Analysis notes

July 30, 2014

V0.0.2 PN

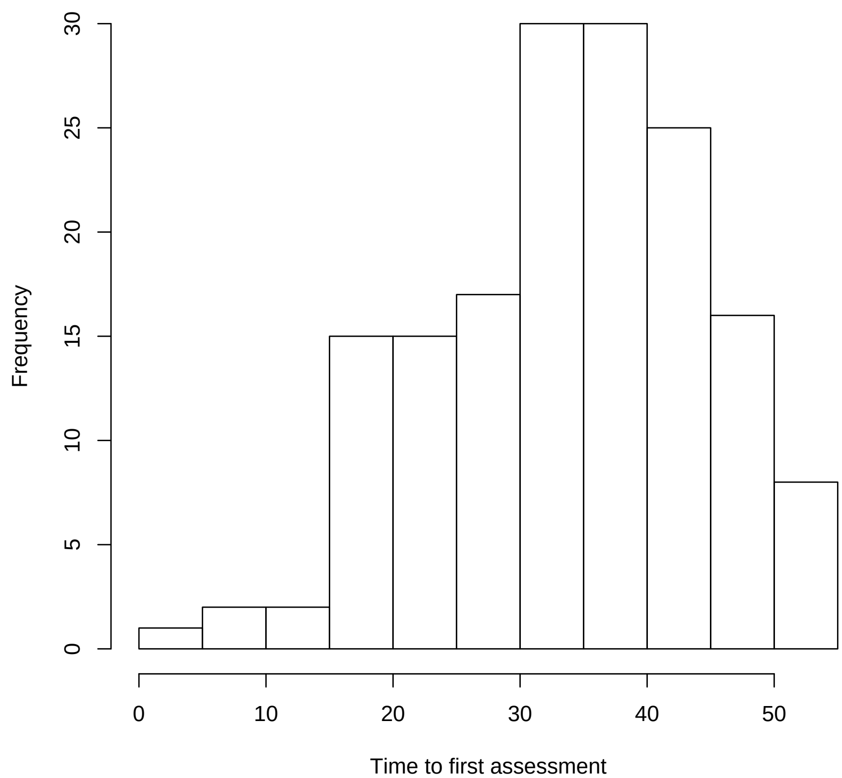
1 Data manupulation

Data were crudely transformed to input, using Mike's suggestions for fishery deveopment year.

```
require(dplyr)

## Loading required package:  dplyr
##
## Attaching package:  'dplyr'
##
## The following objects are masked from 'package:stats':
##
##     filter, lag
##
## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

year.table <- tbl_df(read.csv("~/Work/Dropbox/First year of assessment/V4_Final_dataset.csv"
    na.strings = c("", "NA", "#N/A"), stringsAsFactors = F))

comm.landings <- tbl_df(read.csv("~/Work/Dropbox/First year of assessment/US_comm_landings.c
    na.strings = c("", "NA", "#N/A"), stringsAsFactors = F))




rec.landings <- tbl_df(read.csv("~/Work/Dropbox/First year of assessment/US_rec_landings.csv
    na.strings = c("", "NA", "#N/A"), stringsAsFactors = F))

price <- tbl_df(read.csv("~/Work/Dropbox/First year of assessment/US_price.csv",
    na.strings = c("", "NA", "#N/A"), stringsAsFactors = F))
```

```r
ref.time <- min(year.table$Year.of.first.stock.assessment, na.rm = T) - 1

year.table <- year.table %.% mutate(time = Year.of.first.stock.assessment -
    ref.time, survey.abs = Year.of.first.fishery.indepen.dent.surveys)
```

```r
hist(year.table$time, 10, main = "", xlab = "Time to first assessment")
```



Get covariates from TS; looking at mean and sum @ first assessment for landings.

```r
# convenience
na.fun <- function(f, ...) {
    g <- function(x) f(x, na.rm = T)
}
na.mean <- na.fun(mean)
```

```
na.sum <- na.fun(sum)

## landings --
comm.landings.ts <- comm.landings %.% select(-Stock.name, -Other.comments, -Discards.include
    -Data.source)
comm.landings$mean.landings <- apply(comm.landings.ts, 1, na.mean)

ref.col <- which(colnames(comm.landings.ts) == "X1959")
n.col <- ncol(comm.landings.ts) - ref.col

comm.landings$land.sum <- NA
comm.landings$landings.at.assess <- NA
for (i in 1:nrow(comm.landings)) {
    asses.col <- ref.col + ifelse(!is.na(year.table$time[i]), year.table$time[i],
        n.col)
    comm.landings$land.sum[i] <- na.sum(comm.landings.ts[i, 1:asses.col])
    comm.landings$landings.at.assess[i] <- comm.landings.ts[i, asses.col]
}
```

Same for Rec landings, although I am not sure if these are useable since many rows are NAs.

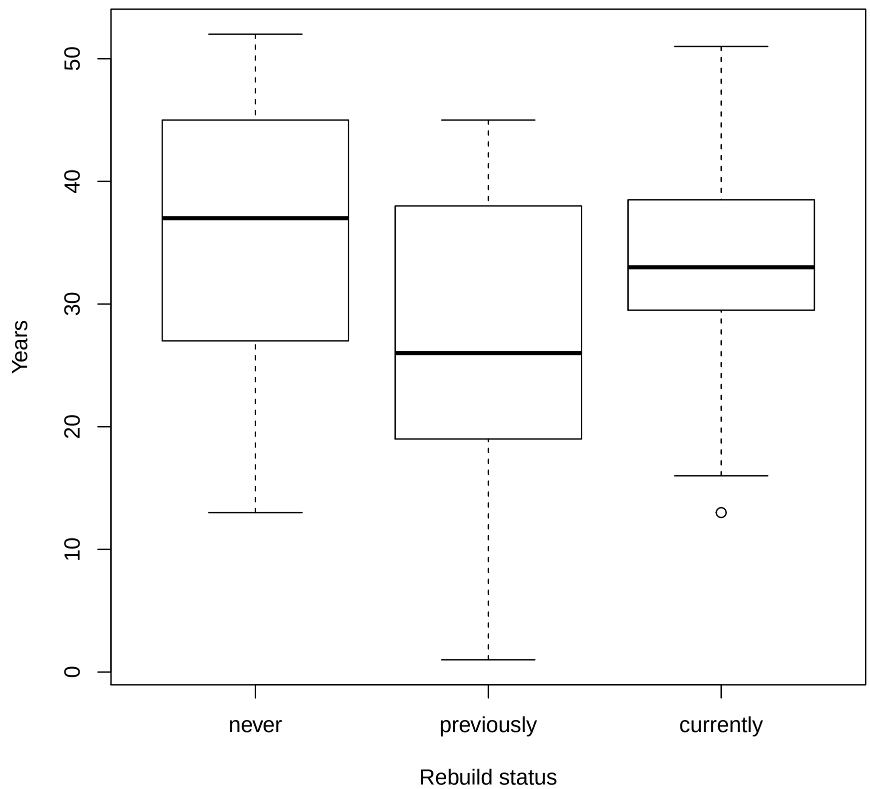
```
## landings --
rec.landings.ts <- rec.landings %.% select(-Stock.name, -Discards.included,
    -Data.source)
rec.landings$mean.landings <- apply(rec.landings.ts, 1, na.mean)
rec.landings$landings.at.assess <- apply(rec.landings.ts, 1, na.mean)

ref.col <- which(colnames(rec.landings.ts) == "X1959")
n.col <- ncol(rec.landings.ts) - ref.col

rec.landings$land.sum <- NA
rec.landings$landings.at.assess <- NA
for (i in 1:nrow(rec.landings)) {
    asses.col <- ref.col + ifelse(!is.na(year.table$time[i]), year.table$time[i],
        n.col)
    rec.landings$land.sum[i] <- na.sum(rec.landings.ts[i, 1:asses.col])
    rec.landings$landings.at.assess[i] <- rec.landings.ts[i, asses.col]
}

rec.landings$land.sum[rec.landings$land.sum == 0] <- NA
```

Same for Price;

```r
## landings --
price.ts <- price %.% select(-Stock.name, -Region.used.for.price.data, -Other.comments)
price$mean.price <- apply(price.ts, 1, na.mean)

ref.col <- which(colnames(price.ts) == "X1959")
n.col <- ncol(price.ts) - ref.col


price$price.sum <- NA
price$price.at.assess <- NA
for (i in 1:nrow(price)) {
    asses.col <- ref.col + ifelse(!is.na(year.table$time[i]), year.table$time[i],
        n.col)
    price$price.sum[i] <- na.sum(price.ts[i, 1:asses.col])
    price$price.at.assess[i] <- price.ts[i, asses.col]
}

price$price.sum[price$price.sum == 0] <- NA
```

```r
year.table$Rebuild <- ordered(year.table$Rebuilding.plan.history, levels = c("never",
    "previously", "currently"))

with(year.table, table(Rebuild))

## Rebuild
##      never previously  currently
##        106         13         25

with(year.table, table(Region))

## Region
## Alaska    USEC    USNE    USSE    USWC
##     51       9      49      34      50

# set north-east as reference treatment
RC <- contr.treatment(levels(factor(year.table$Region)), base = 3)
```

```r
boxplot(time ~ Rebuild, data = year.table, xlab = "Rebuild status", ylab = "Years")
```



2 Simple Bayesian Weibull survival model

Try a Bayesian trunkated Weibull model to keep is simple to start with:

```
# subset to data with price and landings data

model.data <- year.table %>% mutate(price = price$mean.price, landings = comm.landings$mean.
    filter(!is.na(price), !is.na(landings))

# assessment time
a.time <- model.data$time

# true false censoring
censored <- as.numeric(is.na(a.time))
```

```r
# censor time - improve here from the arbitrary 2010 cutoff for censored
# (non-assessed stocks)
ctime <- a.time
ctime[is.na(a.time)] <- 2010 - ref.time

# initial values for censored observations
time.inits <- ctime + 1
time.inits[!is.na(a.time)] <- NA

# habitat and family random effect - note - taxon is half way between
# habitat and family variables, try that too sometime

afs <- function(x) as.numeric(as.factor(x))

hab <- with(model.data, afs(habitat_MM))
n.hab <- length(unique(hab))

fam <- with(model.data, afs(Family))
n.fam <- length(unique(fam))

# fixed effect for regions
region <- data.frame(with(model.data, model.matrix(~Region, contrasts.arg = list(Region = RO
#

# Covariate dataframe
covs <- model.data %.% select(Lmax..cm., TL, Recreational.pc.catch, Year.of.fishery.developm
    price, landings)

# replace TL for CA spiny lobster with something approximate for now since I
# can't find a good value
covs$TL[is.na(covs$TL)] <- 3.2

# scale covariates for comparison
sc.covs <- data.frame(apply(covs, 2, function(x) (x - mean(x))/(2 * sd(x))))
COVS <- cbind(region, sc.covs)
n.covs <- ncol(COVS)
n.stocks <- nrow(COVS)
```

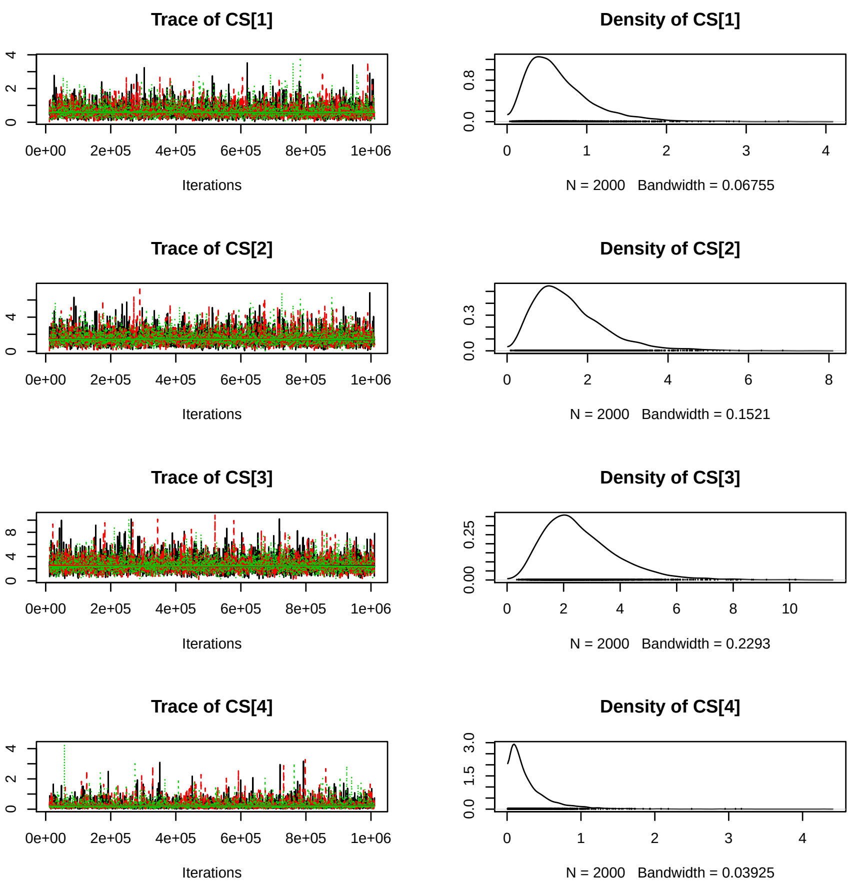
```r
# set up jags model

require(rjags)

## Loading required package:  rjags
## Loading required package:  coda
## Loading required package:  lattice
```

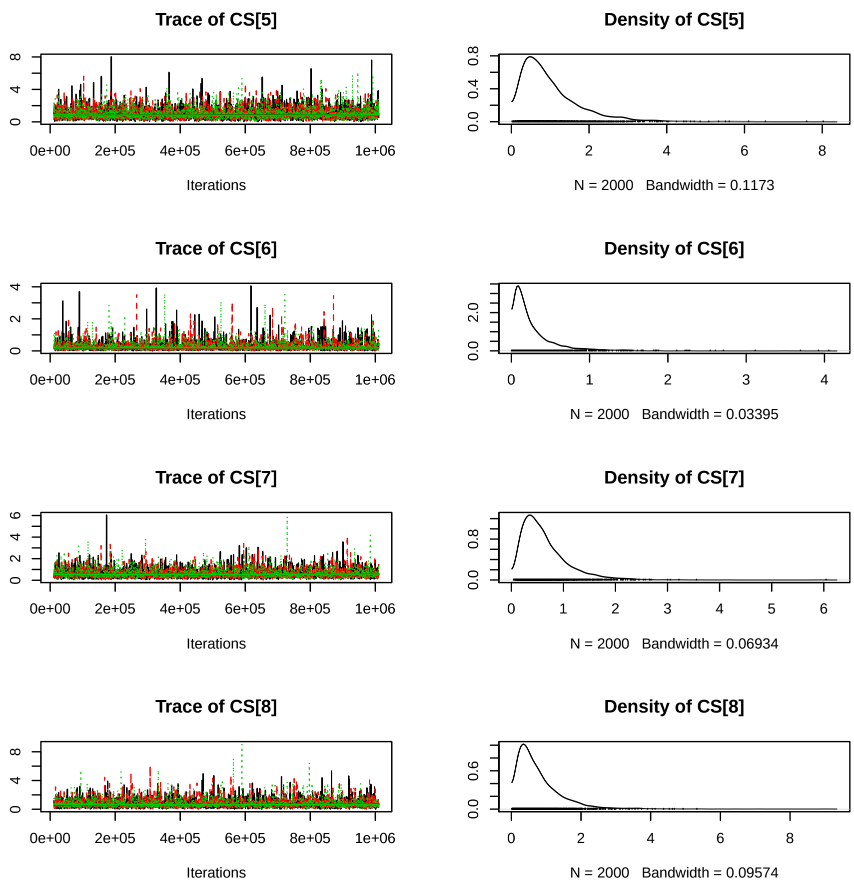
```
## Linked to JAGS 3.3.0
## Loaded modules:  basemod,bugs
```

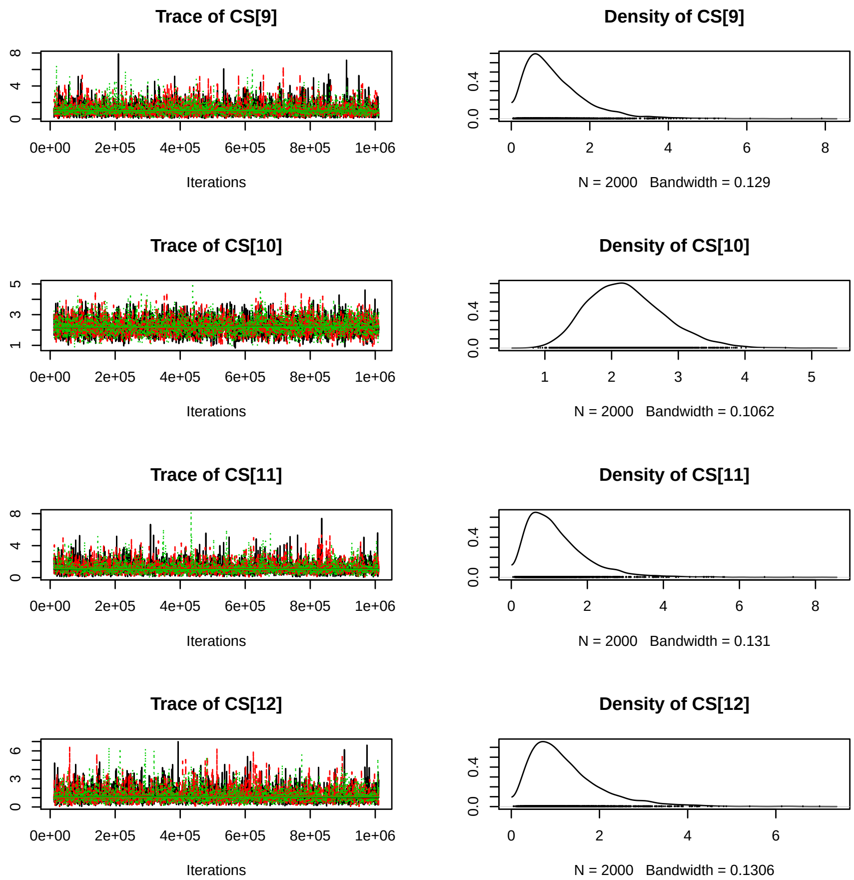
```
jags.data <- list(COVS = COVS, n.covs = n.covs, n.stocks = n.stocks, hab = hab,
    fam = fam, n.hab = n.hab, n.fam = n.fam, ctime = ctime, a.time = a.time,
    censored = censored)

# run model - short run for now...
JM <- jags.model("Weib_surv.R", inits = list(a.time = time.inits), data = jags.data,
    n.chains = 3)
```

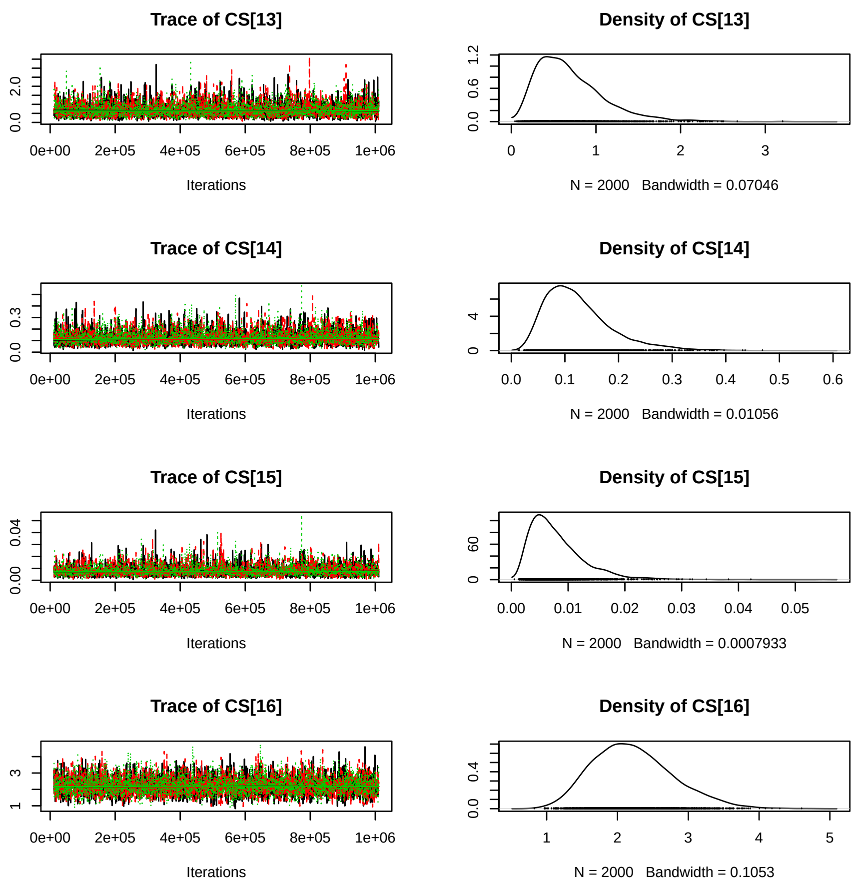
```
update(JM, n.iter = 10000)

a.out <- coda.samples(JM, variable.names = c("betas", "habitat", "fp.var", "CS"),
    n.iter = 1e+06, thin = 500)
```

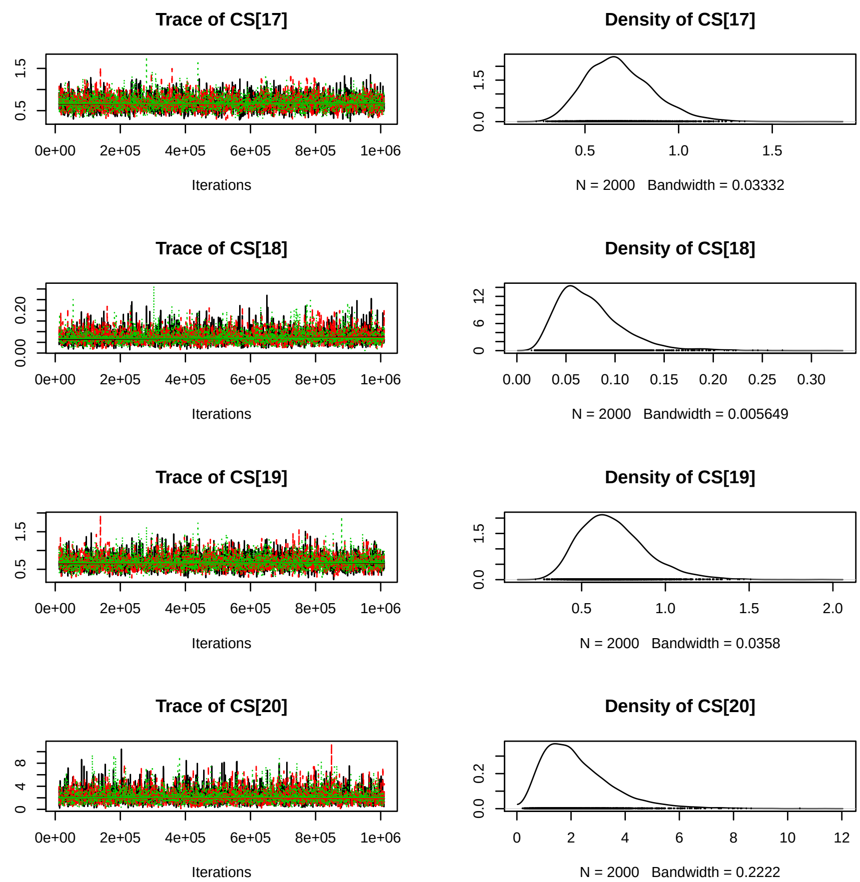
```
plot(a.out)
```

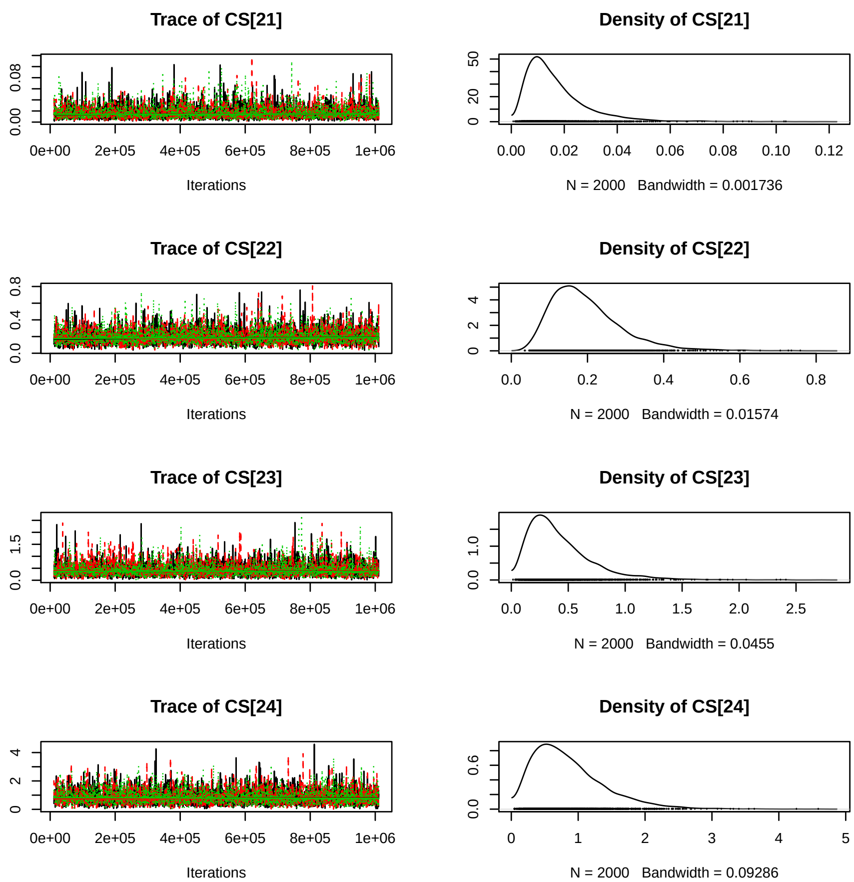

Trace of CS[1]
Iterations
Density of CS[1]
N = 2000 Bandwidth = 0.06755
Trace of CS[2]
Iterations
Density of CS[2]
N = 2000 Bandwidth = 0.1521
Trace of CS[3]
Iterations
Density of CS[3]
N = 2000 Bandwidth = 0.2293
Trace of CS[4]
Iterations
Density of CS[4]
N = 2000 Bandwidth = 0.03925

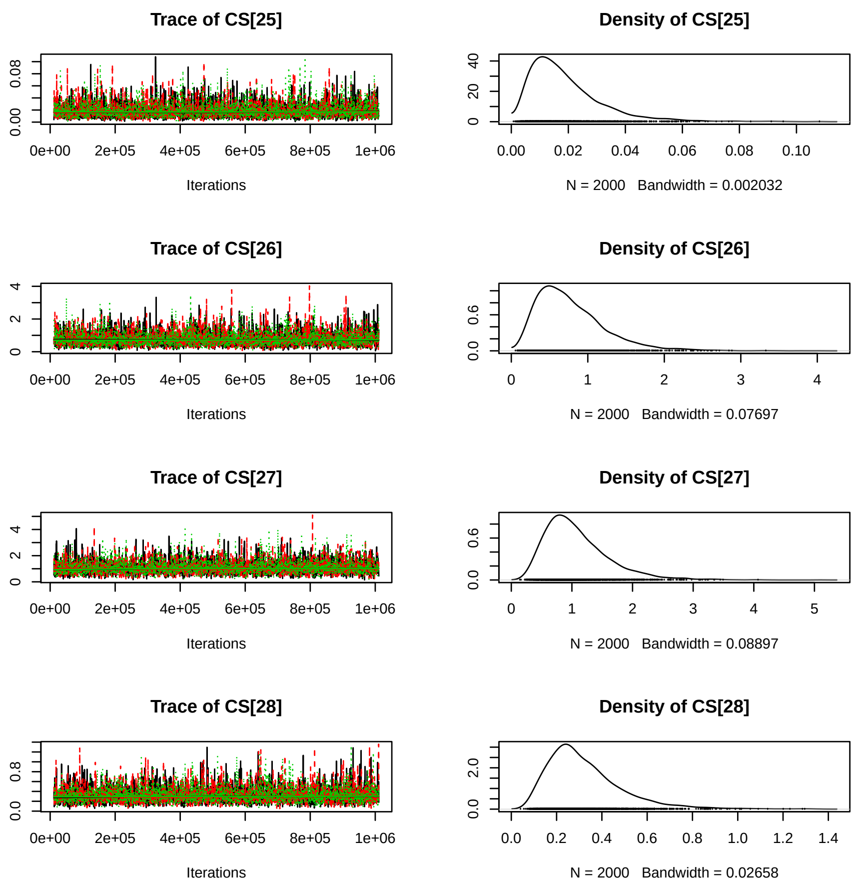

Trace of CS[5]
Iterations
Density of CS[5]
N = 2000 Bandwidth = 0.1173
Trace of CS[6]
Iterations
Density of CS[6]
N = 2000 Bandwidth = 0.03395
Trace of CS[7]
Iterations
Density of CS[7]
N = 2000 Bandwidth = 0.06934
Trace of CS[8]
Iterations
Density of CS[8]
N = 2000 Bandwidth = 0.09574

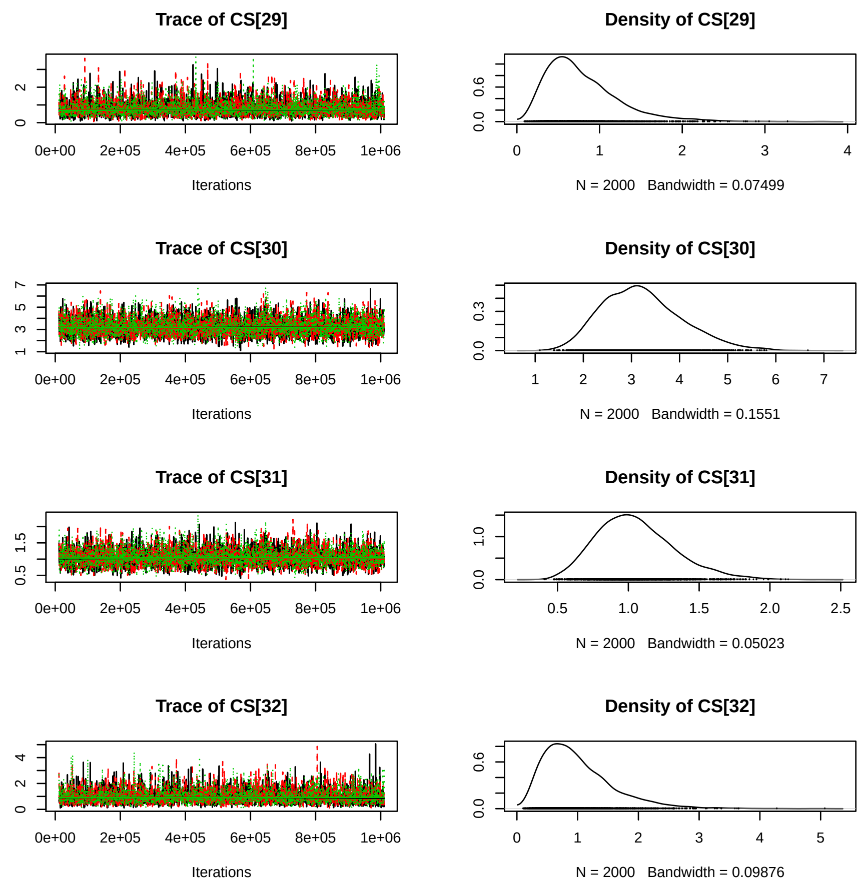

Trace of CS[9]
Iterations
Density of CS[9]
N = 2000 Bandwidth = 0.129
Trace of CS[10]
Iterations
Density of CS[10]
N = 2000 Bandwidth = 0.1062
Trace of CS[11]
Iterations
Density of CS[11]
N = 2000 Bandwidth = 0.131
Trace of CS[12]
Iterations
Density of CS[12]
N = 2000 Bandwidth = 0.1306

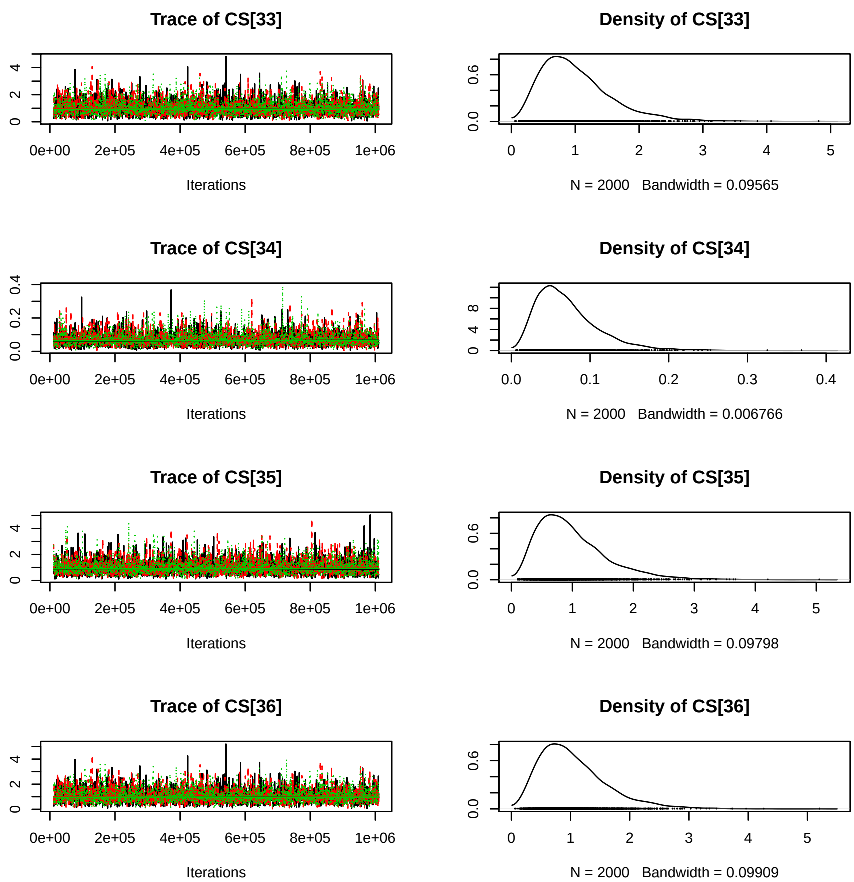

Trace of CS[13]
Iterations
Density of CS[13]
N = 2000 Bandwidth = 0.07046
Trace of CS[14]
Iterations
Density of CS[14]
N = 2000 Bandwidth = 0.01056
Trace of CS[15]
Iterations
Density of CS[15]
N = 2000 Bandwidth = 0.0007933
Trace of CS[16]
Iterations
Density of CS[16]
N = 2000 Bandwidth = 0.1053


Trace of CS[17]
Iterations
Density of CS[17]
N = 2000 Bandwidth = 0.03332
Trace of CS[18]
Iterations
Density of CS[18]
N = 2000 Bandwidth = 0.005649
Trace of CS[19]
Iterations
Density of CS[19]
N = 2000 Bandwidth = 0.0358
Trace of CS[20]
Iterations
Density of CS[20]
N = 2000 Bandwidth = 0.2222

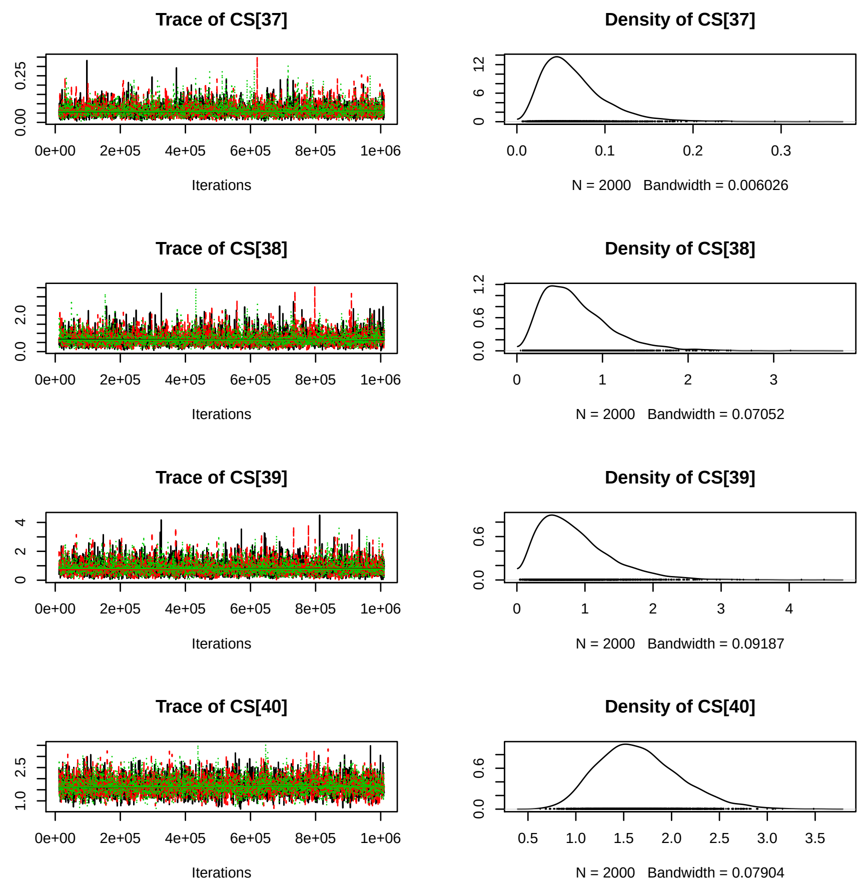

Trace of CS[21]
0.00
0.08
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[21]
0
20
50
0.00
0.02
0.04
0.06
0.08
0.10
0.12
N = 2000 Bandwidth = 0.001736
Trace of CS[22]
0.0
0.4
0.8
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[22]
0
2
4
0.0
0.2
0.4
0.6
0.8
N = 2000 Bandwidth = 0.01574
Trace of CS[23]
0.0
1.5
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[23]
0.0
1.0
0.0
0.5
1.0
1.5
2.0
2.5
N = 2000 Bandwidth = 0.0455
Trace of CS[24]
0
2
4
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[24]
0.0
0.6
0
1
2
3
4
5
N = 2000 Bandwidth = 0.09286

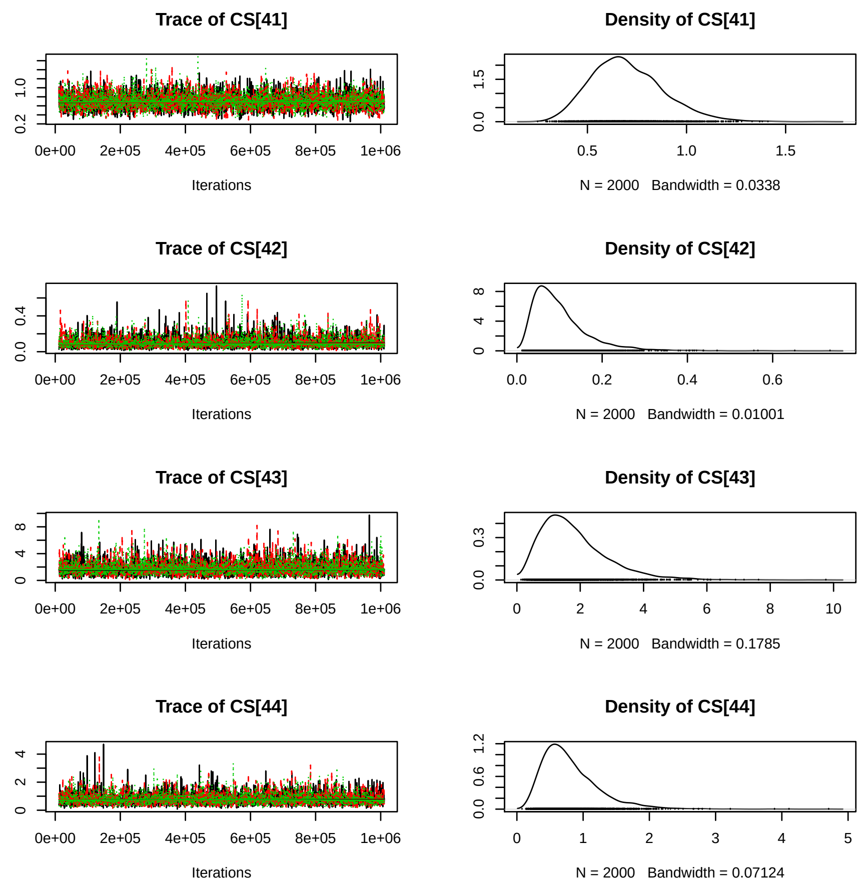

Trace of CS[25]
0.00
0.08
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[25]
0
20
40
0.00
0.02
0.04
0.06
0.08
0.10
N = 2000 Bandwidth = 0.002032
Trace of CS[26]
0
2
4
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[26]
0.0
0.6
0
1
2
3
4
N = 2000 Bandwidth = 0.07697
Trace of CS[27]
0
2
4
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[27]
0.0
0.6
0
1
2
3
4
5
N = 2000 Bandwidth = 0.08897
Trace of CS[28]
0.0
0.8
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[28]
0.0
2.0
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
N = 2000 Bandwidth = 0.02658

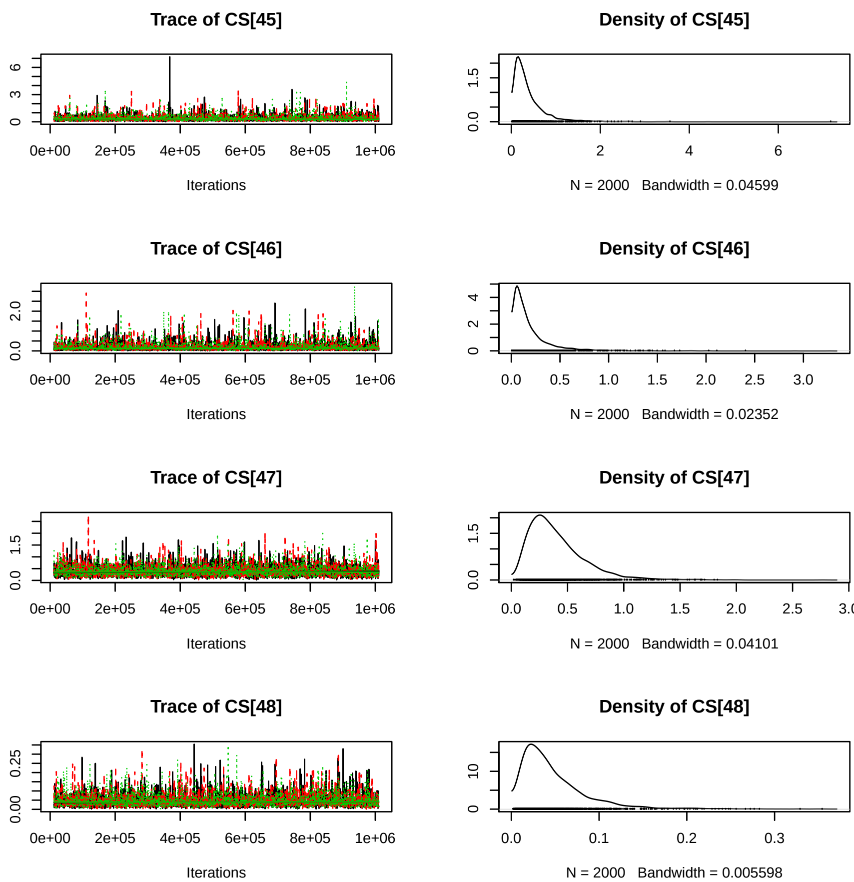

Trace of CS[29]
Density of CS[29]
Iterations
N = 2000 Bandwidth = 0.07499
Trace of CS[30]
Density of CS[30]
Iterations
N = 2000 Bandwidth = 0.1551
Trace of CS[31]
Density of CS[31]
Iterations
N = 2000 Bandwidth = 0.05023
Trace of CS[32]
Density of CS[32]
Iterations
N = 2000 Bandwidth = 0.09876

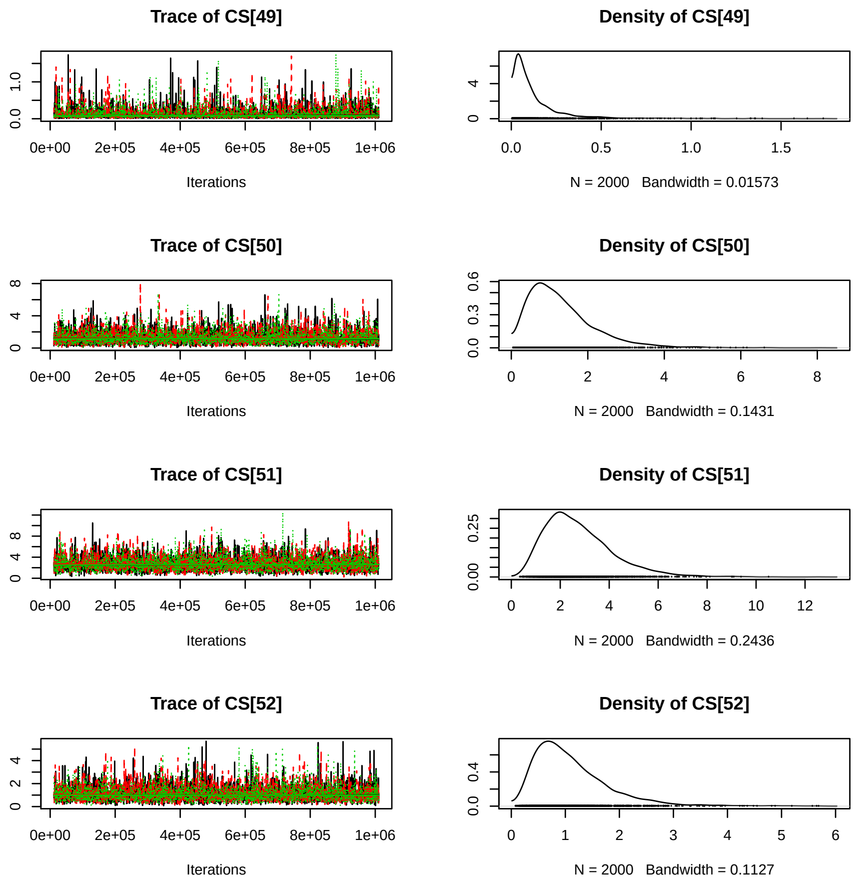


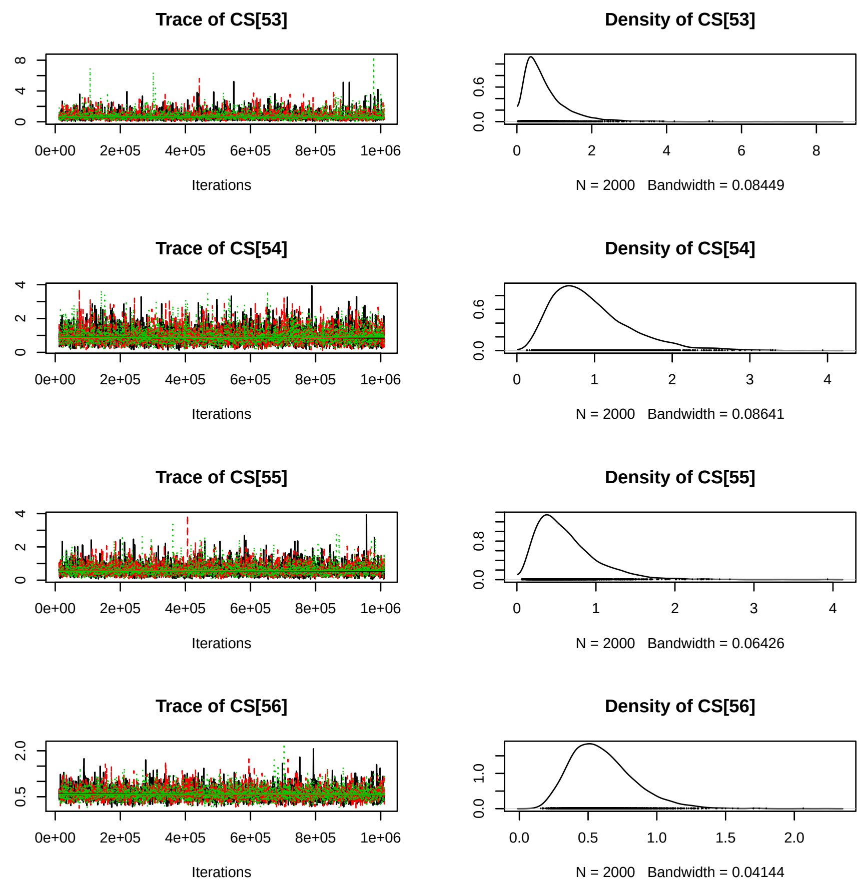
Trace of CS[33]
Iterations
Density of CS[33]
N = 2000 Bandwidth = 0.09565
Trace of CS[34]
Iterations
Density of CS[34]
N = 2000 Bandwidth = 0.006766
Trace of CS[35]
Iterations
Density of CS[35]
N = 2000 Bandwidth = 0.09798
Trace of CS[36]
Iterations
Density of CS[36]
N = 2000 Bandwidth = 0.09909

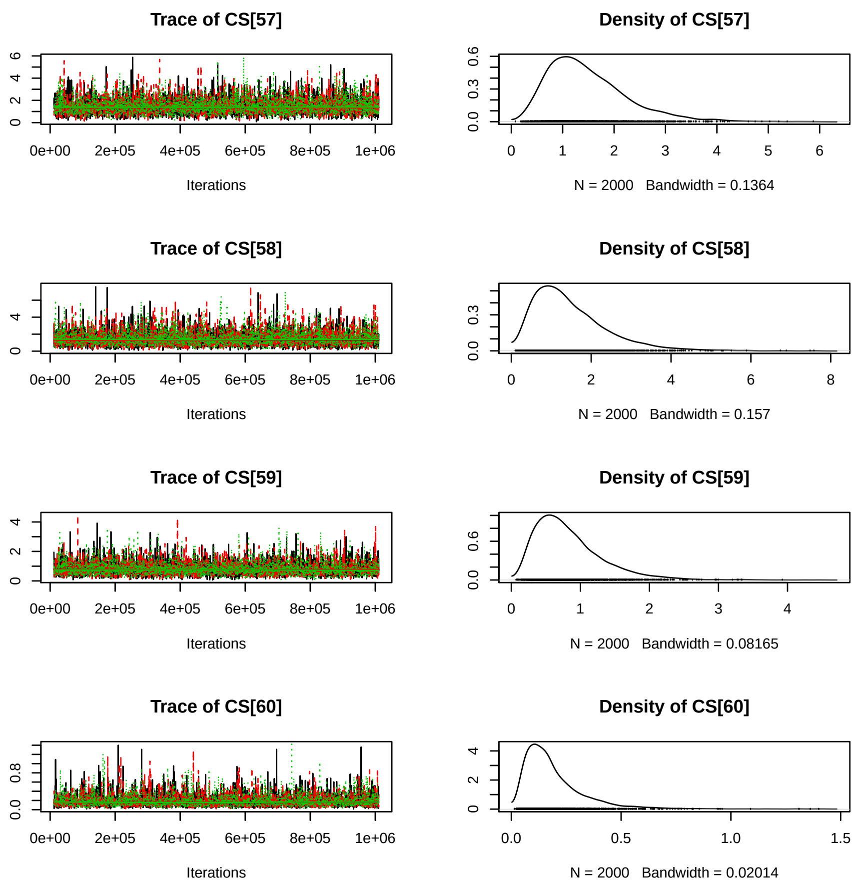

Trace of CS[37]
Density of CS[37]
Iterations
N = 2000   Bandwidth = 0.006026
Trace of CS[38]
Density of CS[38]
Iterations
N = 2000   Bandwidth = 0.07052
Trace of CS[39]
Density of CS[39]
Iterations
N = 2000   Bandwidth = 0.09187
Trace of CS[40]
Density of CS[40]
Iterations
N = 2000   Bandwidth = 0.07904

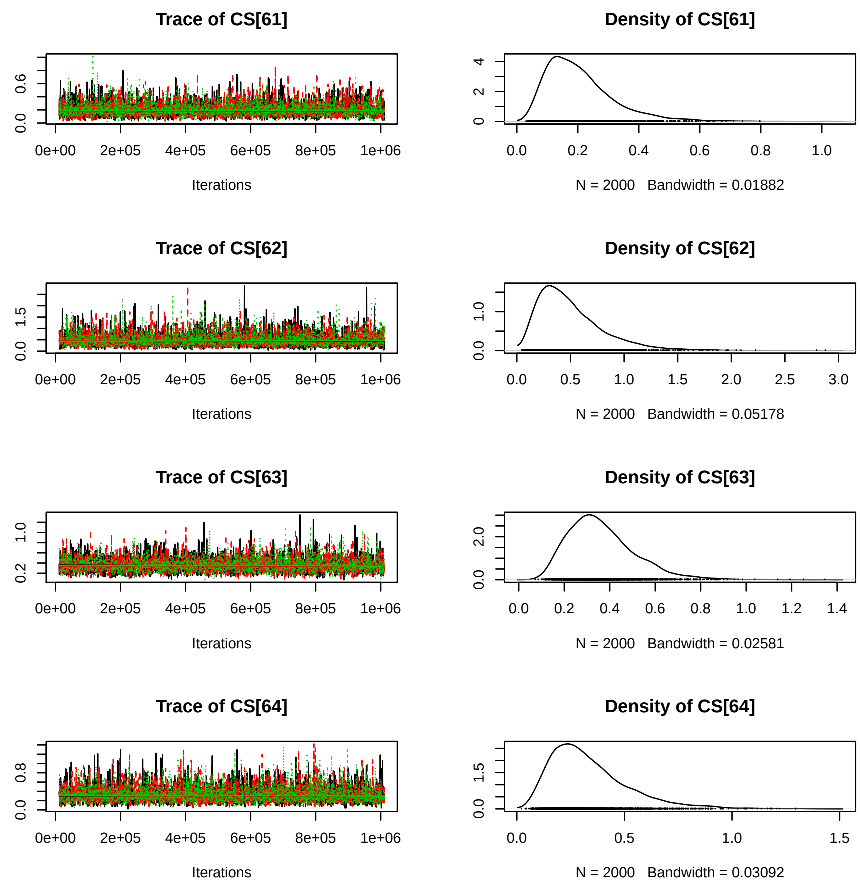

Trace of CS[41]
Iterations
Density of CS[41]
N = 2000 Bandwidth = 0.0338
Trace of CS[42]
Iterations
Density of CS[42]
N = 2000 Bandwidth = 0.01001
Trace of CS[43]
Iterations
Density of CS[43]
N = 2000 Bandwidth = 0.1785
Trace of CS[44]
Iterations
Density of CS[44]
N = 2000 Bandwidth = 0.07124

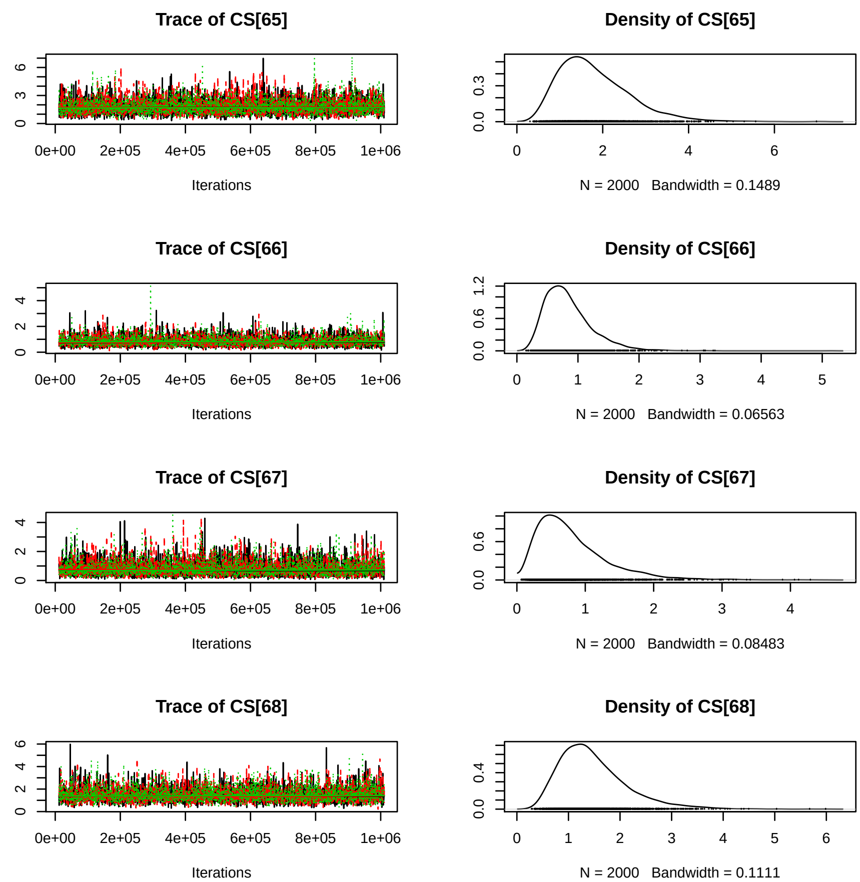

Trace of CS[45]
Density of CS[45]
N = 2000 Bandwidth = 0.04599
Trace of CS[46]
Density of CS[46]
N = 2000 Bandwidth = 0.02352
Trace of CS[47]
Density of CS[47]
N = 2000 Bandwidth = 0.04101
Trace of CS[48]
Density of CS[48]
N = 2000 Bandwidth = 0.005598
Iterations
0e+00 2e+05 4e+05 6e+05 8e+05 1e+06

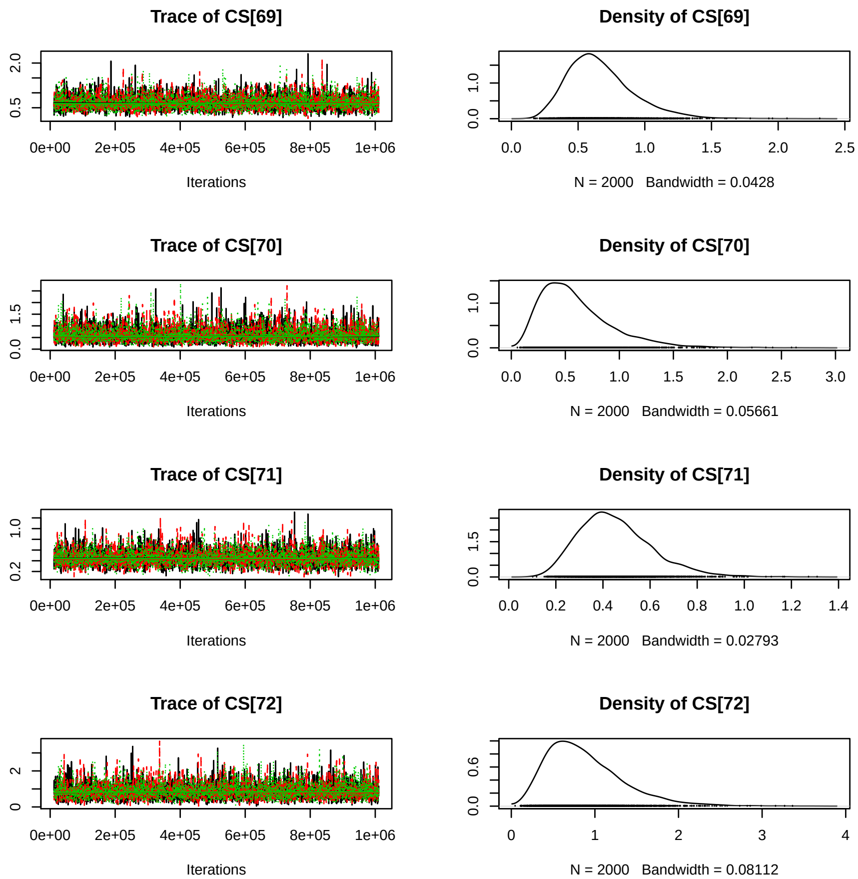

Trace of CS[49]
Iterations
Density of CS[49]
N = 2000 Bandwidth = 0.01573
Trace of CS[50]
Iterations
Density of CS[50]
N = 2000 Bandwidth = 0.1431
Trace of CS[51]
Iterations
Density of CS[51]
N = 2000 Bandwidth = 0.2436
Trace of CS[52]
Iterations
Density of CS[52]
N = 2000 Bandwidth = 0.1127

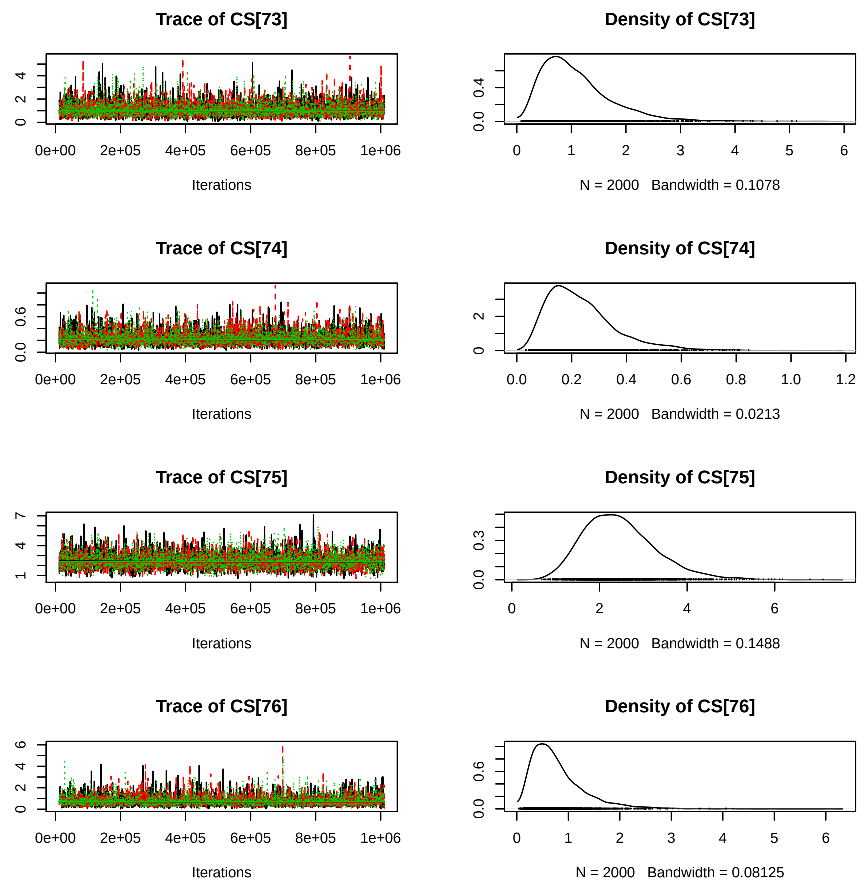

Trace of CS[53]
Iterations
Density of CS[53]
N = 2000 Bandwidth = 0.08449
Trace of CS[54]
Iterations
Density of CS[54]
N = 2000 Bandwidth = 0.08641
Trace of CS[55]
Iterations
Density of CS[55]
N = 2000 Bandwidth = 0.06426
Trace of CS[56]
Iterations
Density of CS[56]
N = 2000 Bandwidth = 0.04144

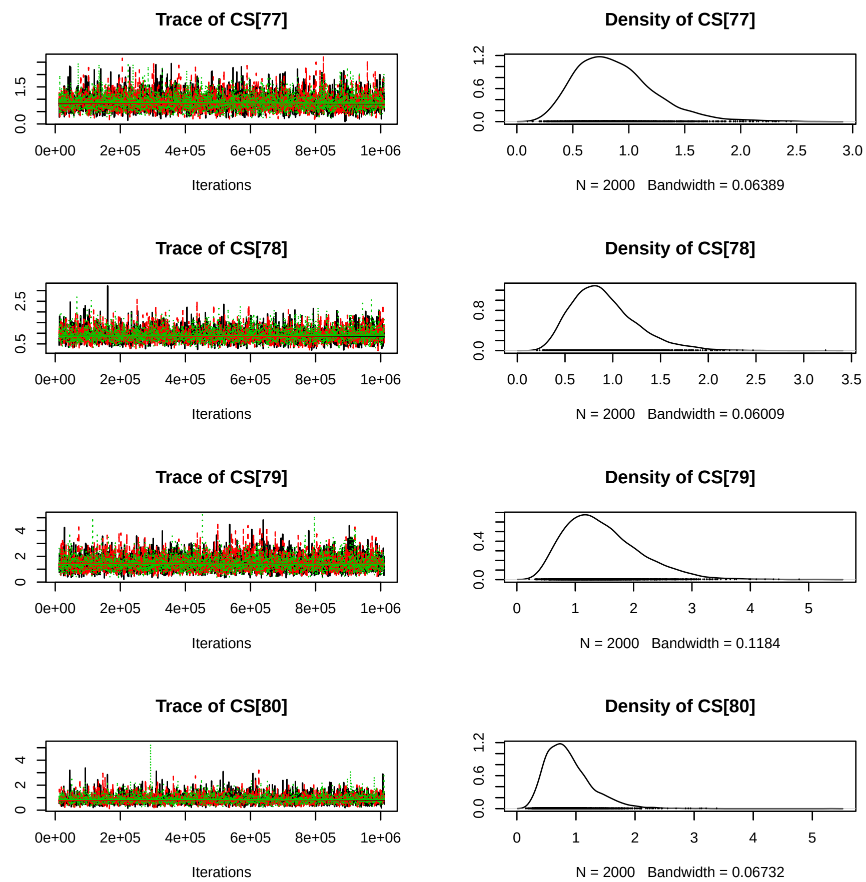

Trace of CS[57]
Iterations
Density of CS[57]
N = 2000 Bandwidth = 0.1364
Trace of CS[58]
Iterations
Density of CS[58]
N = 2000 Bandwidth = 0.157
Trace of CS[59]
Iterations
Density of CS[59]
N = 2000 Bandwidth = 0.08165
Trace of CS[60]
Iterations
Density of CS[60]
N = 2000 Bandwidth = 0.02014

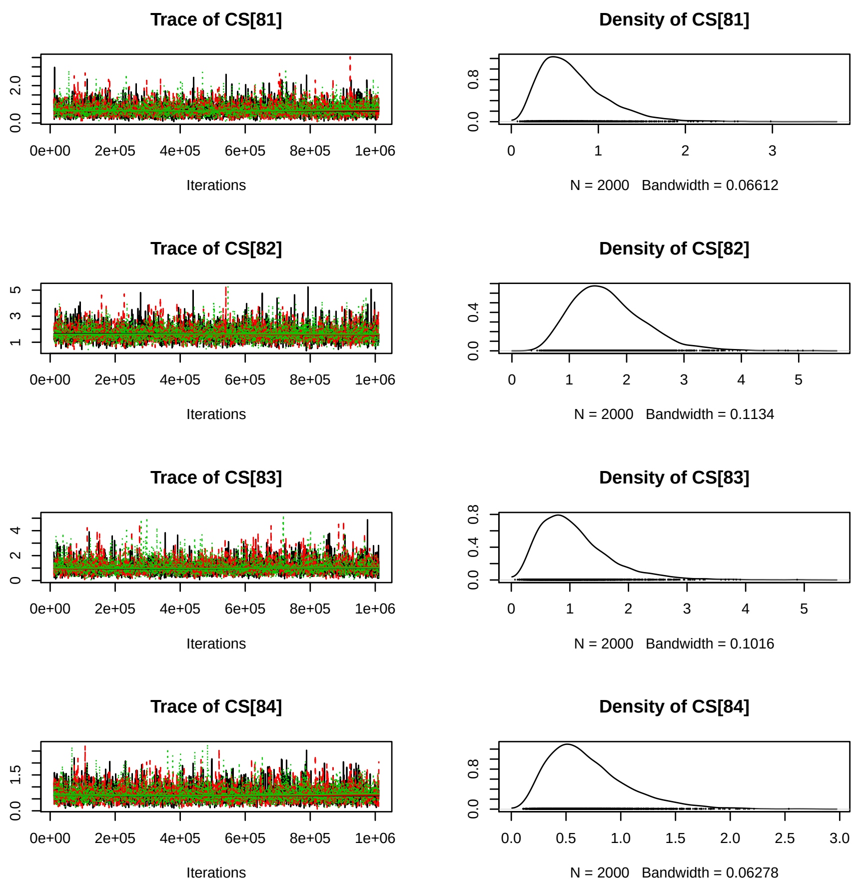

Trace of CS[61]
Iterations
Density of CS[61]
N = 2000   Bandwidth = 0.01882
Trace of CS[62]
Iterations
Density of CS[62]
N = 2000   Bandwidth = 0.05178
Trace of CS[63]
Iterations
Density of CS[63]
N = 2000   Bandwidth = 0.02581
Trace of CS[64]
Iterations
Density of CS[64]
N = 2000   Bandwidth = 0.03092

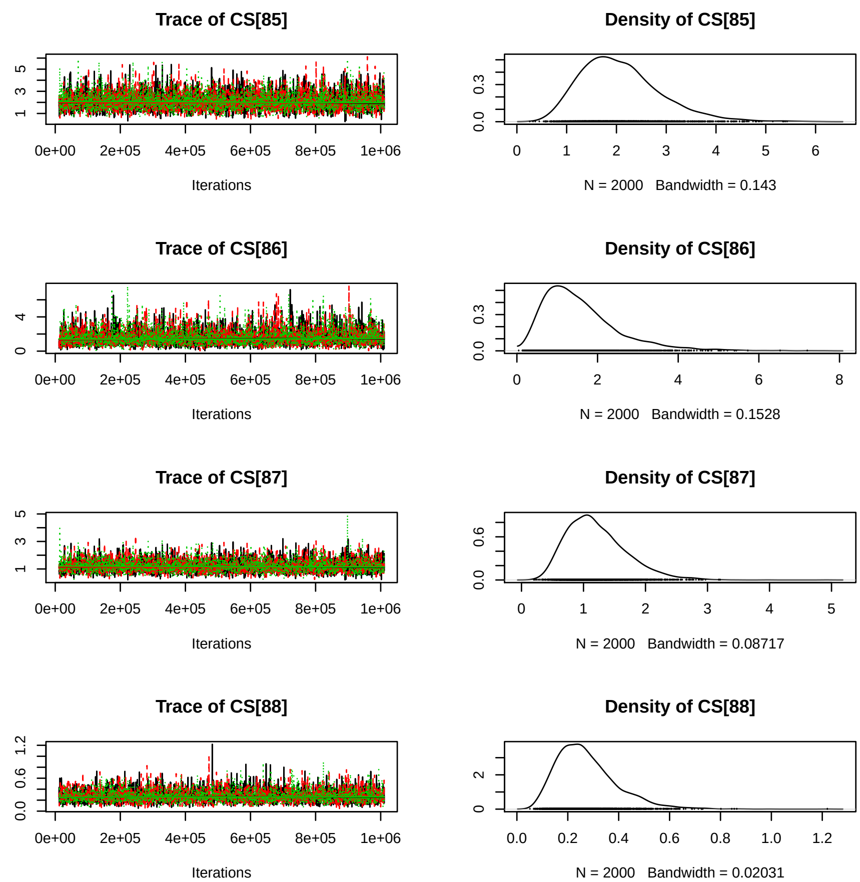

Trace of CS[65]
Iterations
Density of CS[65]
N = 2000 Bandwidth = 0.1489
Trace of CS[66]
Iterations
Density of CS[66]
N = 2000 Bandwidth = 0.06563
Trace of CS[67]
Iterations
Density of CS[67]
N = 2000 Bandwidth = 0.08483
Trace of CS[68]
Iterations
Density of CS[68]
N = 2000 Bandwidth = 0.1111


Trace of CS[69]
Iterations
Density of CS[69]
N = 2000 Bandwidth = 0.0428
Trace of CS[70]
Iterations
Density of CS[70]
N = 2000 Bandwidth = 0.05661
Trace of CS[71]
Iterations
Density of CS[71]
N = 2000 Bandwidth = 0.02793
Trace of CS[72]
Iterations
Density of CS[72]
N = 2000 Bandwidth = 0.08112

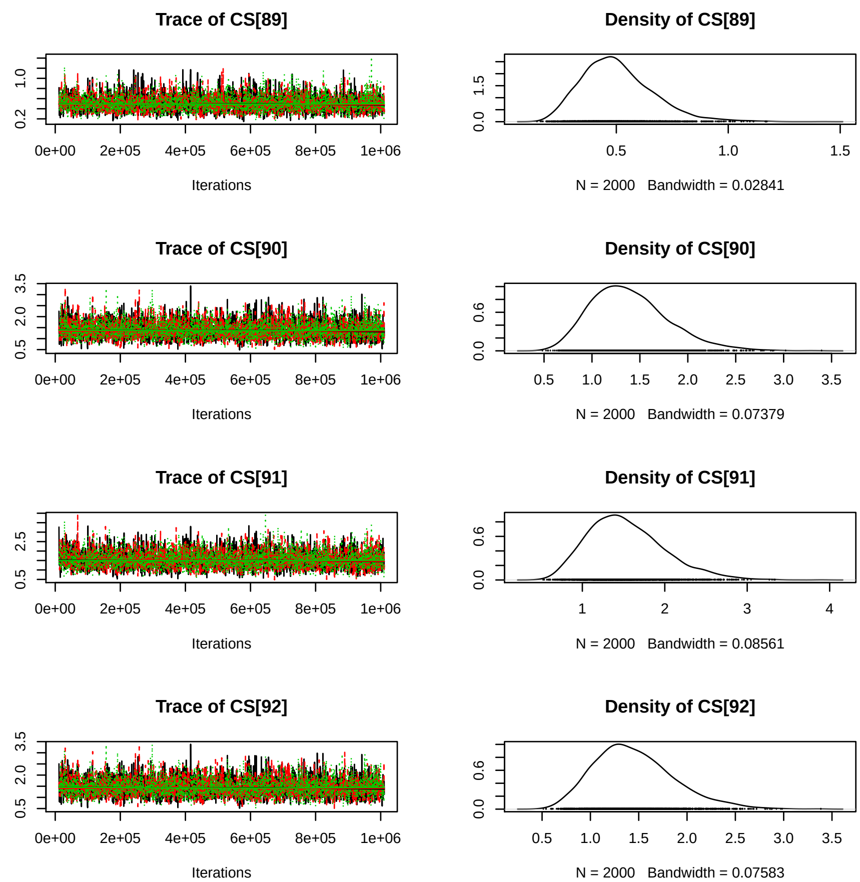

Trace of CS[73]
Iterations
Density of CS[73]
N = 2000 Bandwidth = 0.1078
Trace of CS[74]
Iterations
Density of CS[74]
N = 2000 Bandwidth = 0.0213
Trace of CS[75]
Iterations
Density of CS[75]
N = 2000 Bandwidth = 0.1488
Trace of CS[76]
Iterations
Density of CS[76]
N = 2000 Bandwidth = 0.08125

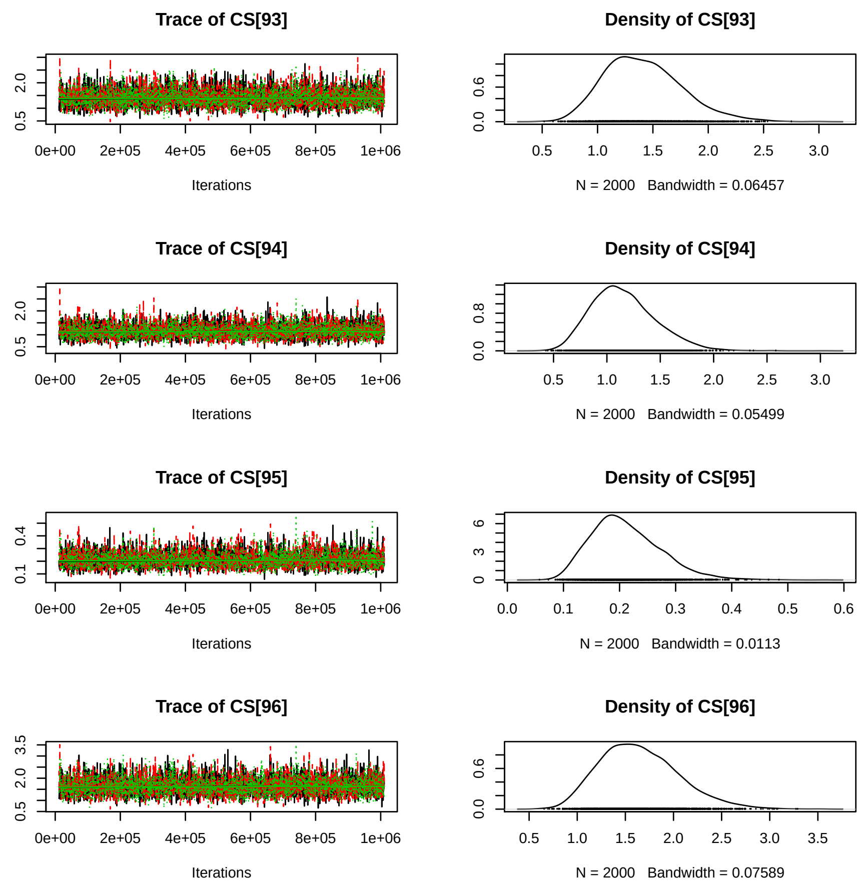

Trace of CS[77]
Iterations
Density of CS[77]
N = 2000 Bandwidth = 0.06389
Trace of CS[78]
Iterations
Density of CS[78]
N = 2000 Bandwidth = 0.06009
Trace of CS[79]
Iterations
Density of CS[79]
N = 2000 Bandwidth = 0.1184
Trace of CS[80]
Iterations
Density of CS[80]
N = 2000 Bandwidth = 0.06732

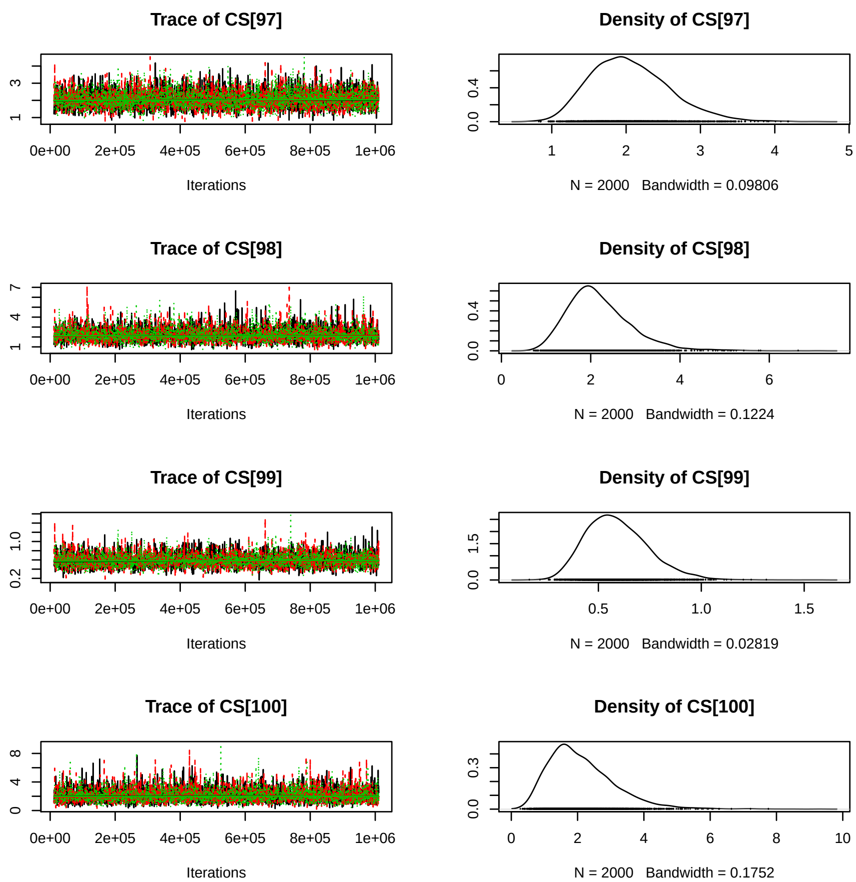

Trace of CS[81]
Iterations
Density of CS[81]
N = 2000 Bandwidth = 0.06612
Trace of CS[82]
Iterations
Density of CS[82]
N = 2000 Bandwidth = 0.1134
Trace of CS[83]
Iterations
Density of CS[83]
N = 2000 Bandwidth = 0.1016
Trace of CS[84]
Iterations
Density of CS[84]
N = 2000 Bandwidth = 0.06278

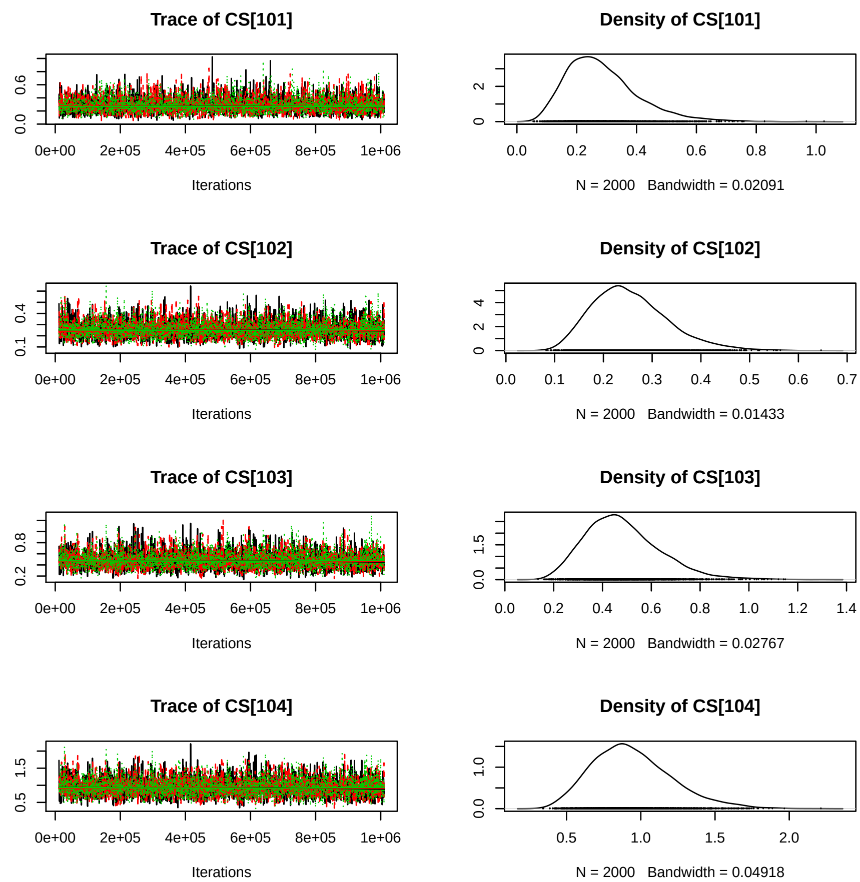


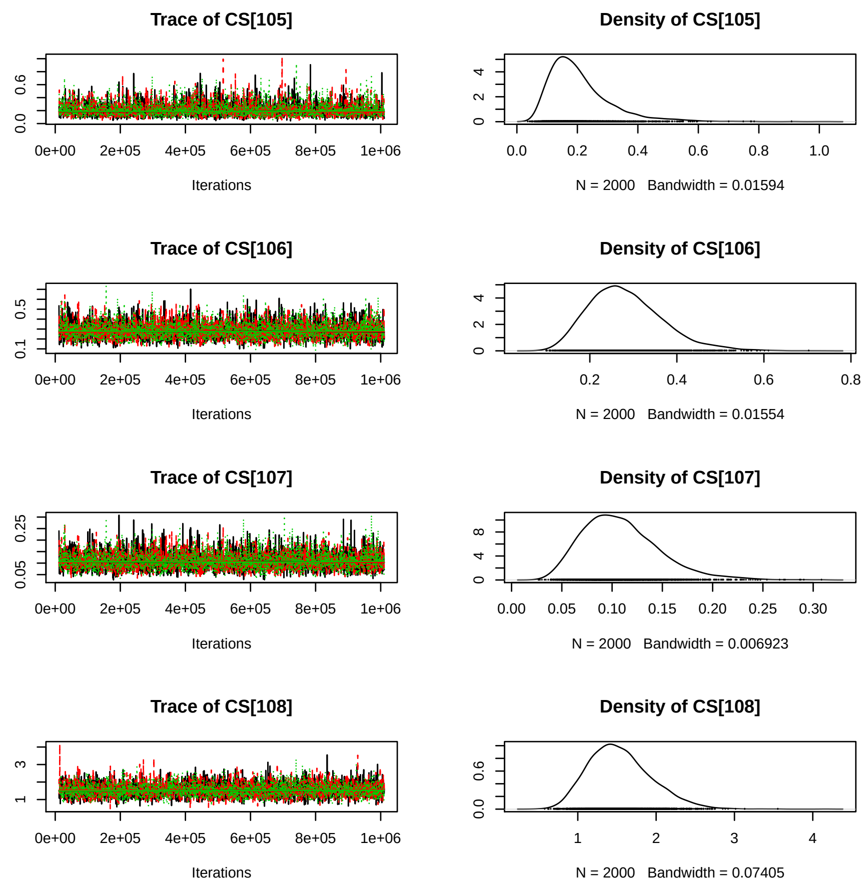
Trace of CS[85]
Iterations
Density of CS[85]
N = 2000 Bandwidth = 0.143
Trace of CS[86]
Iterations
Density of CS[86]
N = 2000 Bandwidth = 0.1528
Trace of CS[87]
Iterations
Density of CS[87]
N = 2000 Bandwidth = 0.08717
Trace of CS[88]
Iterations
Density of CS[88]
N = 2000 Bandwidth = 0.02031

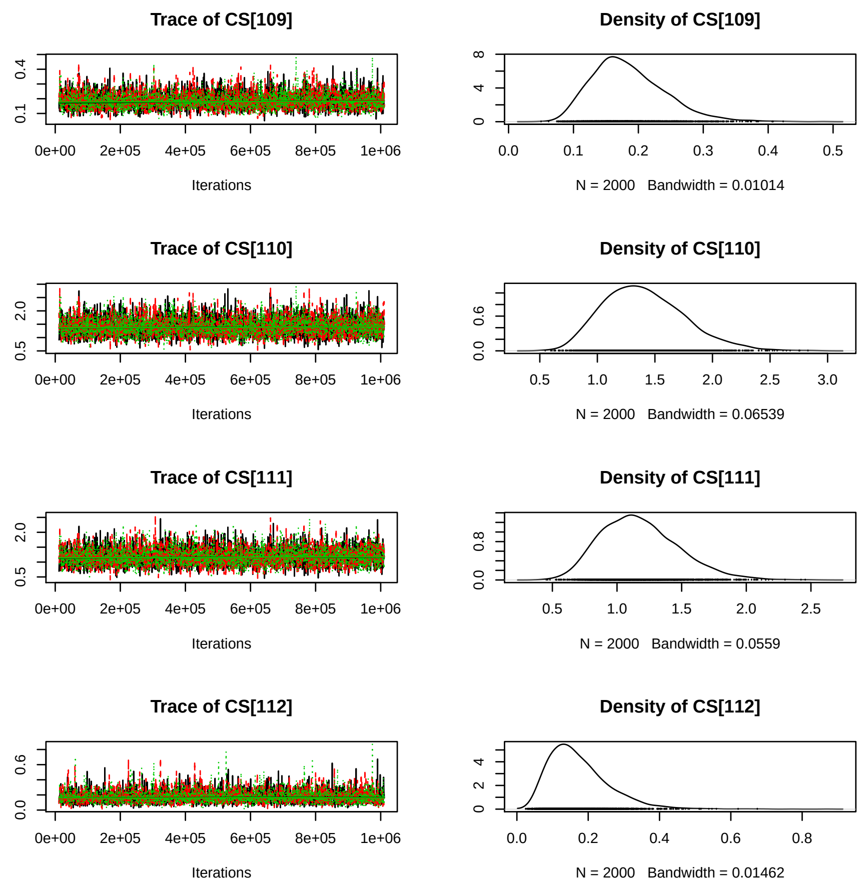

Trace of CS[89]
Density of CS[89]
Iterations
N = 2000 Bandwidth = 0.02841
Trace of CS[90]
Density of CS[90]
Iterations
N = 2000 Bandwidth = 0.07379
Trace of CS[91]
Density of CS[91]
Iterations
N = 2000 Bandwidth = 0.08561
Trace of CS[92]
Density of CS[92]
Iterations
N = 2000 Bandwidth = 0.07583

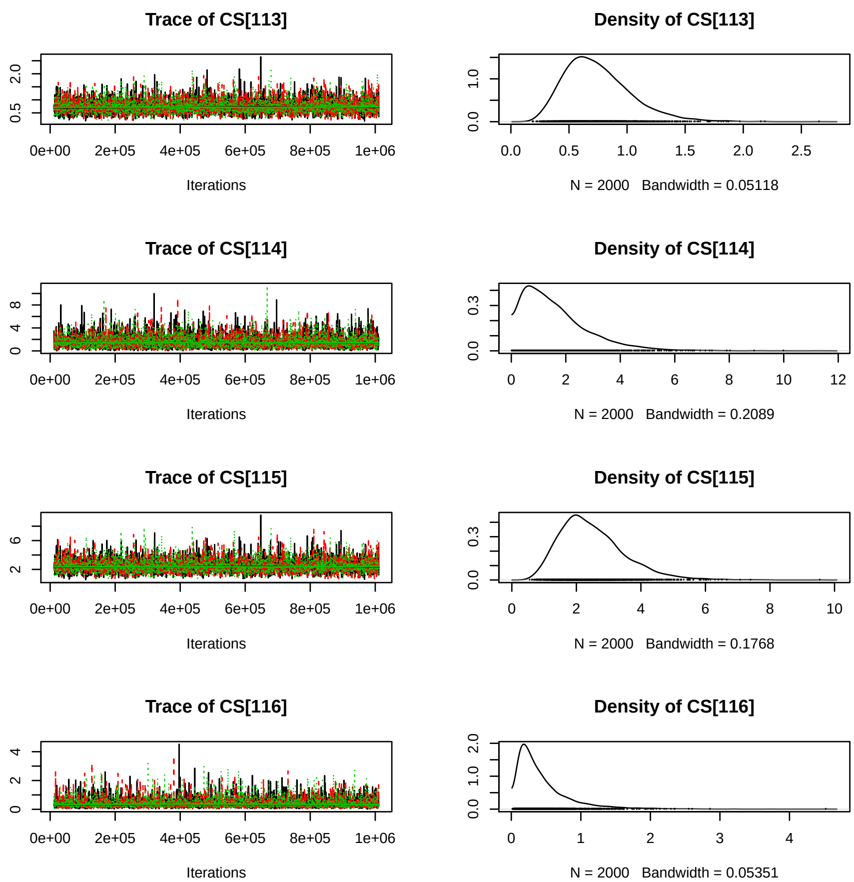

Trace of CS[93]
Density of CS[93]
Iterations
N = 2000 Bandwidth = 0.06457
Trace of CS[94]
Density of CS[94]
Iterations
N = 2000 Bandwidth = 0.05499
Trace of CS[95]
Density of CS[95]
Iterations
N = 2000 Bandwidth = 0.0113
Trace of CS[96]
Density of CS[96]
Iterations
N = 2000 Bandwidth = 0.07589

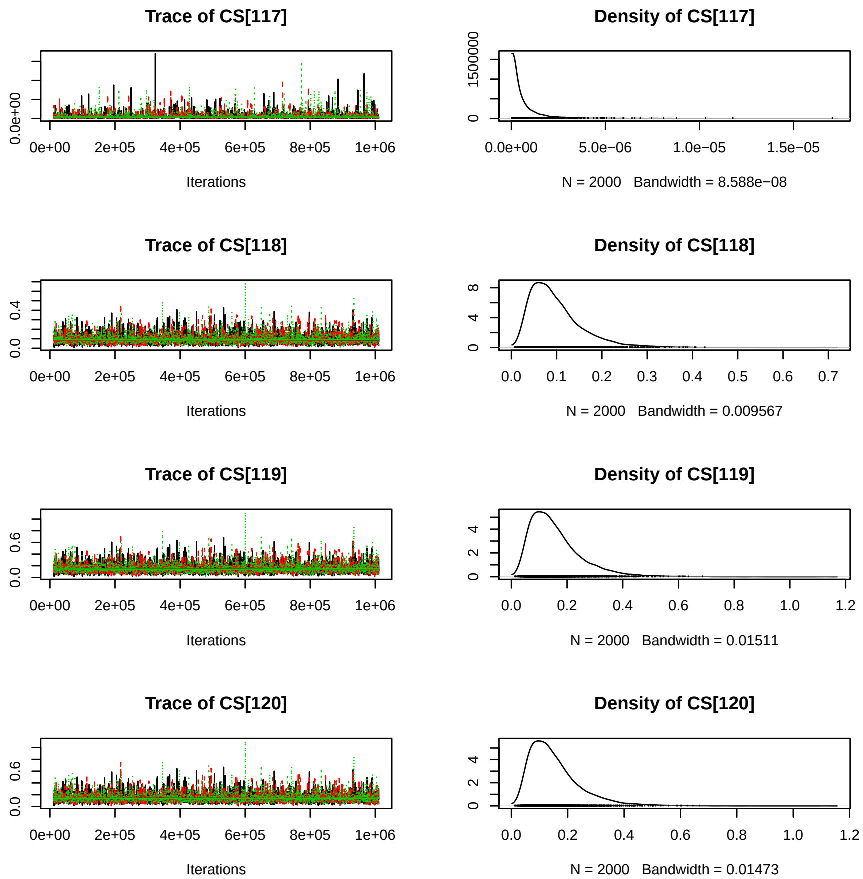

Trace of CS[97]
Iterations
Density of CS[97]
N = 2000 Bandwidth = 0.09806
Trace of CS[98]
Iterations
Density of CS[98]
N = 2000 Bandwidth = 0.1224
Trace of CS[99]
Iterations
Density of CS[99]
N = 2000 Bandwidth = 0.02819
Trace of CS[100]
Iterations
Density of CS[100]
N = 2000 Bandwidth = 0.1752

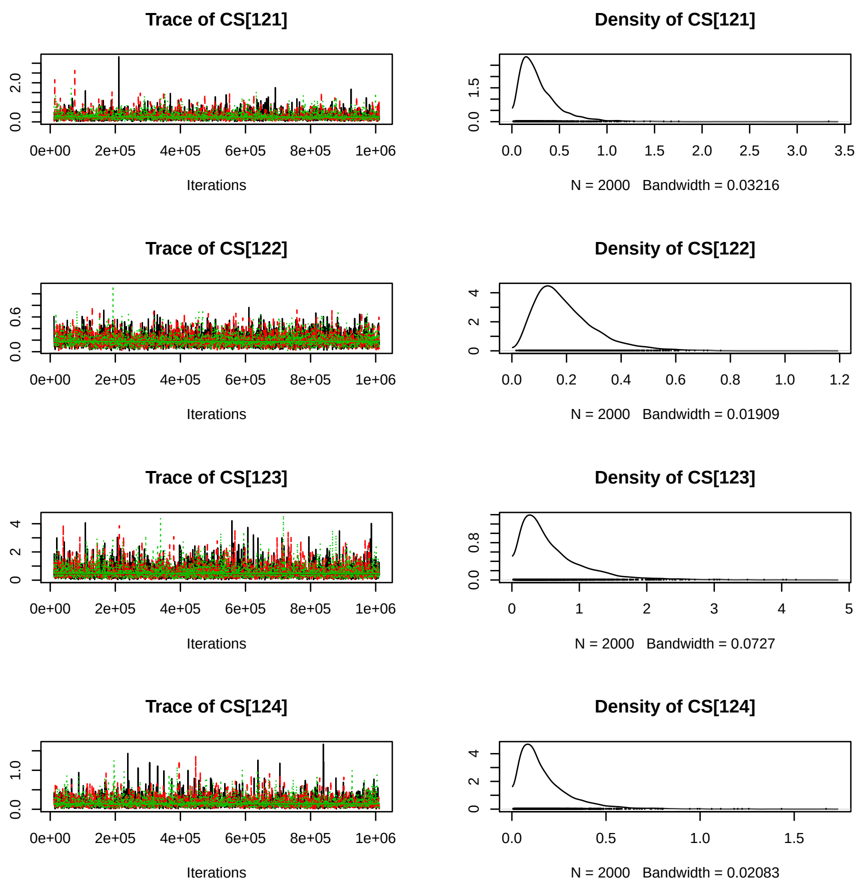

Trace of CS[101]
0.0
0.6
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[101]
0
2
0.0
0.2
0.4
0.6
0.8
1.0
N = 2000 Bandwidth = 0.02091
Trace of CS[102]
0.1
0.4
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[102]
0
2
4
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
N = 2000 Bandwidth = 0.01433
Trace of CS[103]
0.2
0.8
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[103]
0.0
1.5
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
N = 2000 Bandwidth = 0.02767
Trace of CS[104]
0.5
1.5
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[104]
0.0
1.0
0.5
1.0
1.5
2.0
N = 2000 Bandwidth = 0.04918

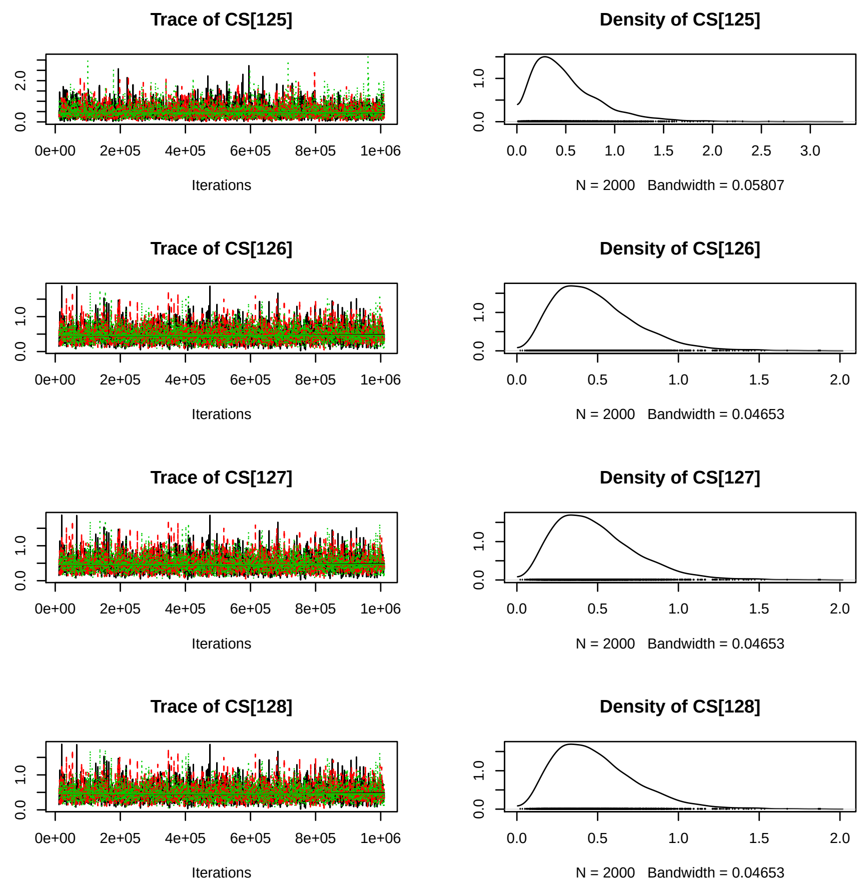

Trace of CS[105]
Density of CS[105]
Iterations
N = 2000 Bandwidth = 0.01594
Trace of CS[106]
Density of CS[106]
Iterations
N = 2000 Bandwidth = 0.01554
Trace of CS[107]
Density of CS[107]
Iterations
N = 2000 Bandwidth = 0.006923
Trace of CS[108]
Density of CS[108]
Iterations
N = 2000 Bandwidth = 0.07405

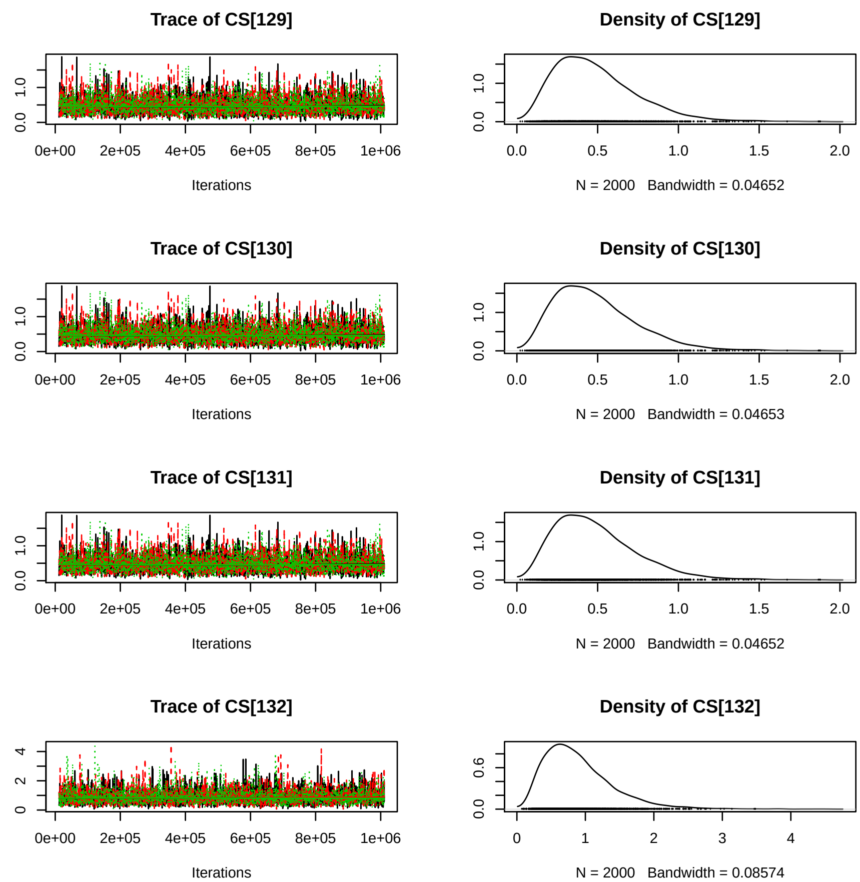

Trace of CS[109]
0.1
0.4
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[109]
0
4
8
0.0
0.1
0.2
0.3
0.4
0.5
N = 2000 Bandwidth = 0.01014
Trace of CS[110]
0.5
2.0
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[110]
0.0
0.6
0.5
1.0
1.5
2.0
2.5
3.0
N = 2000 Bandwidth = 0.06539
Trace of CS[111]
0.5
2.0
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[111]
0.0
0.8
0.5
1.0
1.5
2.0
2.5
N = 2000 Bandwidth = 0.0559
Trace of CS[112]
0.0
0.6
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[112]
0
2
4
0.0
0.2
0.4
0.6
0.8
N = 2000 Bandwidth = 0.01462

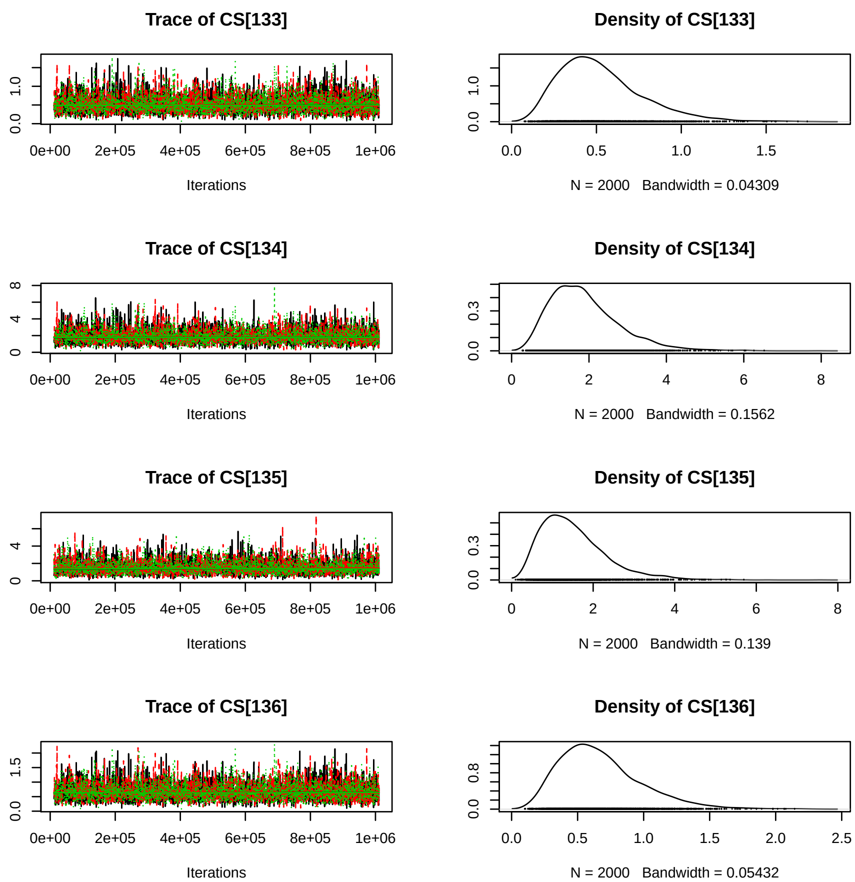

Trace of CS[113]
Iterations
Density of CS[113]
N = 2000 Bandwidth = 0.05118
Trace of CS[114]
Iterations
Density of CS[114]
N = 2000 Bandwidth = 0.2089
Trace of CS[115]
Iterations
Density of CS[115]
N = 2000 Bandwidth = 0.1768
Trace of CS[116]
Iterations
Density of CS[116]
N = 2000 Bandwidth = 0.05351

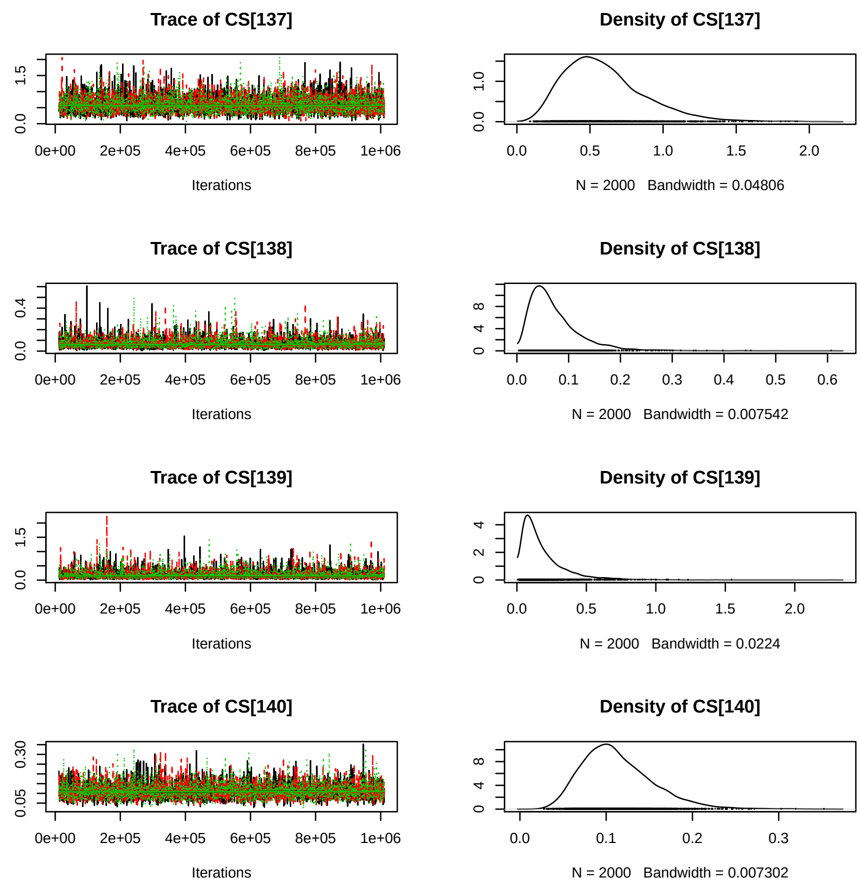

Trace of CS[117]
0.0e+00
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[117]
1500000
0
0.0e+00
5.0e−06
1.0e−05
1.5e−05
N = 2000 Bandwidth = 8.588e−08
Trace of CS[118]
0.0
0.4
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[118]
0
4
8
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
N = 2000 Bandwidth = 0.009567
Trace of CS[119]
0.0
0.6
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[119]
0
2
4
0.0
0.2
0.4
0.6
0.8
1.0
1.2
N = 2000 Bandwidth = 0.01511
Trace of CS[120]
0.0
0.6
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[120]
0
2
4
0.0
0.2
0.4
0.6
0.8
1.0
1.2
N = 2000 Bandwidth = 0.01473

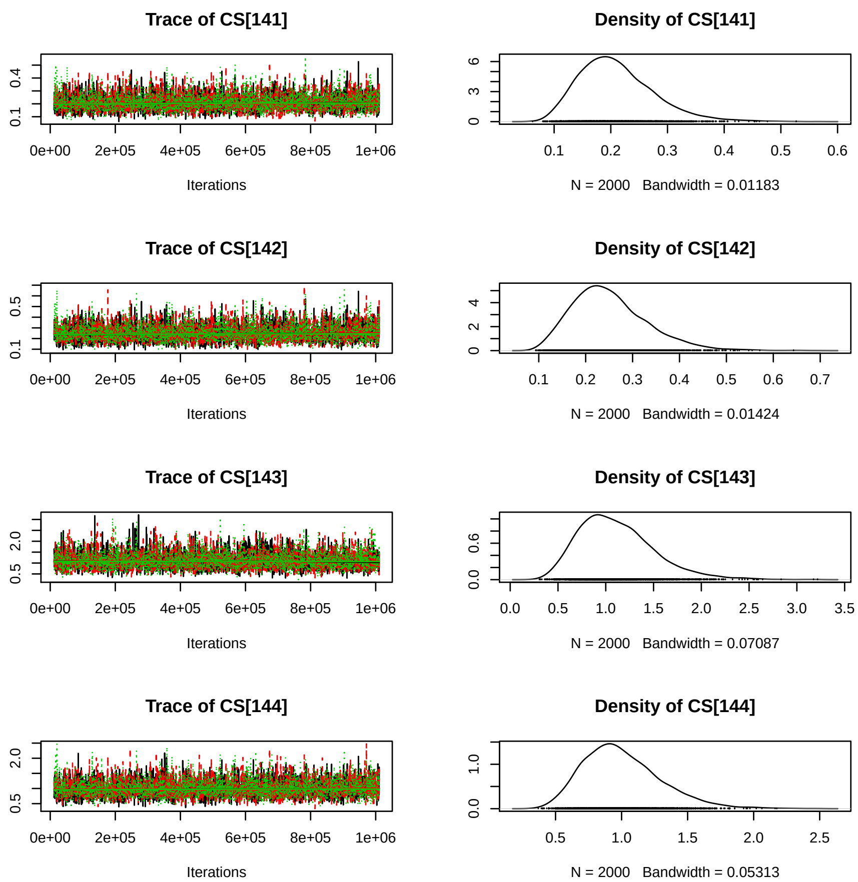

Trace of CS[121]
2.0
0.0
0e+00 2e+05 4e+05 6e+05 8e+05 1e+06
Iterations
Density of CS[121]
1.5
0.0
0.0 0.5 1.0 1.5 2.0 2.5 3.0 3.5
N = 2000 Bandwidth = 0.03216
Trace of CS[122]
0.6
0.0
0e+00 2e+05 4e+05 6e+05 8e+05 1e+06
Iterations
Density of CS[122]
4
2
0
0.0 0.2 0.4 0.6 0.8 1.0 1.2
N = 2000 Bandwidth = 0.01909
Trace of CS[123]
4
2
0
0e+00 2e+05 4e+05 6e+05 8e+05 1e+06
Iterations
Density of CS[123]
0.8
0.0
0 1 2 3 4 5
N = 2000 Bandwidth = 0.0727
Trace of CS[124]
1.0
0.0
0e+00 2e+05 4e+05 6e+05 8e+05 1e+06
Iterations
Density of CS[124]
4
2
0
0.0 0.5 1.0 1.5
N = 2000 Bandwidth = 0.02083

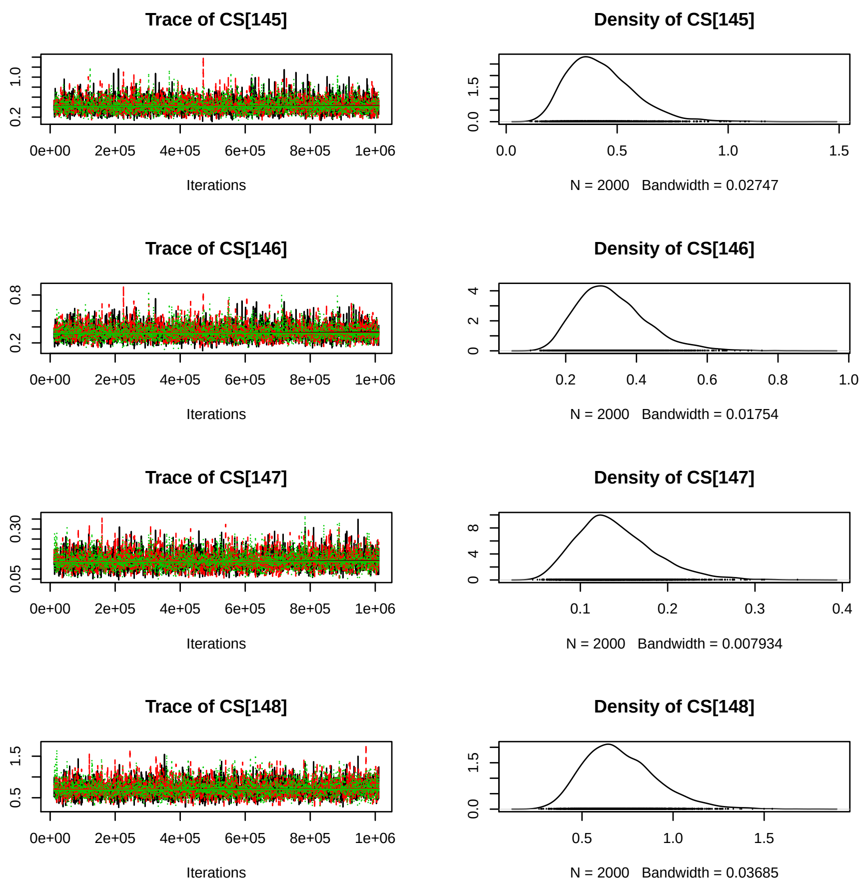

Trace of CS[125]
Density of CS[125]
Iterations
N = 2000 Bandwidth = 0.05807
Trace of CS[126]
Density of CS[126]
Iterations
N = 2000 Bandwidth = 0.04653
Trace of CS[127]
Density of CS[127]
Iterations
N = 2000 Bandwidth = 0.04653
Trace of CS[128]
Density of CS[128]
Iterations
N = 2000 Bandwidth = 0.04653

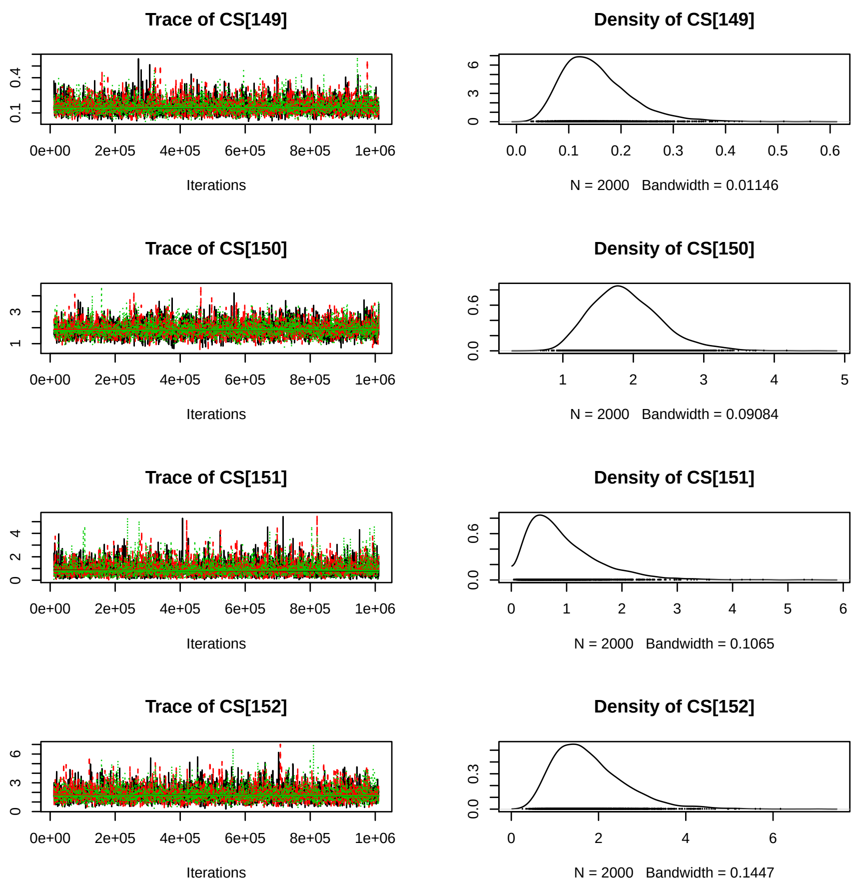

Trace of CS[129]
Density of CS[129]
Iterations
N = 2000 Bandwidth = 0.04652
Trace of CS[130]
Density of CS[130]
Iterations
N = 2000 Bandwidth = 0.04653
Trace of CS[131]
Density of CS[131]
Iterations
N = 2000 Bandwidth = 0.04652
Trace of CS[132]
Density of CS[132]
Iterations
N = 2000 Bandwidth = 0.08574
0e+00 2e+05 4e+05 6e+05 8e+05 1e+06
0.0 0.5 1.0 1.5 2.0
0 1 2 3 4

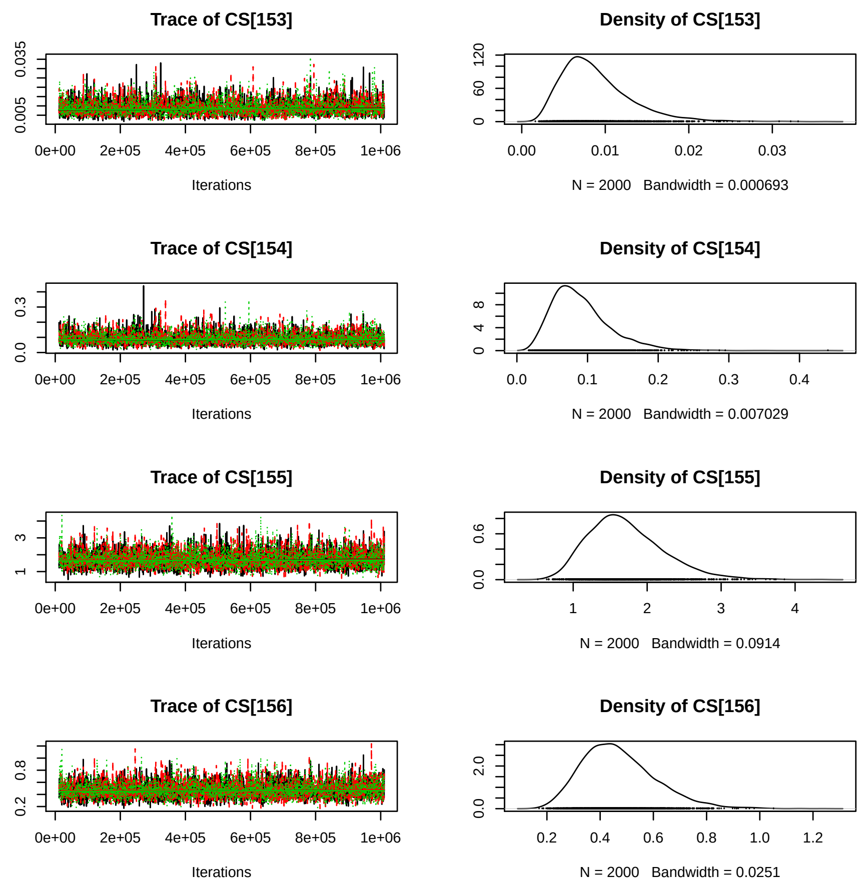

Trace of CS[133]
0.0
1.0
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[133]
0.0
1.0
0.0
0.5
1.0
1.5
N = 2000 Bandwidth = 0.04309
Trace of CS[134]
0
4
8
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[134]
0.0
0.3
0
2
4
6
8
N = 2000 Bandwidth = 0.1562
Trace of CS[135]
0
4
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[135]
0.0
0.3
0
2
4
6
8
N = 2000 Bandwidth = 0.139
Trace of CS[136]
0.0
1.5
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[136]
0.0
0.8
0.0
0.5
1.0
1.5
2.0
2.5
N = 2000 Bandwidth = 0.05432

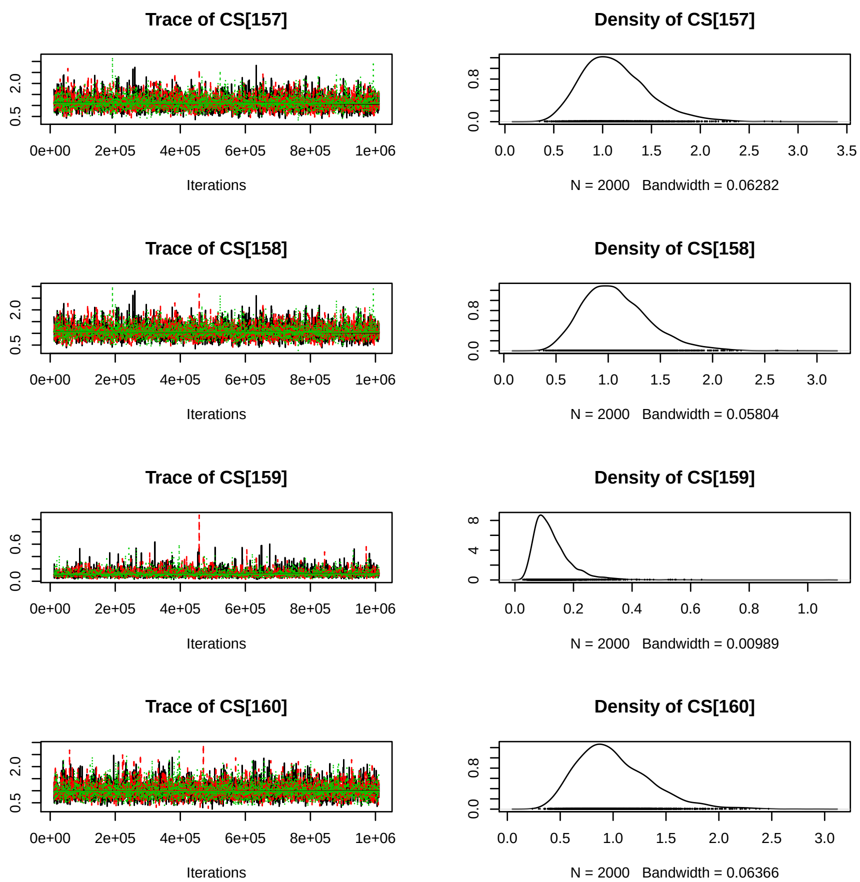

Trace of CS[137]
Iterations
Density of CS[137]
N = 2000 Bandwidth = 0.04806
Trace of CS[138]
Iterations
Density of CS[138]
N = 2000 Bandwidth = 0.007542
Trace of CS[139]
Iterations
Density of CS[139]
N = 2000 Bandwidth = 0.0224
Trace of CS[140]
Iterations
Density of CS[140]
N = 2000 Bandwidth = 0.007302

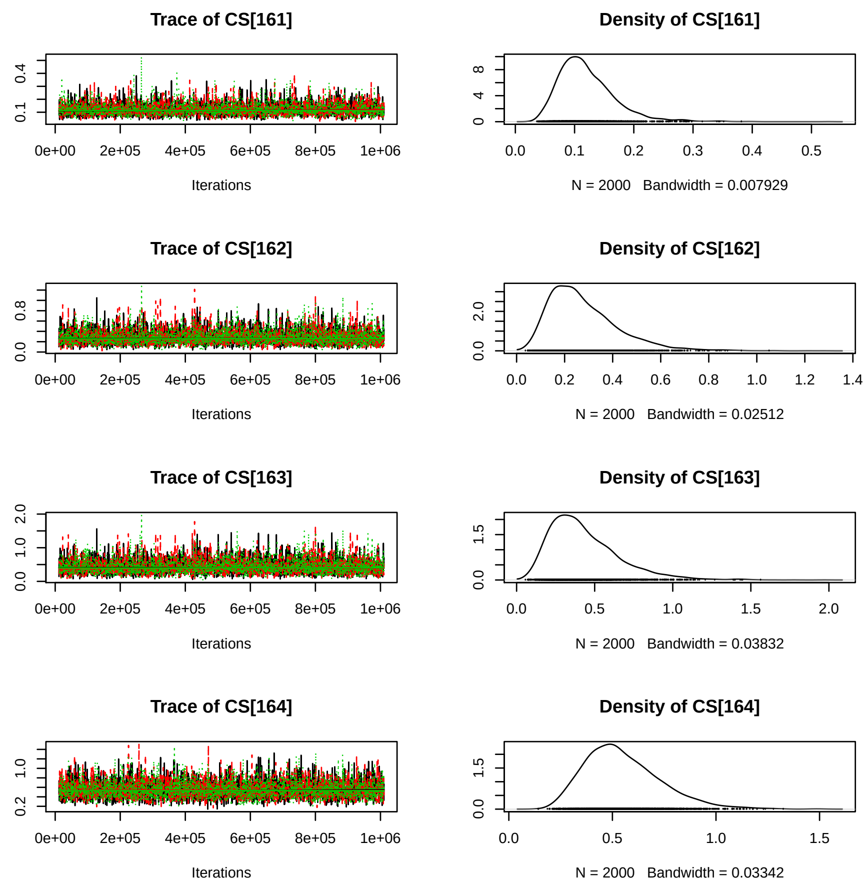

Trace of CS[141]
Density of CS[141]
Iterations
N = 2000 Bandwidth = 0.01183
Trace of CS[142]
Density of CS[142]
Iterations
N = 2000 Bandwidth = 0.01424
Trace of CS[143]
Density of CS[143]
Iterations
N = 2000 Bandwidth = 0.07087
Trace of CS[144]
Density of CS[144]
Iterations
N = 2000 Bandwidth = 0.05313

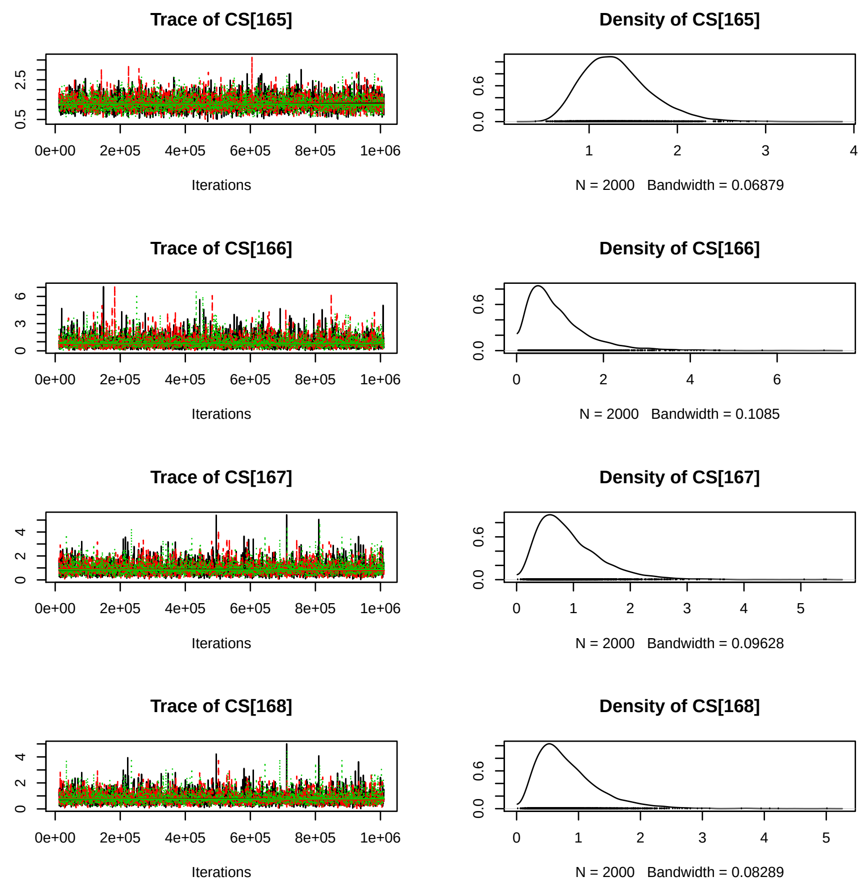

Trace of CS[145]
1.0
0.2
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[145]
1.5
0.0
0.0
0.5
1.0
1.5
N = 2000 Bandwidth = 0.02747
Trace of CS[146]
0.8
0.2
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[146]
4
2
0
0.2
0.4
0.6
0.8
1.0
N = 2000 Bandwidth = 0.01754
Trace of CS[147]
0.30
0.05
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[147]
8
4
0
0.1
0.2
0.3
0.4
N = 2000 Bandwidth = 0.007934
Trace of CS[148]
1.5
0.5
0e+00
2e+05
4e+05
6e+05
8e+05
1e+06
Iterations
Density of CS[148]
1.5
0.0
0.5
1.0
1.5
N = 2000 Bandwidth = 0.03685

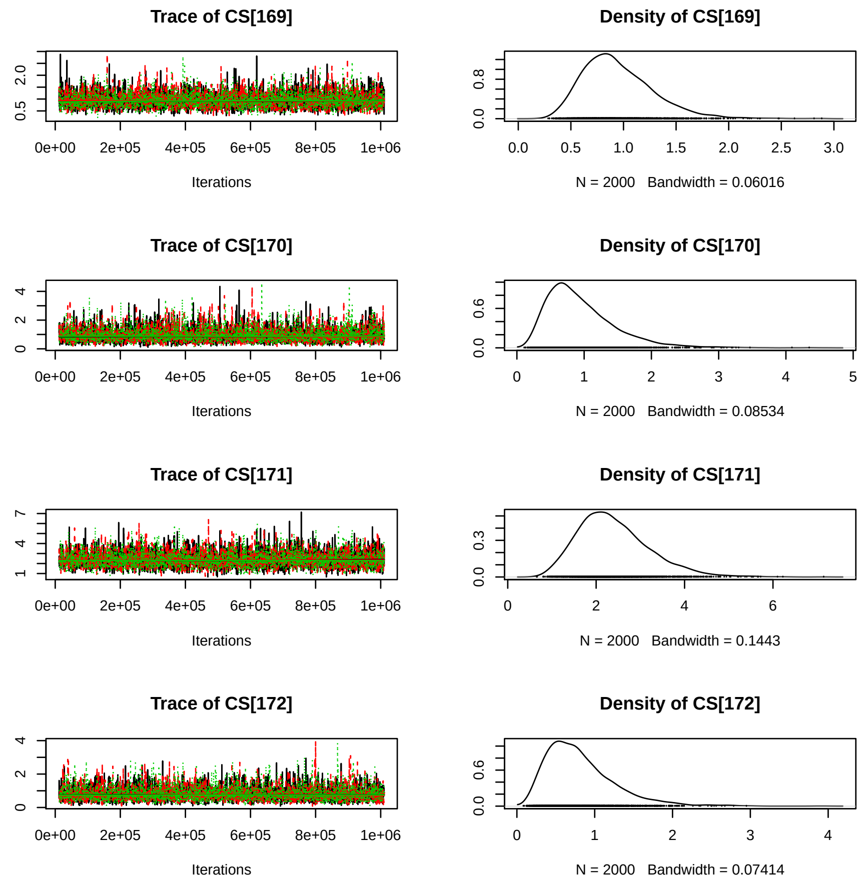

Trace of CS[149]
Iterations
Density of CS[149]
N = 2000 Bandwidth = 0.01146
Trace of CS[150]
Iterations
Density of CS[150]
N = 2000 Bandwidth = 0.09084
Trace of CS[151]
Iterations
Density of CS[151]
N = 2000 Bandwidth = 0.1065
Trace of CS[152]
Iterations
Density of CS[152]
N = 2000 Bandwidth = 0.1447

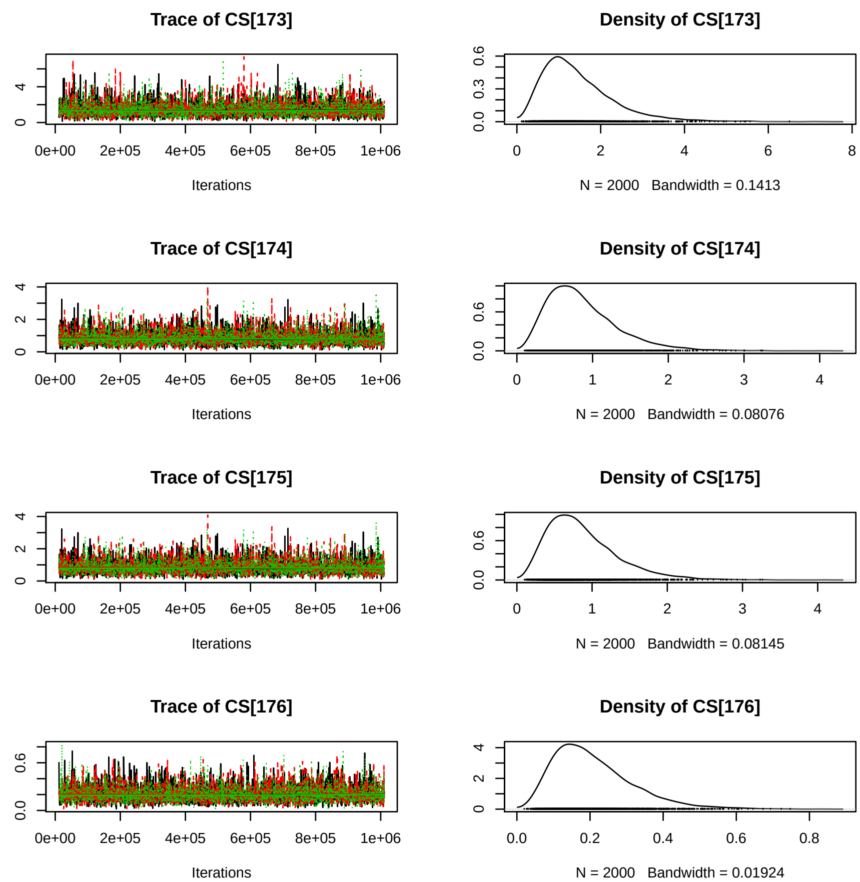

Trace of CS[153]
Density of CS[153]
Iterations
N = 2000 Bandwidth = 0.000693
Trace of CS[154]
Density of CS[154]
Iterations
N = 2000 Bandwidth = 0.007029
Trace of CS[155]
Density of CS[155]
Iterations
N = 2000 Bandwidth = 0.0914
Trace of CS[156]
Density of CS[156]
Iterations
N = 2000 Bandwidth = 0.0251

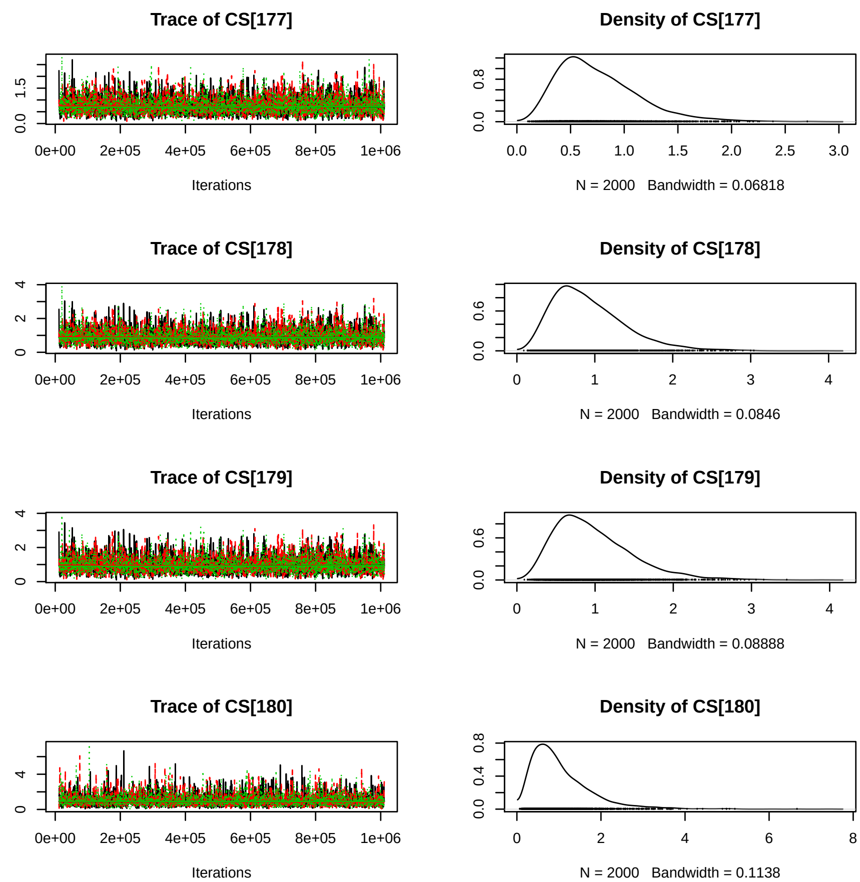

Trace of CS[157]
Density of CS[157]
Iterations
N = 2000 Bandwidth = 0.06282
Trace of CS[158]
Density of CS[158]
Iterations
N = 2000 Bandwidth = 0.05804
Trace of CS[159]
Density of CS[159]
Iterations
N = 2000 Bandwidth = 0.00989
Trace of CS[160]
Density of CS[160]
Iterations
N = 2000 Bandwidth = 0.06366

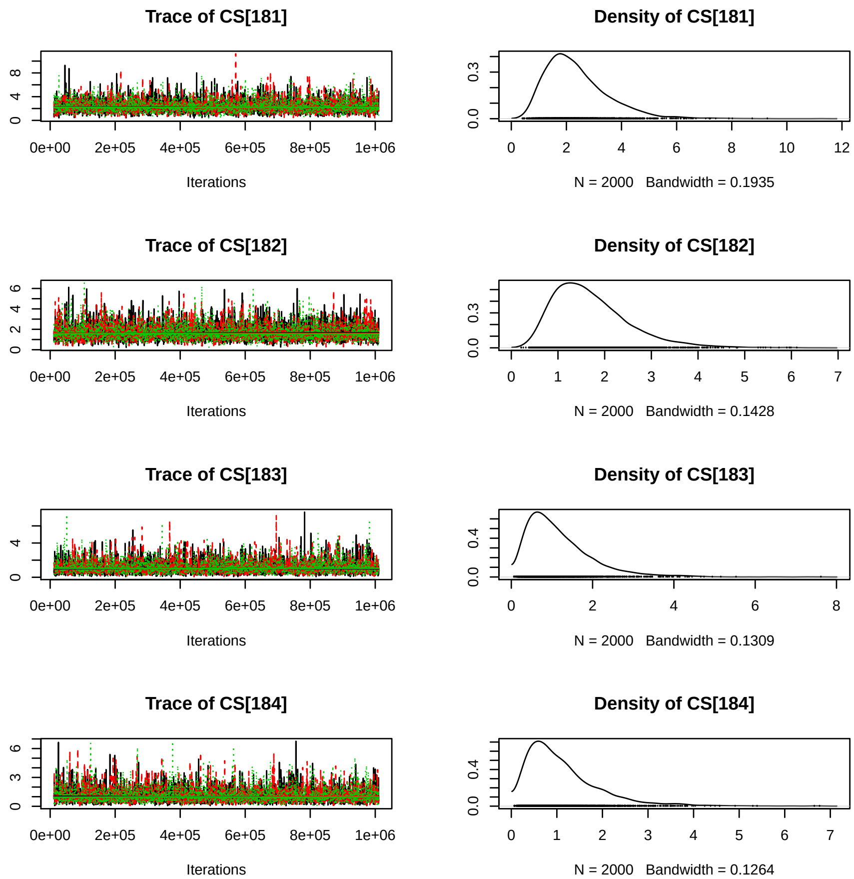

Trace of CS[161]
Iterations
Density of CS[161]
N = 2000 Bandwidth = 0.007929
Trace of CS[162]
Iterations
Density of CS[162]
N = 2000 Bandwidth = 0.02512
Trace of CS[163]
Iterations
Density of CS[163]
N = 2000 Bandwidth = 0.03832
Trace of CS[164]
Iterations
Density of CS[164]
N = 2000 Bandwidth = 0.03342

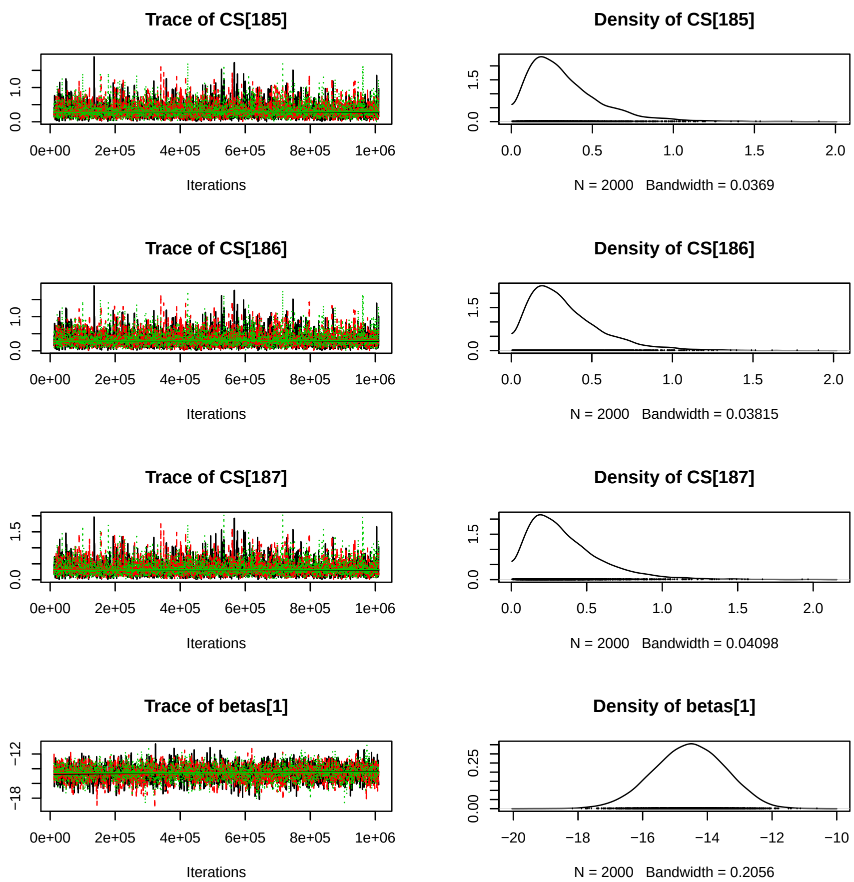

Trace of CS[165]
Density of CS[165]
Iterations
N = 2000 Bandwidth = 0.06879
Trace of CS[166]
Density of CS[166]
Iterations
N = 2000 Bandwidth = 0.1085
Trace of CS[167]
Density of CS[167]
Iterations
N = 2000 Bandwidth = 0.09628
Trace of CS[168]
Density of CS[168]
Iterations
N = 2000 Bandwidth = 0.08289

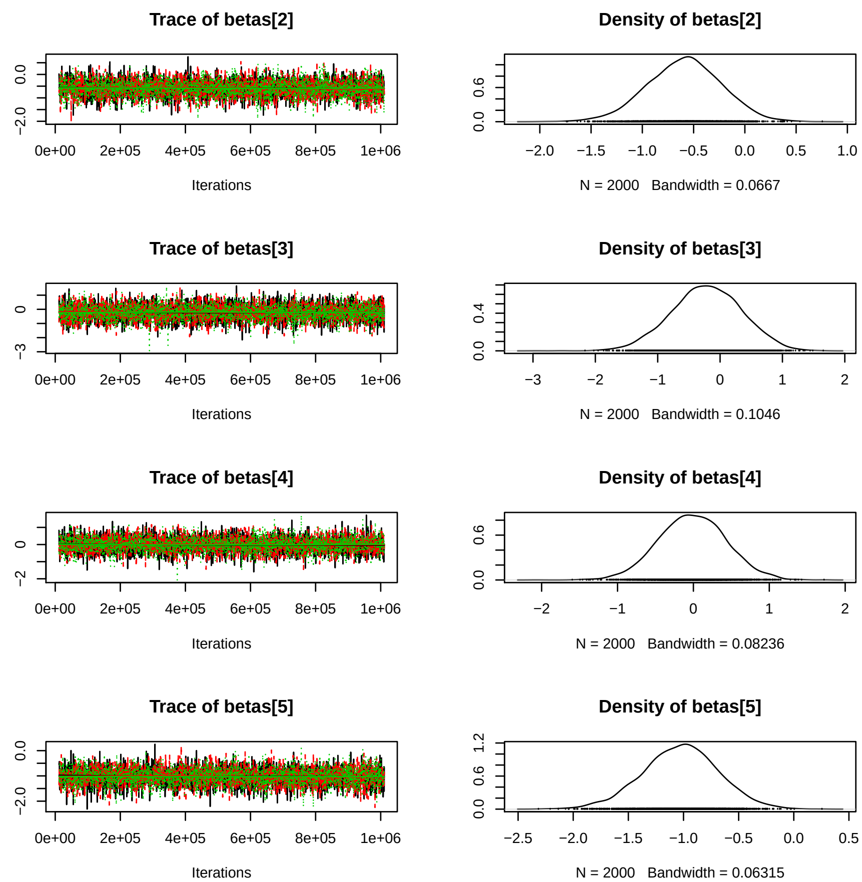

Trace of CS[169]
Iterations
Density of CS[169]
N = 2000 Bandwidth = 0.06016
Trace of CS[170]
Iterations
Density of CS[170]
N = 2000 Bandwidth = 0.08534
Trace of CS[171]
Iterations
Density of CS[171]
N = 2000 Bandwidth = 0.1443
Trace of CS[172]
Iterations
Density of CS[172]
N = 2000 Bandwidth = 0.07414

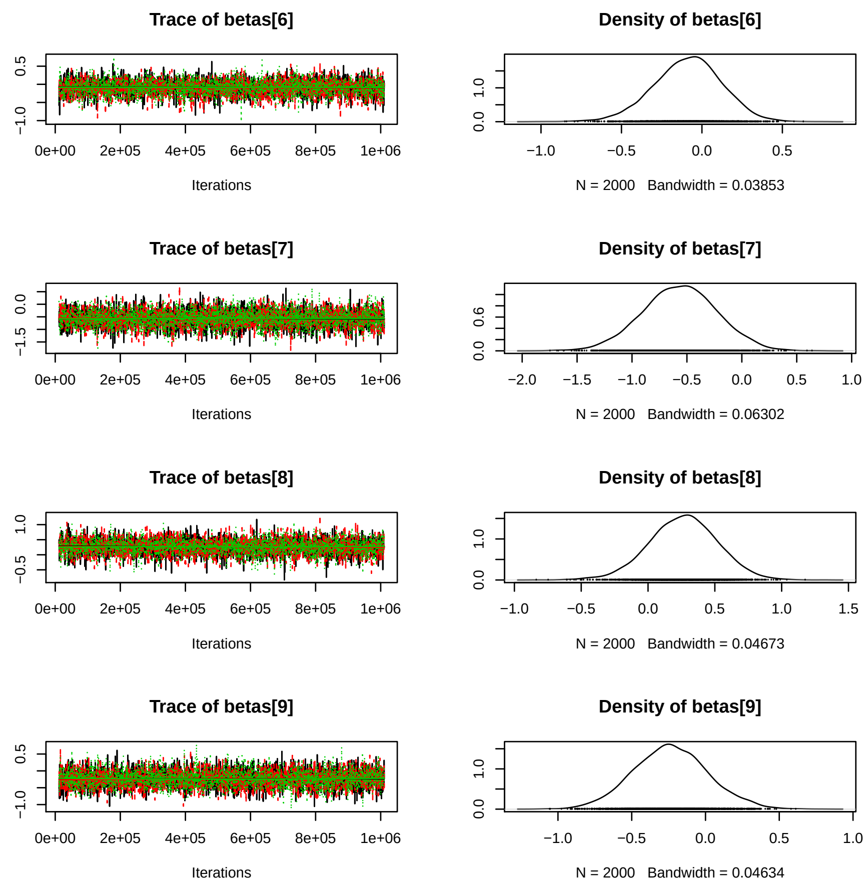

Trace of CS[173]
Iterations
Density of CS[173]
N = 2000 Bandwidth = 0.1413
Trace of CS[174]
Iterations
Density of CS[174]
N = 2000 Bandwidth = 0.08076
Trace of CS[175]
Iterations
Density of CS[175]
N = 2000 Bandwidth = 0.08145
Trace of CS[176]
Iterations
Density of CS[176]
N = 2000 Bandwidth = 0.01924

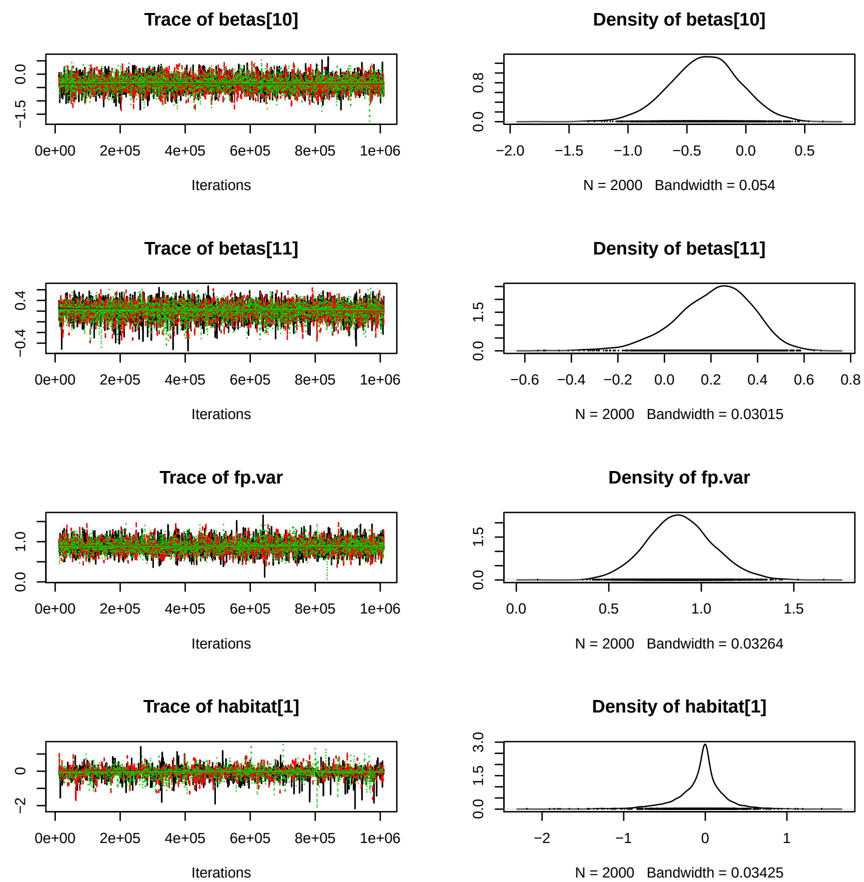

Trace of CS[177]
Iterations
Density of CS[177]
N = 2000 Bandwidth = 0.06818
Trace of CS[178]
Iterations
Density of CS[178]
N = 2000 Bandwidth = 0.0846
Trace of CS[179]
Iterations
Density of CS[179]
N = 2000 Bandwidth = 0.08888
Trace of CS[180]
Iterations
Density of CS[180]
N = 2000 Bandwidth = 0.1138

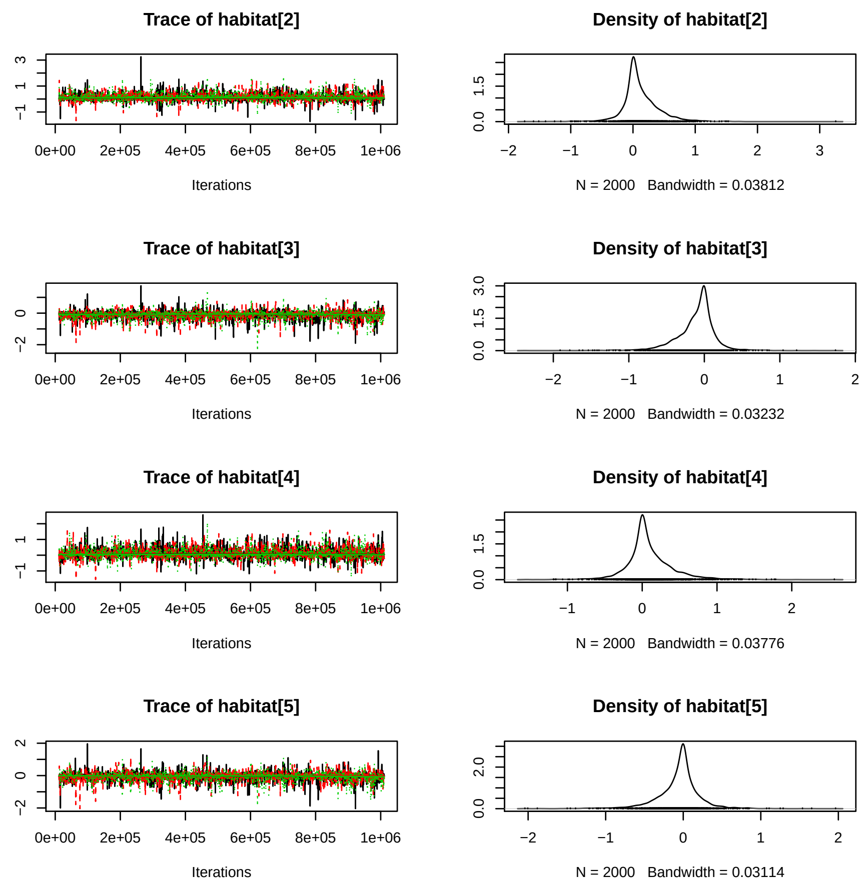

Trace of CS[181]
Iterations
Density of CS[181]
N = 2000 Bandwidth = 0.1935
Trace of CS[182]
Iterations
Density of CS[182]
N = 2000 Bandwidth = 0.1428
Trace of CS[183]
Iterations
Density of CS[183]
N = 2000 Bandwidth = 0.1309
Trace of CS[184]
Iterations
Density of CS[184]
N = 2000 Bandwidth = 0.1264


Trace of CS[185]
Iterations
Density of CS[185]
N = 2000   Bandwidth = 0.0369
Trace of CS[186]
Iterations
Density of CS[186]
N = 2000   Bandwidth = 0.03815
Trace of CS[187]
Iterations
Density of CS[187]
N = 2000   Bandwidth = 0.04098
Trace of betas[1]
Iterations
Density of betas[1]
N = 2000   Bandwidth = 0.2056

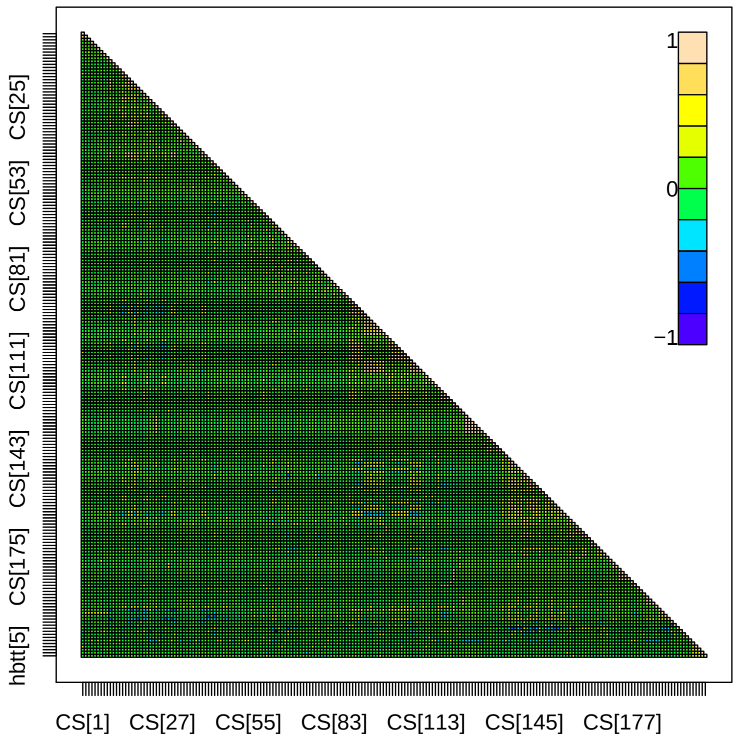

Trace of betas[2]
Density of betas[2]
Iterations
N = 2000 Bandwidth = 0.0667
Trace of betas[3]
Density of betas[3]
Iterations
N = 2000 Bandwidth = 0.1046
Trace of betas[4]
Density of betas[4]
Iterations
N = 2000 Bandwidth = 0.08236
Trace of betas[5]
Density of betas[5]
Iterations
N = 2000 Bandwidth = 0.06315


Trace of betas[6]
Iterations
Density of betas[6]
N = 2000 Bandwidth = 0.03853
Trace of betas[7]
Iterations
Density of betas[7]
N = 2000 Bandwidth = 0.06302
Trace of betas[8]
Iterations
Density of betas[8]
N = 2000 Bandwidth = 0.04673
Trace of betas[9]
Iterations
Density of betas[9]
N = 2000 Bandwidth = 0.04634


Trace of betas[10]
Density of betas[10]
Iterations
N = 2000 Bandwidth = 0.054
Trace of betas[11]
Density of betas[11]
Iterations
N = 2000 Bandwidth = 0.03015
Trace of fp.var
Density of fp.var
Iterations
N = 2000 Bandwidth = 0.03264
Trace of habitat[1]
Density of habitat[1]
Iterations
N = 2000 Bandwidth = 0.03425

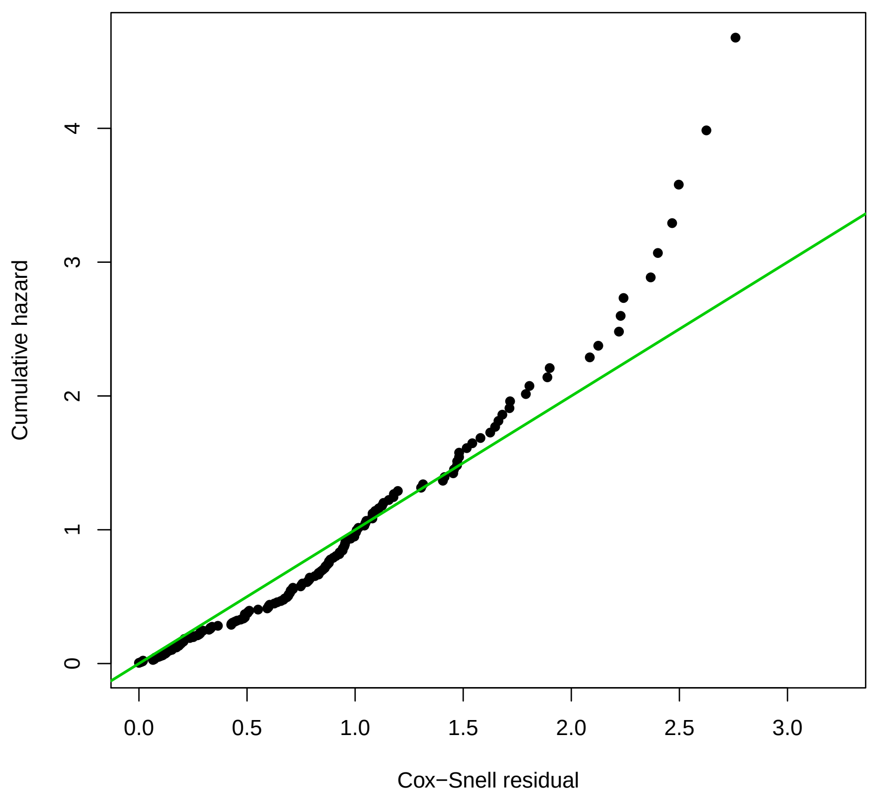



```
crosscorr.plot(a.out)
```




```
# get coeffs from the chains - pull in some helper functions and Rdata from
# Bayesian model
source("helper_functs.R")
# load('~/Work/Dropbox/First year of assessment/FA_V001.RData')

# get posterior for cox-snell(CS) residuals from MCMC
CS.full <- tbl_df(get_coef_chains(model.out = a.out, coef.names = "CS"))

# just look at mean CS for now, can put posterior around it later
CS.means <- CS.full %.% group_by(Parameter) %.% summarise(post.mean = mean(MCMC))

library(survival)

## Loading required package:  splines

CS = CS.means$post.mean
```

```r
# Kaplan-Meyer non-parametric survival at CS - should follow exp(1)
# distribution
km.cs <- survfit(Surv(CS, !censored) ~ 1)
summary.km.cs <- summary(km.cs)
rcu <- summary.km.cs$time  # Cox-Snell residuals of
# uncensored points.
surv.cs <- summary.km.cs$surv
plot(rcu, -log(surv.cs), type = "p", pch = 16, xlab = "Cox-Snell residual",
    ylab = "Cumulative hazard")
abline(a = 0, b = 1, col = 3, lwd = 2)
```



It looks as though the fit of the Weibull isn't too bad, some deviation is expected in the tails of the distribution, but over the bulk it seems to follow the 1:1 line fairly closely. Perhaps not much of an improvement over the normal GLM above - should try differnet distributional assumptions here. We could also plot the posterior for the CS residuals and see if the 1:1 line falls outside a

Table 1: Posterior mean and $P(\beta > 0)$ for model parameters

Parameter	Posterior Mean	Bayesian P
landings	-0.21	0.10
Lmax..cm.	0.09	0.66
price	0.35	0.88
Recreational.pc.catch	-0.26	0.15
RegionAlaska	0.59	0.95
RegionUSEC	0.22	0.65
RegionUSSE	0.01	0.51
RegionUSWC	1.03	1.00
TL	0.57	0.95
X.Intercept.	14.56	1.00
Year.of.fishery.development..stock.based.	0.24	0.83

Table 2: Posterior mean and $P(\beta > 0)$ for model habitat

Habitat	Posterior Mean	Bayesian P
benthic	0.06	0.57
benthopelagic	-0.12	0.33
demersal	0.11	0.67
pelagic	-0.09	0.39
reef	0.06	0.58

95% interval for any points.

```
coeffs <- tbl_df(get_coef_chains(model.out = a.out, coef.names = "betas", var.names = colnam

# regressin coeffs are -beta
coef_P <- coeffs %.% group_by(Parameter) %.% summarise(post.mean = -mean(MCMC),
    post.P = 1 - mean(MCMC > 0))
```

```
# habitat
habs <- tbl_df(get_coef_chains(model.out = a.out, coef.names = "habitat", var.names = with(y
    levels(factor(habitat_MM)))))


hab_P <- habs %.% group_by(Parameter) %.% summarise(post.mean = -mean(MCMC),
    post.P = 1 - mean(MCMC > 0))
```

```
# finite population variance of family random effects
fp.vars <- tbl_df(get_coef_chains(model.out = a.out, coef.names = "fp.var")) %.%
    summarise(mean(MCMC)^2)

fp.vars
```

```
## Source: local data frame [1 x 1]
##
##   mean(MCMC)^2
## 1       0.7839
```