Number of birds affected by the lights

Here we estimate the total number of birds affected by the lights. Our best estimate of turnover time comes from the simulations, where the stabilization time is 34 minutes. Since on average there should be complete turnover within that period of time, we use 34 minutes as our best estimate of the turnover time. Then we find the median time between radar scans in minutes

```
time.between.scans = as.numeric(median(diff(data.m$sweep.time.e1))); time.between.scans
```

```
## [1] 9.466667
```

Next we divide the time between scans by the turnover time to find the proportion of samples that can be treated as 'independent.' We will therefore calculate total numbers of birds only from a subset of the dataset of this size.

```
retain.proportion = time.between.scans/34; retain.proportion
```

```
## [1] 0.2784314
```

To accomplish this, we subsample the dataset 10000 times with the probablity of keeping a data point equal to 'retain.proportion.'

```
set.seed(123)
yrs = sort(unique(data.m$year))
n.sim = 1e4
res.array = array(dim=c(n.sim,length(yrs)))
# xx = rep(NA,n.sim)
for (i in 1:n.sim) {
res.array[i,] = with(data.m[sample.int(nrow(data.m),size=nrow(data.m)*retain.proportion),],
             tapply(n.birds.difference.5k.e1,year,sum,na.rm=T)) # %>% sum
}
colnames(res.array) = levels(data.m$year)
```

We take the mean value of these 10000 iterations as our best estimate of number of the total number of birds affected by the lights during the study period, rounded to nearest hundred thousand.

```
# All years combined
apply(res.array,2,mean) %>% sum %>% round(-5)
```

```
## [1] 1100000
```

```
# Breakdown by year
apply(res.array,2,mean) %>% round(-3)
```

```
##   2008   2010   2012   2013   2014   2015   2016
##  21000 669000  29000 198000   5000 130000  34000
```

```
# Mean year
apply(res.array,2,mean) %>% mean %>% round(-4)
```

```
## [1] 160000
```

```
# Standard deviation
apply(res.array,2,mean) %>% sd %>% round(-4)
```

```
## [1] 240000
```

```
# Median year
apply(res.array,2,mean) %>% median %>% round(-4)
```

```
## [1] 30000
```