# Preliminary analysis of the Icelandic Gyrfalcon CMR dataset - v2

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Here I attempt to explore the CMR dataset, before we go to inferential models to estimate survival and perhaps link this to an integrated pop. model.

## Basic statistics

How many birds have been ringed?

```
dringed<-read.csv("data/Gyrs_ringed.csv")
head(dringed) # What's in the data table
```

```
##   Ring_No Ringed_date Ringed_day Ringed_month Ringed_year EurAgeCode
## 1   15551   7/12/1975         12            7        1975          1
## 2   15552   7/12/1975         12            7        1975          1
## 3   15553   7/12/1975         12            7        1975          1
## 4   15554   6/20/1976         20            6        1976          1
## 5   15555   6/20/1976         20            6        1976          1
## 6   15556   6/20/1976         20            6        1976          1
##   EurAgeText SEX
## 1     Pullus   0
## 2     Pullus   0
## 3     Pullus   0
## 4     Pullus   0
## 5     Pullus   0
## 6     Pullus   0
```

```
length(unique(dringed$Ring_No)) #How many unique bird IDs
```

```
## [1] 1653
```

OK, so we have 1653 unique IDs. Let's compare to how many gyrs have been recovered.

```
drecov<-read.csv("data/Gyrs_recovered.csv")
head(drecov)
```

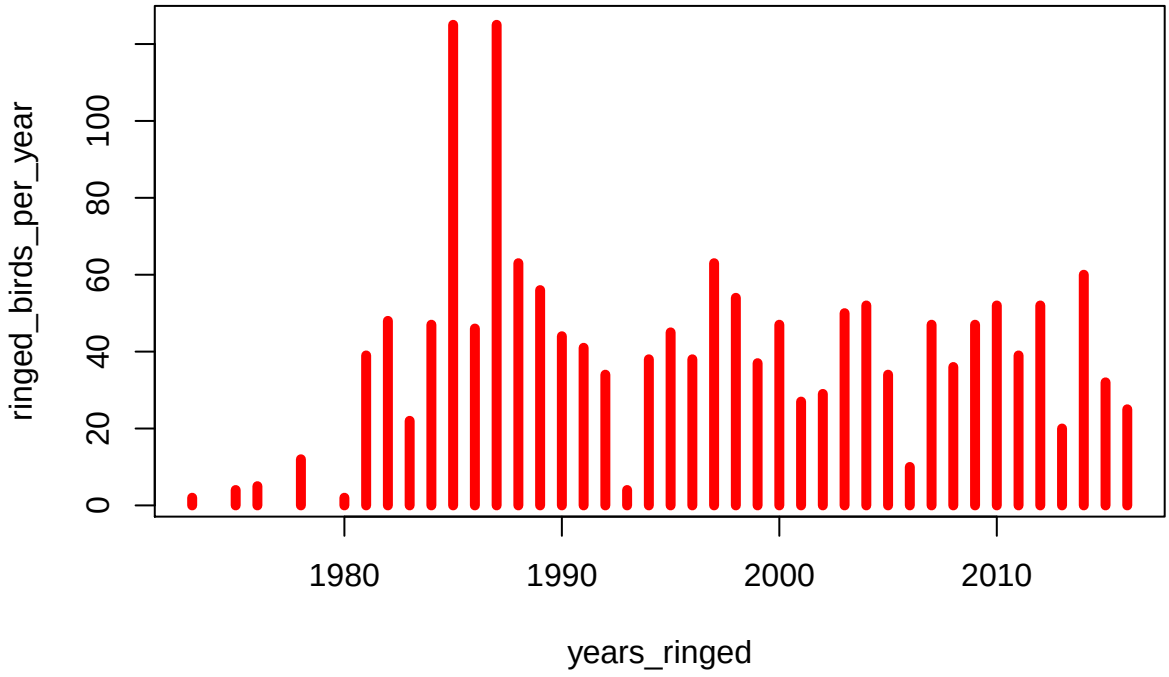
```
##   Ring_No Date_recovered Day_recorded Month_recorded Year_recorded
## 1   15554     10/15/1976           15             10          1976
## 2   15556      9/18/1980           18              9          1980
## 3   15559      6/18/1980           18              6          1980
## 4   15560      4/15/1979           15              4          1979
## 5   15562      8/20/1987           20              8          1987
## 6   15567      5/13/1995           13              5          1995
##   Accurancy_of_date_Euring_code Condition_Euring_code
## 1                             5                    3
## 2                             9                    3
## 3                             9                    3
## 4                             9                    3
## 5                             0                    3
## 6                             9                    3
##   Circumstances_Euring_code         Circumstances_Euring_text
## 1                         1                   Bird found dead
## 2                         1              Bird found long dead
## 3                         1              Bird found long dead
## 4                         1              Bird found long dead
## 5                         1 Bird found dead (less than month)
## 6                         1              Bird found long dead
##               When.dead Date_reported
## 1                          14.09.1985
## 2      Died summer 1980    22.09.1980
```

```
## 3                          18.12.1980
## 4 Died winter 1978-1979    29.06.1984
## 5       Died summer 1987   25.08.1987
## 6                          26.05.1995
```

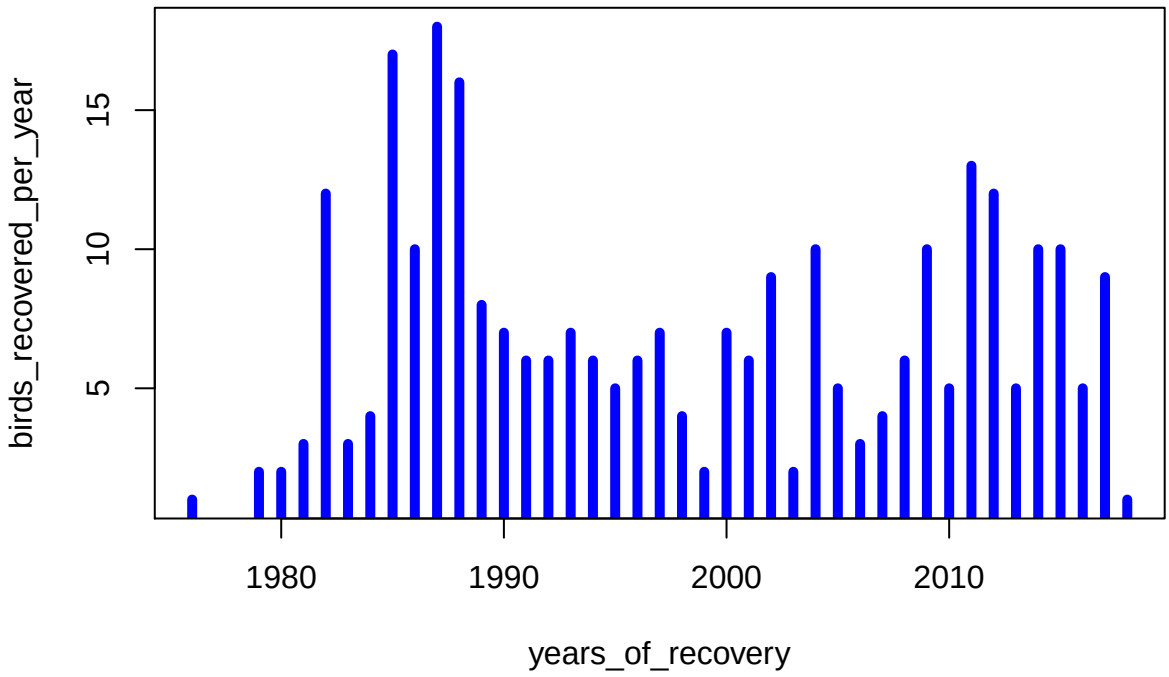
```r
length(unique(drecov$Ring_No)) #How many unique bird IDs in Gyrs_recovered.csv
```

```
## [1] 270
```

Let's now analyse the number of birds that have been ringed as a function of the year




We now analyse the patterns of recovery (and resighting)



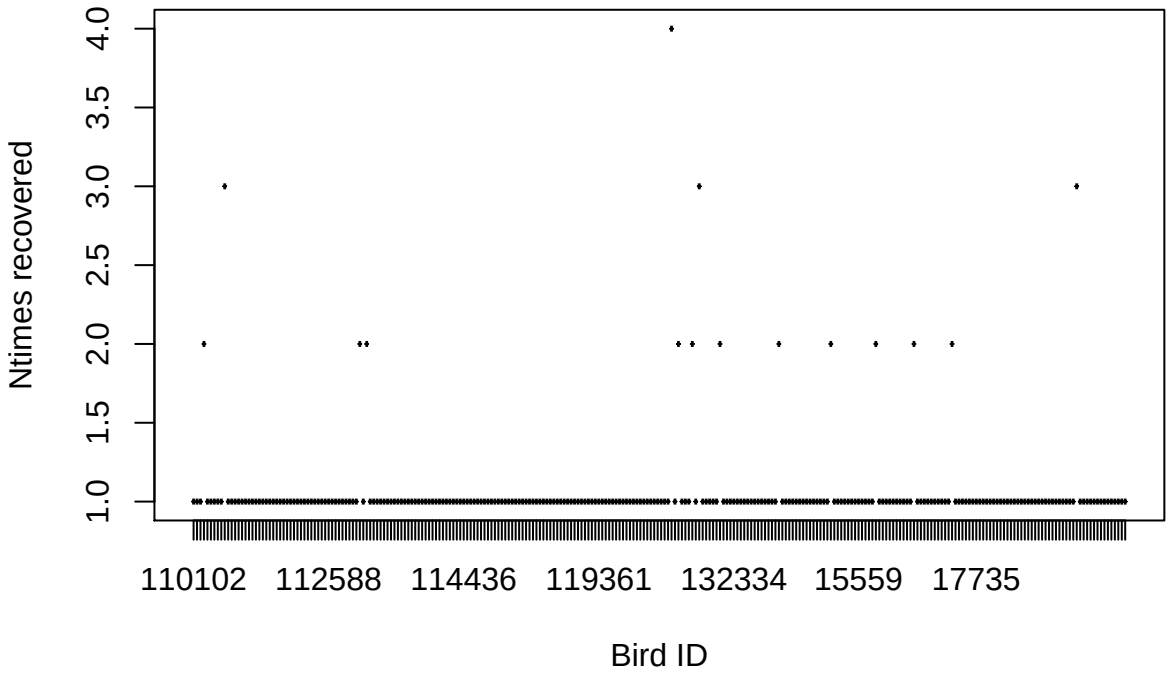

Now how many birds have been seen several times? We see below that very few birds have been recovered more than once (also this tends to be recent?).

---

**Question: when did the change from recovery of dead birds to resighting of live birds occur?**

---

I can infer the earliest date at which a bird has been resighted a second time, but given few birds have been resighted, but it might be preferable to allow later for a change in protocol (in the CMR models) using a predefined time (we can use several if unsure). I have noted 2006 earlier but I am unsure.




```
## ntimes_recovered
##   1   2   3   4
## 255  11   3   1
```

This is coherent with the info given by Oli – 1 bird recovered 4 times, 3 birds 3 times, 11 birds two times and the rest 1 time.

Thus for all practical purposes, we can consider that such data consists mainly of individual that are either recovered or not recovered/resighted. We'll now turn to whether the individuals have been found live or dead, and how this varies in time.

Also whether the recoveries of dead birds are of young vs. adult birds (which may provide quick and dirty estimates of survival rates, at least for the youngs...)

```
## these are all the recovery codes that we have (top row), and how many of those we have in the dataset


table(drecov$Condition_Euring_code)
```

```
##
##   1   2   3   4   5   7   8
##   2  66 136   8  26  31  21
```

```
### [previous comment: For instance, we can see 15 read colourmarks.
### We need to simplify this complexity to some extent by aggregating some values. ]
```

*Now we need some more info on the codes*

These are defined according to The EURING EXCHANGE Code 2000+ https://euring.org/files/documents/E2000PLUSExchangeCodeV117.pdf

| Condition Code | Meaning |
|---|---|
| 0 | Condition completely unknown |
| 1 | Dead but no information on how recently died/killed |
| 2 | Freshly dead – within about a week |
| 3 | dead for > a week. If >>, use 9 in Accuracy of Date, and 3 here |
| 4 | Found sick/wounded and released afterwards |
| 5 | Found sick/wounded and NOT released afterwards |
| 6 | Alive and probably healthy but taken into captivity. |
| 7 | Alive and probably healthy and certainly released (ring seen without the bird having being caught). |
| 8 | Alive and probably healthy and released by a ringer |
| 9 | Alive and probably healthy but ultimate fate of bird is not known |

Thus categories 4, 7 and 8 (respectively 8, 31 and 21 birds) correspond to cases where the bird is 'released' alive, i.e. effectively resighted rather than recovered (when dead).

```
drecov$Date_recovered[drecov$Condition_Euring_code %in% c(4,7,8)]
```

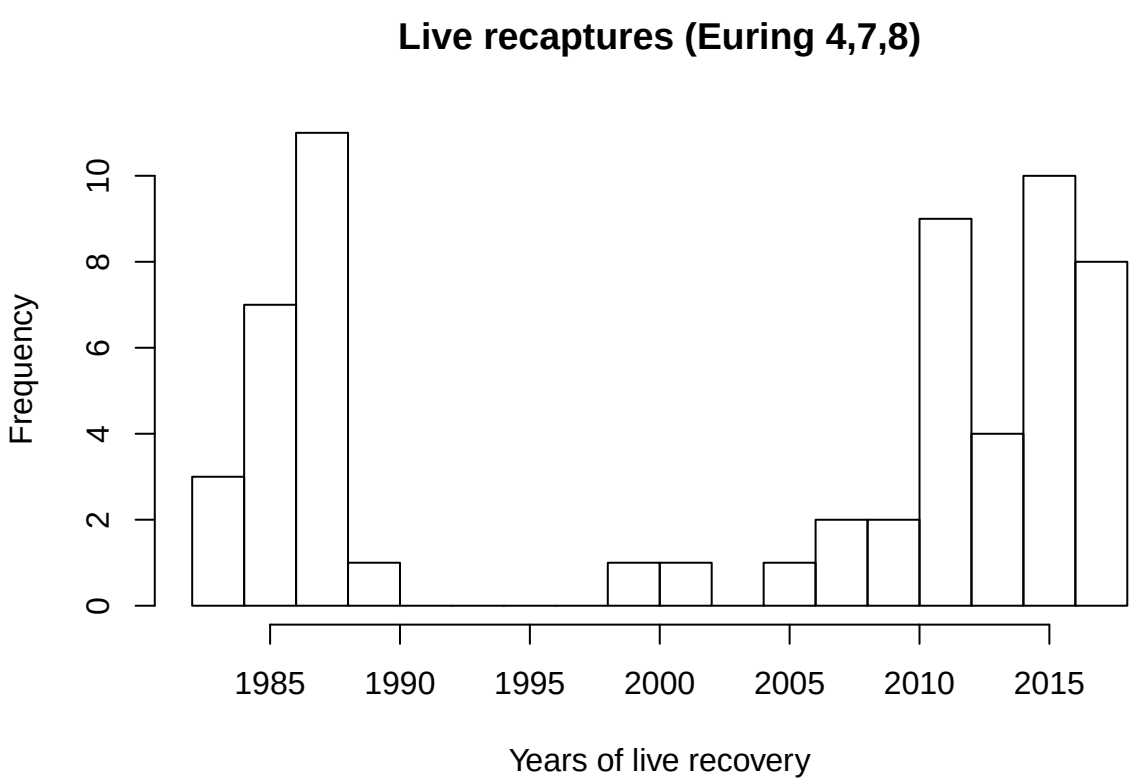
```
##  [1] 7/16/1986  5/16/1985  5/17/1987  5/14/1987  4/22/1985  2/4/1988
##  [7] 5/6/1988   5/6/1987   5/21/1988  6/3/1982   5/15/1985  5/16/1987
## [13] 5/10/1985  3/17/1984  5/28/1984  5/15/1987  10/30/1985 11/29/1986
## [19] 5/9/1988   7/28/1988  1/4/1988   9/13/1990  6/9/2009   8/27/2000
## [25] 3/6/2005   12/12/2001 6/5/2011   6/30/2007  10/23/2008 6/14/2014
## [31] 6/14/2015  6/5/2016   6/17/2017  5/4/2012   11/1/2011  10/1/2012
## [37] 1/2/2013   6/17/2010  6/16/2011  6/13/2012  6/16/2016  3/7/2015
## [43] 6/19/2017  6/17/2017  5/5/2012   2/26/2012  7/21/2012  6/11/2014
## [49] 1/22/2018  3/14/2016  1/5/2017   3/10/2017  6/9/2015   11/11/2014
```

```
## [55] 2/6/2016   3/10/2017  8/28/2015  8/13/2015  8/17/2016  10/19/2017
## 269 Levels: 10/10/2008 10/1/2012 10/15/1976 10/15/1981 ... 9/8/1982
```

```
drecov$Year[drecov$Condition_Euring_code %in% c(4,7,8)]
```

```
##  [1] "1986" "1985" "1987" "1987" "1985" "1988" "1988" "1987" "1988" "1982"
## [11] "1985" "1987" "1985" "1984" "1984" "1987" "1985" "1986" "1988" "1988"
## [21] "1988" "1990" "2009" "2000" "2005" "2001" "2011" "2007" "2008" "2014"
## [31] "2015" "2016" "2017" "2012" "2011" "2012" "2013" "2010" "2011" "2012"
## [41] "2016" "2015" "2017" "2017" "2012" "2012" "2012" "2014" "2018" "2016"
## [51] "2017" "2017" "2015" "2014" "2016" "2017" "2015" "2015" "2016" "2017"
```

```
vec_year_recovered_live = as.numeric(drecov$Year[drecov$Condition_Euring_code %in% c(4,7,8)])
hist(vec_year_recovered_live,breaks=20,xlab = "Years of live recovery", main = "Live recaptures (Euring
```




```
drecov$Date_recovered[drecov$Condition_Euring_code %in% c(7,8)]
```

```
##  [1] 5/16/1985  5/17/1987  5/14/1987  2/4/1988   5/6/1988   5/6/1987
##  [7] 5/21/1988  6/3/1982   5/15/1985  5/16/1987  5/10/1985  3/17/1984
```

```
## [13] 5/15/1987  10/30/1985 11/29/1986 5/9/1988   6/9/2009   8/27/2000
## [19] 3/6/2005   12/12/2001 6/5/2011   6/30/2007  10/23/2008 6/14/2014
## [25] 6/14/2015  6/5/2016   6/17/2017  5/4/2012   11/1/2011  10/1/2012
## [31] 1/2/2013   6/17/2010  6/16/2011  6/13/2012  6/16/2016  3/7/2015
## [37] 6/19/2017  6/17/2017  5/5/2012   2/26/2012  7/21/2012  6/11/2014
## [43] 1/22/2018  3/14/2016  1/5/2017   3/10/2017  11/11/2014 2/6/2016
## [49] 3/10/2017  8/13/2015  8/17/2016  10/19/2017
## 269 Levels: 10/10/2008 10/1/2012 10/15/1976 10/15/1981 ... 9/8/1982
```

```
### Check not a problem of date recording
drecov$Year[(drecov$Condition_Euring_code %in% c(4,7,8))&(drecov$Accurancy_of_date_Euring_code!=9)]
```

```
##  [1] "1986" "1985" "1987" "1987" "1985" "1988" "1988" "1987" "1988" "1982"
## [11] "1985" "1987" "1985" "1984" "1984" "1987" "1985" "1986" "1988" "1988"
## [21] "1988" "1990" "2009" "2000" "2005" "2001" "2011" "2007" "2008" "2014"
## [31] "2015" "2016" "2017" "2012" "2011" "2012" "2013" "2010" "2011" "2012"
## [41] "2016" "2015" "2017" "2017" "2012" "2012" "2012" "2014" "2018" "2016"
## [51] "2017" "2017" "2015" "2014" "2016" "2017" "2015" "2015" "2016" "2017"
```

```
drecov$Accurancy_of_date_Euring_code[drecov$Condition_Euring_code %in% c(4,7,8)]
```

```
##  [1] 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
## [36] 0 0 0 0 0 0 0 0 0 0 0 5 0 0 0 0 0 0 0 0 0 0 0 0 0
```

```
table(drecov$Accurancy_of_date_Euring_code)
```

```
##
##   0   1   2   3   4   5   9
## 212   8   5   9   6   5  45
```

| Accuracy of date Code | Meaning |
|---|---|
| 0 | Accurate to the day |
| 1 | Accurate to within 1 day either side of date coded. |
| 2 | Accurate to within 3 days either side of date coded. |

| Accuracy of date Code | Meaning |
|---|---|
| 3 | Accurate to within 1 week either side of date coded. |
| 4 | Accurate to within 2 weeks either side of date coded. |
| 5 | Accurate to within 6 weeks either side of date coded. |
| 6 | Accurate to within 3 months either side of date coded. |
| 7 | Accurate to within 6 months either side of date coded. |
| 8 | Accurate to within some years only |
| 9 | Date of earliest possible use of ring (EURING for details) |

For the circumstances, see the EURING pdf. Here are the numbers for the various categories

```
table(drecov$Circumstances_Euring_code)
```

```
##
##   1   2  11  20  28  29  32  35  40  43  46  48  50  58  62  63
## 110   2   7  14   7  25   3   1  23  17   5   1  23  50   1   1
```

Old codes

I'm attempting below to fill this gap but may need some help

| AGE Code | Meaning |
|---|---|
| 100 | unfledged young |
| 101 | unfledged young at the nest |
| 501 | adult at the nest |

| RECOVERY Code | Meaning |
|---|---|
| 100 | found dead |
| 120 | found dead for a long time |
| 121 | found dead with one tag only? |
| 146 | found dead just outside the nest |
| 5700 | read colourmark |
| 981,996 | found injured and had to kill it |

| RECOVERY Code | Meaning |
|---|---|