DVM Parametric Bootstrap - Work 3

Jeremy Williams and Spyridoula Chrysikopoulou-Soldatou

October 25, 2017

Multiple capture-recapture problem

Chao's estimator (No. of females)

```
#install.packages("SPECIES")
suppressMessages(suppressWarnings(library(SPECIES)))

F_sights <- data.frame(sights = 1:7, # Number of sight cases,
                       nbear = c(11, 13, 5, 1, 1, 0, 2)) # Frequencies

F_sights
```

```
##   sights nbear
## 1      1    11
## 2      2    13
## 3      3     5
## 4      4     1
## 5      5     1
## 6      6     0
## 7      7     2
```

```
chao1984(F_sights,conf=0.95)
```

```
## $Nhat
## [1] 38
##
## $SE
## [1] 3.767706
##
## $CI
##      lb ub
## [1,] 34 52
```

This returns:

Nhat - point estimate of the no. of Females

SE - standard error of the point estimate

CI - confidence interval using a log transformation explained in Chao 1987.

Note: We can also show this below by estimating the Lambda and then Parametric bootstrap (to compute CI).

Zero-truncated Poisson Distribution (Lambda estimate and CI)

```
#install.packages("SPECIES")
suppressMessages(suppressWarnings(library(SPECIES)))
```

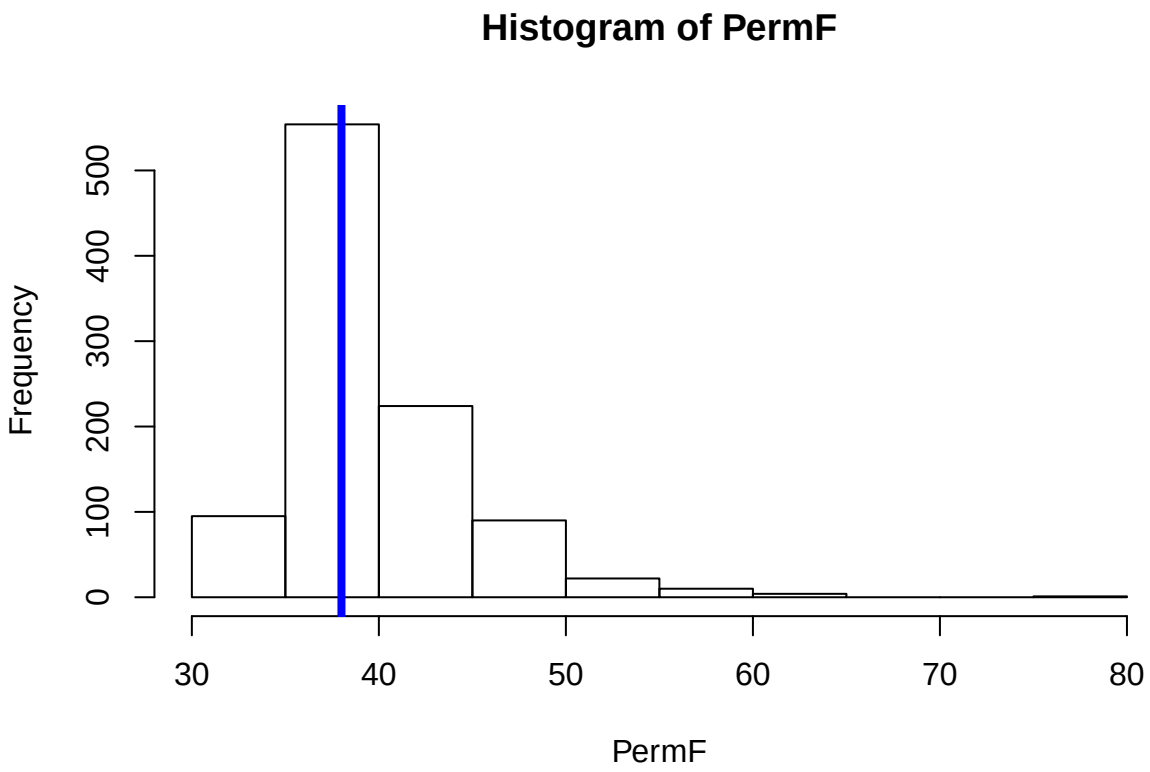
```r
F_sights <- data.frame(sights = 1:7, # Number of sight cases,
                       nbear = c(11, 13, 5, 1, 1, 0, 2)) # Frequencies

PermF_T <- chao1984(F_sights,conf=0.95)$Nhat

#install.packages("fossil")
suppressMessages(suppressWarnings(library(fossil)))


Fu <- function(x) x/(1-exp(-x))-2.3
Ux <- uniroot(Fu,c(1,10))

Lamd <-Ux$root


# Parametric bootstrap (compute CI)
set.seed(11)
nsim <-1000
PermF <-numeric((length (nsim)))
     for (i in 1:nsim){
       n<- rpois(33,Lamd)
       while (any(n==0)== "TRUE"){
         n <-rpois(33,Lamd)
       }
       PermF[i] <-chao2(n)
     }

#Lambda
Lamd
```

```
## [1] 1.983573
```

```r
quantile(PermF, probs = c(0.025, 0.975))
```

```
##     2.5%    97.5%
## 34.19841 51.75000
```

```r
par(mfrow=c(1,1))
hist(PermF)
abline(v=PermF_T, lwd=4, col="blue")
```



It is estimated that lambda is **1.983573**.

The blue line shows "Nhat" (**38**) - point estimate of the no. of Females

The confidence interval of the total number of females is (**34.19841**, **51.75000**)