.2845 1083.537
```

En séparant les sexes. Femelles, puis mâles.

```
iguane.proc <- process.data(iguaneF, begin.time = 1, model = "FullHet")
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

```
run.iguane <- function() {

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
```

```
  p.h.time.behav <- list(formula =  ~ mixture + time)

  iguane.model.list <- create.model.list("FullHet")

  iguane.results <- mark.wrapper(iguane.model.list,
                                 data = iguane.proc,
                                 ddl = iguane.ddl)

  return(iguane.results)
}
```

```
iguane.results <- run.iguane()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3
## -2lnL:  -70.97173
## AICc :  -64.91113
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -0.0000641788 0.0000000 -0.0000641788 -0.0000641788
## p:(Intercept)  -5.1447327000 0.1404356 -5.4199865000 -4.8694789000
## f0:(Intercept)  6.9564033000 0.0000000  6.9564033000  6.9564033000
##
##
## Real Parameter pi
##
##
## mixture:1 0.499984
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
## mixture:2 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
##                    8
## mixture:1 0.0057962
## mixture:2 0.0057962
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
## mixture:2 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962 0.0057962
##
##
## Real Parameter f0
##
```

```
##         1
##  1049.851
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -71.17643
## AICc :  -63.07516  (unadjusted=-67.146199)
##
## Beta
##                     estimate se           lcl           ucl
## pi:(Intercept)  1.441452e-04  0  1.441452e-04  1.441452e-04
## p:(Intercept)  -1.075829e+01  0 -1.075829e+01 -1.075829e+01
## c:(Intercept)  -5.038849e+00  0 -5.038849e+00 -5.038849e+00
## f0:(Intercept)  1.259441e+01  0  1.259441e+01  1.259441e+01
##
##
## Real Parameter pi
##
##
## mixture:1 0.500036
##
##
## Real Parameter p
##
##                       1            2            3            4            5
## mixture:1 2.126783e-05 2.126783e-05 2.126783e-05 2.126783e-05 2.126783e-05
## mixture:2 2.126783e-05 2.126783e-05 2.126783e-05 2.126783e-05 2.126783e-05
##                       6            7            8
## mixture:1 2.126783e-05 2.126783e-05 2.126783e-05
## mixture:2 2.126783e-05 2.126783e-05 2.126783e-05
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.0064395 0.0064395 0.0064395 0.0064395 0.0064395 0.0064395 0.0064395
## mixture:2 0.0064395 0.0064395 0.0064395 0.0064395 0.0064395 0.0064395 0.0064395
##
##
## Real Parameter f0
##
##         1
##  294904.4
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -70.97173
## AICc :  -62.87047  (unadjusted=-66.941505)
##
## Beta
```

```
##                  estimate          se          lcl         ucl
## pi:(Intercept) -19.95008 1752.825700 -3455.488400 3415.588300
## p:(Intercept)   -1.49639    0.000000    -1.496390   -1.496390
## p:mixture2      -3.64816    0.000000    -3.648160   -3.648160
## f0:(Intercept)   6.95622    1.029569     4.938265    8.974175
##
##
## Real Parameter pi
##
##
## mixture:1 2.166666e-09
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1829646 0.1829646 0.1829646 0.1829646 0.1829646 0.1829646 0.1829646
## mixture:2 0.0057973 0.0057973 0.0057973 0.0057973 0.0057973 0.0057973 0.0057973
##                    8
## mixture:1 0.1829646
## mixture:2 0.0057973
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1829646 0.1829646 0.1829646 0.1829646 0.1829646 0.1829646 0.1829646
## mixture:2 0.0057973 0.0057973 0.0057973 0.0057973 0.0057973 0.0057973 0.0057973
##
##
## Real Parameter f0
##
##         1
##  1049.659
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
## Npar :  5  (unadjusted=2)
## -2lnL:  -71.17733
## AICc :  -61.02505  (unadjusted=-67.147108)
##
## Beta
##                   estimate         se          lcl        ucl
## pi:(Intercept) -25.193875 518.020850 -1040.514800 990.127010
## p:(Intercept)    8.087232  18.871168   -28.900259  45.074722
## p:mixture2     -19.387746  42.338591  -102.371390  63.595894
## c:(Intercept)   -5.032177   1.001027    -6.994191  -3.070163
## f0:(Intercept)  13.133391  23.468027   -32.863943  59.130726
##
##
## Real Parameter pi
##
##
```

```
## mixture:1 1.144034e-11
##
##
## Real Parameter p
##
##                      1            2            3            4            5
## mixture:1 9.996927e-01 9.996927e-01 9.996927e-01 9.996927e-01 9.996927e-01
## mixture:2 1.236641e-05 1.236641e-05 1.236641e-05 1.236641e-05 1.236641e-05
##                      6            7            8
## mixture:1 9.996927e-01 9.996927e-01 9.996927e-01
## mixture:2 1.236641e-05 1.236641e-05 1.236641e-05
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0064823 0.0064823 0.0064823 0.0064823 0.0064823 0.0064823 0.0064823
## mixture:2 0.0064823 0.0064823 0.0064823 0.0064823 0.0064823 0.0064823 0.0064823
##
##
## Real Parameter f0
##
##         1
##  505544.5
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  11  (unadjusted=9)
## -2lnL:  -73.53263
## AICc :  -50.85222  (unadjusted=-55.071092)
##
## Beta
##                      estimate          se           lcl         ucl
## pi:(Intercept) -1.880866e+01 764.4123300 -1517.0569000 1479.439500
## p:(Intercept)  -1.177897e+00 407.0651600  -799.0256400  796.669840
## p:time2         1.829661e-01   0.6069958    -1.0067456    1.372678
## p:time3        -3.056216e-04   0.6338537    -1.2426588    1.242048
## p:time4         1.829602e-01   0.6069904    -1.0067410    1.372661
## p:time5         3.380485e-01   0.5870531    -0.8125756    1.488673
## p:time6         1.829383e-01   0.6069973    -1.0067763    1.372653
## p:time7         1.829239e-01   0.6069946    -1.0067856    1.372633
## p:time8         6.974705e-01   0.5493641    -0.3792832    1.774224
## p:mixture2     -4.202767e+00 407.0671500  -802.0543900  793.648860
## f0:(Intercept)  6.948047e+00   1.0298205     4.9295986    8.966495
##
##
## Real Parameter pi
##
##
## mixture:1 6.784256e-09
##
##
## Real Parameter p
```

```
##
##                   1         2         3         4         5         6         7
## mixture:1 0.2354305 0.2699392 0.2353755 0.2699381 0.3015667 0.2699338 0.2699309
## mixture:2 0.0045837 0.0054989 0.0045823 0.0054988 0.0064154 0.0054987 0.0054986
##                   8
## mixture:1 0.3821514
## mixture:2 0.0091647
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.2699392 0.2353755 0.2699381 0.3015667 0.2699338 0.2699309 0.3821514
## mixture:2 0.0054989 0.0045823 0.0054988 0.0064154 0.0054987 0.0054986 0.0091647
##
##
## Real Parameter f0
##
##         1
##  1041.114
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  12  (unadjusted=8)
## -2lnL:  -79.75377
## AICc :  -54.94757  (unadjusted=-63.385484)
##
## Beta
##                    estimate          se           lcl           ucl
## pi:(Intercept)  -6.4712608    0.000000 -6.471261e+00    -6.4712608
## p:(Intercept)    3.0785986    0.000000  3.078599e+00     3.0785986
## p:mixture2      -5.2906274    0.000000 -5.290627e+00    -5.2906274
## p:time2          0.3396808    0.000000  3.396808e-01     0.3396808
## p:time3          0.2950856    0.000000  2.950856e-01     0.2950856
## p:time4          0.4541702    0.000000  4.541702e-01     0.4541702
## p:time5          1.0668964    0.000000  1.066896e+00     1.0668964
## p:time6          1.2311997    0.000000  1.231200e+00     1.2311997
## p:time7          1.7012034    0.000000  1.701203e+00     1.7012034
## p:time8         21.8833330 5850.478000 -1.144505e+04 11488.8200000
## c:(Intercept)   -5.0369526    1.003241 -7.003306e+00    -3.0705992
## f0:(Intercept) -20.7054750 5991.513500 -1.176407e+04 11722.6610000
##
##
## Real Parameter pi
##
##
## mixture:1 0.0015449
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.9560013 0.9682710 0.9668719 0.9716059 0.9844113 0.9867419 0.9916723
```

```
## mixture:2 0.0986755 0.1332703 0.1282028 0.1470587 0.2413793 0.2727273 0.3750000
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516
## mixture:2 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516 0.0064516
##
##
## Real Parameter f0
##
##            1
##  1.01795e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  9  (unadjusted=10)
## -2lnL:  -73.53264
## AICc :  -55.0711  (unadjusted=-55.071098)
##
## Beta
##                      estimate se           lcl           ucl
## pi:(Intercept)  0.000000e+00  0  0.000000e+00  0.000000e+00
## p:(Intercept)  -5.380916e+00  0 -5.380916e+00 -5.380916e+00
## p:time2         1.832447e-01  0  1.832447e-01  1.832447e-01
## p:time3         3.956888e-06  0  3.956888e-06  3.956888e-06
## p:time4         1.832483e-01  0  1.832483e-01  1.832483e-01
## p:time5         3.383159e-01  0  3.383159e-01  3.383159e-01
## p:time6         1.832457e-01  0  1.832457e-01  1.832457e-01
## p:time7         1.832469e-01  0  1.832469e-01  1.832469e-01
## p:time8         6.977628e-01  0  6.977628e-01  6.977628e-01
## f0:(Intercept)  6.948035e+00  0  6.948035e+00  6.948035e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.5
##
##
## Real Parameter p
##
##                    1        2         3        4         5        6        7
## mixture:1 0.0045825 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499
## mixture:2 0.0045825 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499
##                   8
## mixture:1 0.009165
## mixture:2 0.009165
##
```

```
##
## Real Parameter c
##
##                  2         3        4         5        6        7        8
## mixture:1 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499 0.009165
## mixture:2 0.005499 0.0045825 0.005499 0.0064155 0.005499 0.005499 0.009165
##
##
## Real Parameter f0
##
##         1
##  1041.102
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  11  (unadjusted=8)
## -2lnL:  -79.75377
## AICc :  -57.07336  (unadjusted=-63.385484)
##
## Beta
##                      estimate           se           lcl           ucl
## pi:(Intercept) -1.884983e-04    0.0000000 -1.884983e-04 -1.884983e-04
## p:(Intercept)  -2.197220e+00    0.4714034 -3.121171e+00 -1.273270e+00
## p:time2         3.254191e-01    0.6438390 -9.365053e-01  1.587344e+00
## p:time3         2.803853e-01    0.6720251 -1.036784e+00  1.597555e+00
## p:time4         4.393566e-01    0.6757996 -8.852105e-01  1.763924e+00
## p:time5         1.052073e+00    0.6407295 -2.037570e-01  2.307903e+00
## p:time6         1.216451e+00    0.6718493 -1.003733e-01  2.533276e+00
## p:time7         1.686381e+00    0.6992050  3.159391e-01  3.056823e+00
## p:time8         2.146978e+01 4512.4473000 -8.822927e+03  8.865867e+03
## c:(Intercept)  -5.037055e+00    1.0032920 -7.003507e+00 -3.070602e+00
## f0:(Intercept) -1.920048e+01    5.2577337 -2.950564e+01 -8.895321e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999529
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1000004 0.1333334 0.1282149 0.1470581 0.2413765 0.2727392 0.3749967
## mixture:2 0.1000004 0.1333334 0.1282149 0.1470581 0.2413765 0.2727392 0.3749967
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                  2        3        4        5        6        7        8
```

```
## mixture:1 0.006451 0.006451 0.006451 0.006451 0.006451 0.006451 0.006451
## mixture:2 0.006451 0.006451 0.006451 0.006451 0.006451 0.006451 0.006451
##
##
## Real Parameter f0
##
##             1
##  4.584985e-09
```

```
iguane.results
```

```
##                                 model npar      AICc DeltaAICc       weight
## 1               pi(~1)p(~1)c()f0(~1)    3 -64.91113  0.000000 0.5160020227
## 2             pi(~1)p(~1)c(~1)f0(~1)    4 -63.07516  1.835967 0.2060517404
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -62.87047  2.040661 0.1860062554
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -61.02505  3.886076 0.0739265907
## 8           pi(~1)p(~time)c(~1)f0(~1)   11 -57.07336  7.837768 0.0102494755
## 7             pi(~1)p(~time)c()f0(~1)    9 -55.07110  9.840028 0.0037663128
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   12 -54.94757  9.963557 0.0035407265
## 5   pi(~1)p(~time + mixture)c()f0(~1)   11 -50.85222 14.058908 0.0004568759
##    Deviance
## 1 15.858398
## 2 15.653705
## 3 15.858399
## 4 15.652796
## 8  7.076361
## 7 13.297494
## 6  7.076361
## 5 13.297501
```

```
names(iguane.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

```
iguane.results$p.dot$results$real
```

```
##                  estimate           se          lcl          ucl fixed note
## pi g1 m1       0.4999840 0.0000000000    0.4999840    0.4999840
## p g1 t1 m1     0.0057962 0.0008092804    0.0044077    0.0076189
## f0 g1 a0 t1 1049.8508000 0.0000000000 1049.8508000 1049.8508000
```

```
iguane.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 1099.851 1099.851 1099.851
```

Les mâles maintenant.

```
iguane.proc <- process.data(iguaneM, begin.time = 1, model = "FullHet")
iguane.ddl <- make.design.data(iguane.proc)
```

Liste des modèles.

```
run.iguane <- function() {

  p.dot <- list(formula =  ~ 1, share = TRUE)
  p.dot.behav <- list(formula =  ~ 1)
  p.time <- list(formula =  ~ time, share = TRUE)
  p.h <- list(formula = ~ mixture, share = TRUE)
  p.time.behav <- list(formula =  ~ time)
  p.h.behav <- list(formula =  ~ mixture)
  p.h.time <- list(formula = ~ time + mixture, share = TRUE)
  p.h.time.behav <- list(formula =  ~ mixture + time)


  iguane.model.list <- create.model.list("FullHet")

  iguane.results <- mark.wrapper(iguane.model.list,
                                 data = iguane.proc,
                                 ddl = iguane.ddl)

  return(iguane.results)
}
```

```
iguane.results <- run.iguane()
```

```
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c()f0(~1)
##
## Npar :  3  (unadjusted=2)
## -2lnL:  -89.86369
## AICc :  -83.82288  (unadjusted=-85.84332)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -0.0002157054 0.0000000 -0.0002157054 -0.0002157054
## p:(Intercept)  -3.1630235000 0.2989446 -3.7489549000 -2.5770922000
## f0:(Intercept)  5.2354890000 0.3713738  4.5075962000  5.9633817000
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999461
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
```

```
## mixture:1 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
## mixture:2 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
##                   8
## mixture:1 0.0405812
## mixture:2 0.0405812
##
##
## Real Parameter c
##
##                   2         3         4         5         6         7         8
## mixture:1 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
## mixture:2 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812 0.0405812
##
##
## Real Parameter f0
##
##         1
##  187.8209
##
## Output summary for FullHet model
## Name : pi(~1)p(~1)c(~1)f0(~1)
##
## Npar :  4  (unadjusted=3)
## -2lnL:  -91.71901
## AICc :  -83.65086  (unadjusted=-85.67819)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -3.239647e-06 0.0000000 -3.239647e-06 -3.239647e-06
## p:(Intercept)  -2.156301e+00 0.4986273 -3.133611e+00 -1.178991e+00
## c:(Intercept)  -3.258097e+00 0.3072549 -3.860316e+00 -2.655877e+00
## f0:(Intercept)  3.956746e+00 0.7386010  2.509088e+00  5.404404e+00
##
##
## Real Parameter pi
##
##
## mixture:1 0.4999992
##
##
## Real Parameter p
##
##                   1         2         3         4         5         6         7
## mixture:1 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439
## mixture:2 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439 0.1037439
##                   8
## mixture:1 0.1037439
## mixture:2 0.1037439
##
##
## Real Parameter c
##
##                  2        3        4        5        6        7        8
## mixture:1 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
```

```
## mixture:2 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
##
##
## Real Parameter f0
##
##         1
##  52.28689
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c()f0(~1)
##
## Npar :  4  (unadjusted=2)
## -2lnL:  -89.86369
## AICc :  -81.79555  (unadjusted=-85.843319)
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) -16.018718 2976.7969000 -5850.540700 5818.503300
## p:(Intercept)   -1.657662  693.7435500 -1361.395100 1358.079700
## p:mixture2      -1.505362  693.7422000 -1361.240100 1358.229400
## f0:(Intercept)   5.235490    0.3713783     4.507588    5.963391
##
##
## Real Parameter pi
##
##
## mixture:1 1.104483e-07
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1600761 0.1600761 0.1600761 0.1600761 0.1600761 0.1600761 0.1600761
## mixture:2 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811
##                    8
## mixture:1 0.1600761
## mixture:2 0.0405811
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1600761 0.1600761 0.1600761 0.1600761 0.1600761 0.1600761 0.1600761
## mixture:2 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811 0.0405811
##
##
## Real Parameter f0
##
##         1
##  187.8211
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture)c(~1)f0(~1)
##
```

```
## Npar :  5  (unadjusted=4)
## -2lnL:  -91.71901
## AICc :  -81.61662  (unadjusted=-83.650863)
##
## Beta
##                   estimate           se          lcl         ucl
## pi:(Intercept) -19.872325 3379.0045000 -6642.721300 6602.976700
## p:(Intercept)    3.166355    0.0000000     3.166355    3.166355
## p:mixture2      -5.322657    0.0000000    -5.322657   -5.322657
## c:(Intercept)   -3.258097    0.3072549    -3.860316   -2.655877
## f0:(Intercept)   3.956747    0.7386019     2.509088    5.404407
##
##
## Real Parameter pi
##
##
## mixture:1 2.341849e-09
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.9595483 0.9595483 0.9595483 0.9595483 0.9595483 0.9595483 0.9595483
## mixture:2 0.1037438 0.1037438 0.1037438 0.1037438 0.1037438 0.1037438 0.1037438
##                    8
## mixture:1 0.9595483
## mixture:2 0.1037438
##
##
## Real Parameter c
##
##                   2        3        4        5        6        7        8
## mixture:1 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
## mixture:2 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
##
##
## Real Parameter f0
##
##         1
##  52.28698
##
## Output summary for FullHet model
## Name : pi(~1)p(~time + mixture)c()f0(~1)
##
## Npar :  11  (unadjusted=9)
## -2lnL:  -100.5401
## AICc :  -78.08498  (unadjusted=-82.230875)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept) -17.9991730 3309.9468000 -6505.4951000 6469.4967000
## p:(Intercept)   -1.8115629  345.0081900  -678.0276200  674.4045000
## p:time2          0.2087227    0.4583533    -0.6896497    1.1070952
## p:time3          0.3839045    0.4428881    -0.4841562    1.2519652
```

```
## p:time4          0.6038694    0.4264041    -0.2318826    1.4396214
## p:time5          0.4620978    0.4366736    -0.3937825    1.3179781
## p:time6         -0.1217993    0.4940898    -1.0902153    0.8466168
## p:time7          0.1093682    0.4681435    -0.8081930    1.0269295
## p:time8         -0.8308334    0.6075295    -2.0215913    0.3599245
## p:mixture2      -1.5086177  345.0079400  -677.7241900  674.7069500
## f0:(Intercept)   5.2148911    0.3722105     4.4853585    5.9444236
##
##
## Real Parameter pi
##
##
## mixture:1 1.524257e-08
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.1404493 0.1675850 0.1934638 0.2301094 0.2059578 0.1263789 0.1541789
## mixture:2 0.0348853 0.0426371 0.0503892 0.0620177 0.0542650 0.0310089 0.0387609
##                    8
## mixture:1 0.0664592
## mixture:2 0.0155043
##
##
## Real Parameter c
##
##                    2         3         4         5         6         7         8
## mixture:1 0.1675850 0.1934638 0.2301094 0.2059578 0.1263789 0.1541789 0.0664592
## mixture:2 0.0426371 0.0503892 0.0620177 0.0542650 0.0310089 0.0387609 0.0155043
##
##
## Real Parameter f0
##
##         1
##  183.9918
##
## Output summary for FullHet model
## Name : pi(~1)p(~mixture + time)c(~1)f0(~1)
##
## Npar :  12  (unadjusted=8)
## -2lnL:  -104.9976
## AICc :  -80.45871  (unadjusted=-88.750568)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)  -6.1668780 7.526713e+02  -1481.402600  1469.068800
## p:(Intercept)    2.0336099 1.565007e+03  -3065.379800  3069.447000
## p:mixture2      -4.0258182 1.565497e+03  -3072.399300  3064.347700
## p:time2          0.3996500 1.031952e+01    -19.826612    20.625912
## p:time3          0.8434827 1.103099e+01    -20.777251    22.464216
## p:time4          0.9888911 1.108671e+01    -20.741051    22.718833
## p:time5          1.5867419 1.109068e+01    -20.150991    23.324475
## p:time6          1.5402364 1.109508e+01    -20.206114    23.286587
```

```
## p:time7          3.4963264 1.111208e+01    -18.283353    25.276006
## p:time8         24.1402690 1.771813e+04 -34703.402000 34751.683000
## c:(Intercept)   -3.2580984 3.072552e-01     -3.860319    -2.655878
## f0:(Intercept) -18.7700270 2.731503e+03  -5372.516300  5334.976200
##
##
## Real Parameter pi
##
##
## mixture:1 0.0020934
##
##
## Real Parameter p
##
##                    1         2         3         4         5         6         7
## mixture:1 0.8842810 0.9193286 0.9467024 0.9535804 0.9739249 0.9727174 0.9960494
## mixture:2 0.1200234 0.1690243 0.2407219 0.2682897 0.3999997 0.3888920 0.8181879
##           8
## mixture:1 1
## mixture:2 1
##
##
## Real Parameter c
##
##                   2        3        4        5        6        7        8
## mixture:1 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
## mixture:2 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
##
##
## Real Parameter f0
##
##             1
##  7.051491e-09
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c()f0(~1)
##
## Npar :  10  (unadjusted=9)
## -2lnL:  -100.5401
## AICc :  -80.16149  (unadjusted=-82.230876)
##
## Beta
##                      estimate        se           lcl           ucl
## pi:(Intercept) -5.739661e-05 0.0000000 -5.739661e-05 -5.739661e-05
## p:(Intercept)  -3.320197e+00 0.3890004 -4.082638e+00 -2.557757e+00
## p:time2         2.087368e-01 0.2579529 -2.968509e-01  7.143246e-01
## p:time3         3.839213e-01 0.3949050 -3.900924e-01  1.157935e+00
## p:time4         6.038821e-01 0.3080207  1.615212e-04  1.207603e+00
## p:time5         4.621198e-01 0.4286751 -3.780834e-01  1.302323e+00
## p:time6        -1.217893e-01 0.4515987 -1.006923e+00  7.633443e-01
## p:time7         1.093861e-01 0.4230458 -7.197837e-01  9.385559e-01
## p:time8        -8.308112e-01 0.5735143 -1.954899e+00  2.932767e-01
## f0:(Intercept)  5.214892e+00 0.3722027  4.485375e+00  5.944409e+00
##
```

```
##
## Real Parameter pi
##
##
## mixture:1 0.4999857
##
##
## Real Parameter p
##
##                   1        2         3         4         5         6         7
## mixture:1 0.0348848 0.042637 0.0503892 0.0620175 0.0542653 0.0310087 0.0387609
## mixture:2 0.0348848 0.042637 0.0503892 0.0620175 0.0542653 0.0310087 0.0387609
##                   8
## mixture:1 0.0155044
## mixture:2 0.0155044
##
##
## Real Parameter c
##
##                  2         3         4         5         6         7         8
## mixture:1 0.042637 0.0503892 0.0620175 0.0542653 0.0310087 0.0387609 0.0155044
## mixture:2 0.042637 0.0503892 0.0620175 0.0542653 0.0310087 0.0387609 0.0155044
##
##
## Real Parameter f0
##
##        1
##  183.992
##
## Output summary for FullHet model
## Name : pi(~1)p(~time)c(~1)f0(~1)
##
## Npar :  11  (unadjusted=8)
## -2lnL:  -104.9976
## AICc :  -82.5424  (unadjusted=-88.750568)
##
## Beta
##                    estimate           se           lcl          ucl
## pi:(Intercept)    0.0037133 5.618362e+03 -1.101199e+04 11011.994000
## p:(Intercept)    -1.9771629 3.556631e-01 -2.674263e+00    -1.280063
## p:time2           0.3860748 4.857199e-01 -5.659362e-01     1.338086
## p:time3           0.8285402 4.772940e-01 -1.069561e-01     1.764037
## p:time4           0.9738610 5.007388e-01 -7.587100e-03     1.955309
## p:time5           1.5716977 5.151559e-01  5.619921e-01     2.581403
## p:time6           1.5251778 6.002188e-01  3.487490e-01     2.701607
## p:time7           3.4812403 8.588408e-01  1.797912e+00     5.164568
## p:time8          19.9224510 7.384870e+03 -1.445442e+04 14494.268000
## c:(Intercept)    -3.2580966 3.072549e-01 -3.860316e+00    -2.655877
## f0:(Intercept) -20.8911470 1.577225e+04 -3.093451e+04 30892.724000
##
##
## Real Parameter pi
##
##
```

```
## mixture:1 0.5009283
##
##
## Real Parameter p
##
##                   1         2         3         4   5         6         7 8
## mixture:1 0.1216216 0.1692309 0.2407407 0.2682927 0.4 0.3888889 0.8181818 1
## mixture:2 0.1216216 0.1692309 0.2407407 0.2682927 0.4 0.3888889 0.8181818 1
##
##
## Real Parameter c
##
##                   2        3        4        5        6        7        8
## mixture:1 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
## mixture:2 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037 0.037037
##
##
## Real Parameter f0
##
##             1
##  8.454542e-10
```

```
iguane.results
```

```
##                                model npar      AICc DeltaAICc     weight
## 1                pi(~1)p(~1)c()f0(~1)    3 -83.82288 0.0000000 0.28228499
## 2              pi(~1)p(~1)c(~1)f0(~1)    4 -83.65086 0.1720138 0.25902129
## 8           pi(~1)p(~time)c(~1)f0(~1)   11 -82.54240 1.2804791 0.14881108
## 3          pi(~1)p(~mixture)c()f0(~1)    4 -81.79555 2.0273268 0.10243759
## 4        pi(~1)p(~mixture)c(~1)f0(~1)    5 -81.61662 2.2062598 0.09367087
## 6 pi(~1)p(~mixture + time)c(~1)f0(~1)   12 -80.45871 3.3641668 0.05250108
## 7             pi(~1)p(~time)c()f0(~1)   10 -80.16149 3.6613842 0.04525101
## 5   pi(~1)p(~time + mixture)c()f0(~1)   11 -78.08498 5.7378991 0.01602208
##   Deviance
## 1 50.25967
## 2 48.40436
## 8 35.12580
## 3 50.25967
## 4 48.40436
## 6 35.12580
## 7 39.58321
## 5 39.58321
```

```
names(iguane.results)
```

```
## [1] "p.dot"          "p.dot.behav"    "p.h"            "p.h.behav"
## [5] "p.h.time"       "p.h.time.behav" "p.time"         "p.time.behav"
## [9] "model.table"
```

```
iguane.results$p.dot$results$real
```

```
##                estimate         se        lcl         ucl fixed note
```

```
## pi g1 m1      0.4999461  0.0000000  0.4999461   0.4999461
## p g1 t1 m1    0.0405812  0.0116392  0.0230008   0.0706274
## f0 g1 a0 t1 187.8209200 69.7517780 92.8491990 379.9354200
```

```
iguane.results$p.dot$results$derived
```

```
## $`N Population Size`
##   estimate      lcl      ucl
## 1 261.8209 166.8492 453.9354
```

Nettoyage

On supprime les fichiers temporaires.

```
rm(list = ls(all = TRUE))
cleanup(ask = FALSE)
```