Turbot life-history parameters for MYAS project

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26 November 2018

MYDAS

The MYDAS project https://github.com/laurieKell/mydas requires realistic life-history parameters for each of the case-study stocks. By default these are obtained from http://www.fishbase.org but the quality of these parameters is difficult to judge. For Pollack the MI has a reasonable amount of data available from surveys, observer trips and port sampling. Age data are available for the landings data for 2016 and 2017 and for a number of surveys.

Data extraction

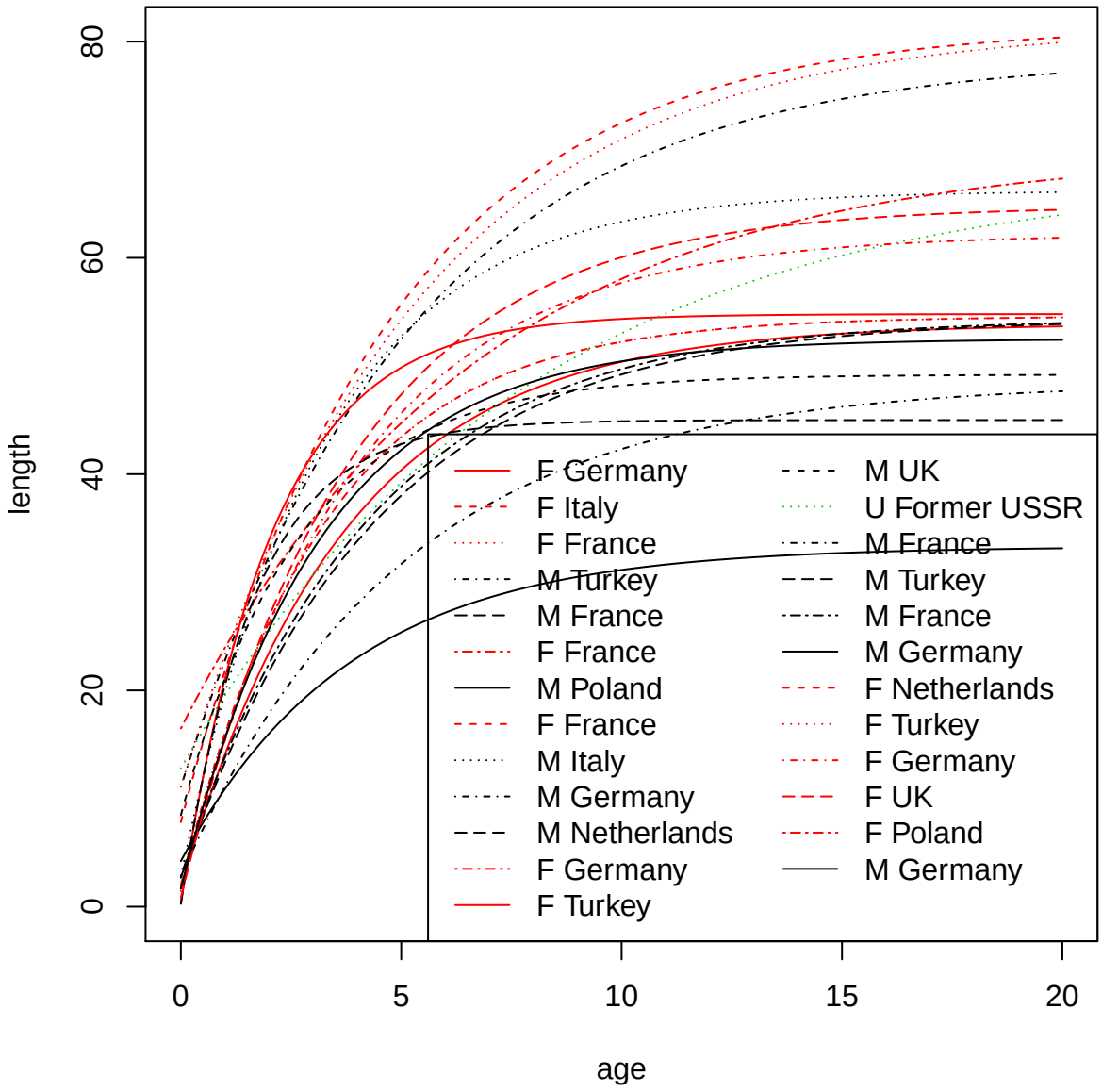
First load the required libraries

Fishbase

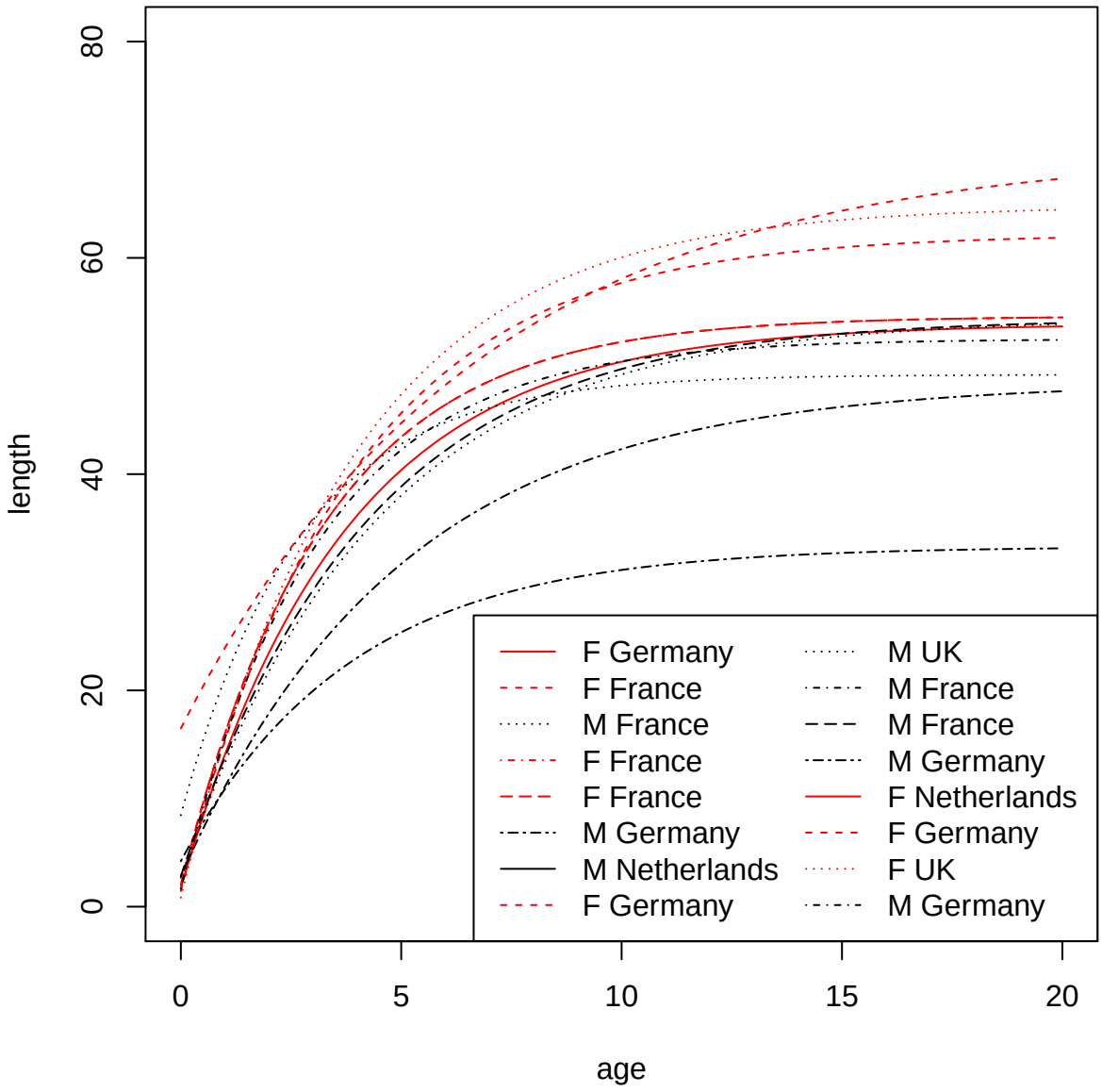
```
##       linf          k         t0          a          b        a50
## 58.6840000  0.2868000 -0.4194737  0.0203800  2.9250000  4.0000000
##        l50
## 43.2500000
```

Growth

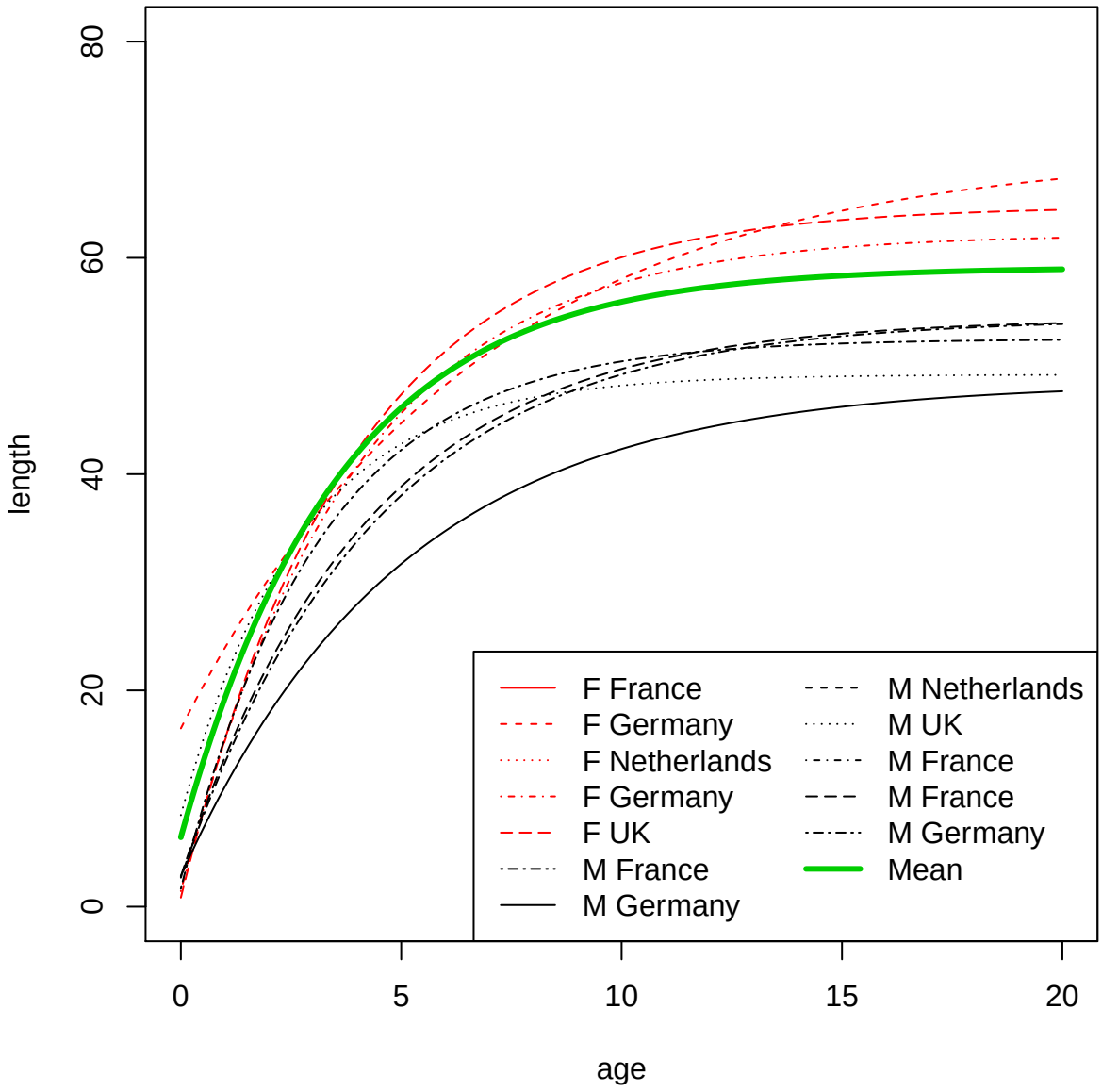
The MI have no age data for turbot. The fishbase data are quite variable but some of that can be explained by differences in growth between males and females. I wouldnt trust L50<60 for females, or L50<45 for males (we do get males at least as large as 60cm).



What if we subset the data only for the north-east Atlantic:



We still have male linf < 45 and female <60, lets remove those too:

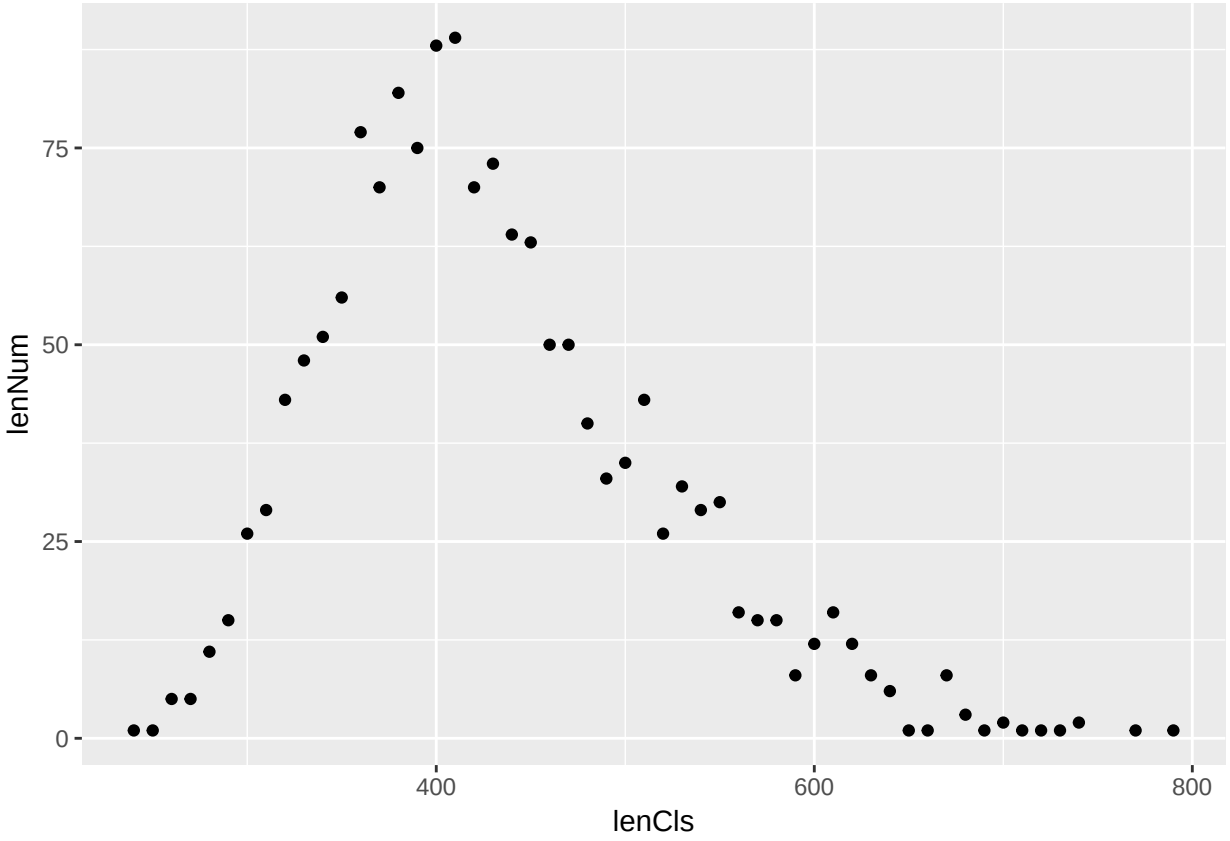


This looks quite reasonable. The mean growth parameters of the remaining data are: Linf = 59.1, k = 0.28 and t0 = -0.4.

If we want sex-specific growth parameters, the female means are: Linf = 67.5, k = 0.25 and t0 = -0.6.

And the males: Linf = 53.2, k = 0.3 and t0 = -0.3.

Length frequency of the landings



The largest fish is 79 cm. That can tell us something about Linf. If growth levels off in the older fish, you would expect the largest fish to be a couple of standard deviations above Linf, so you wouldnt expect Linf to be less than, say 60cm.

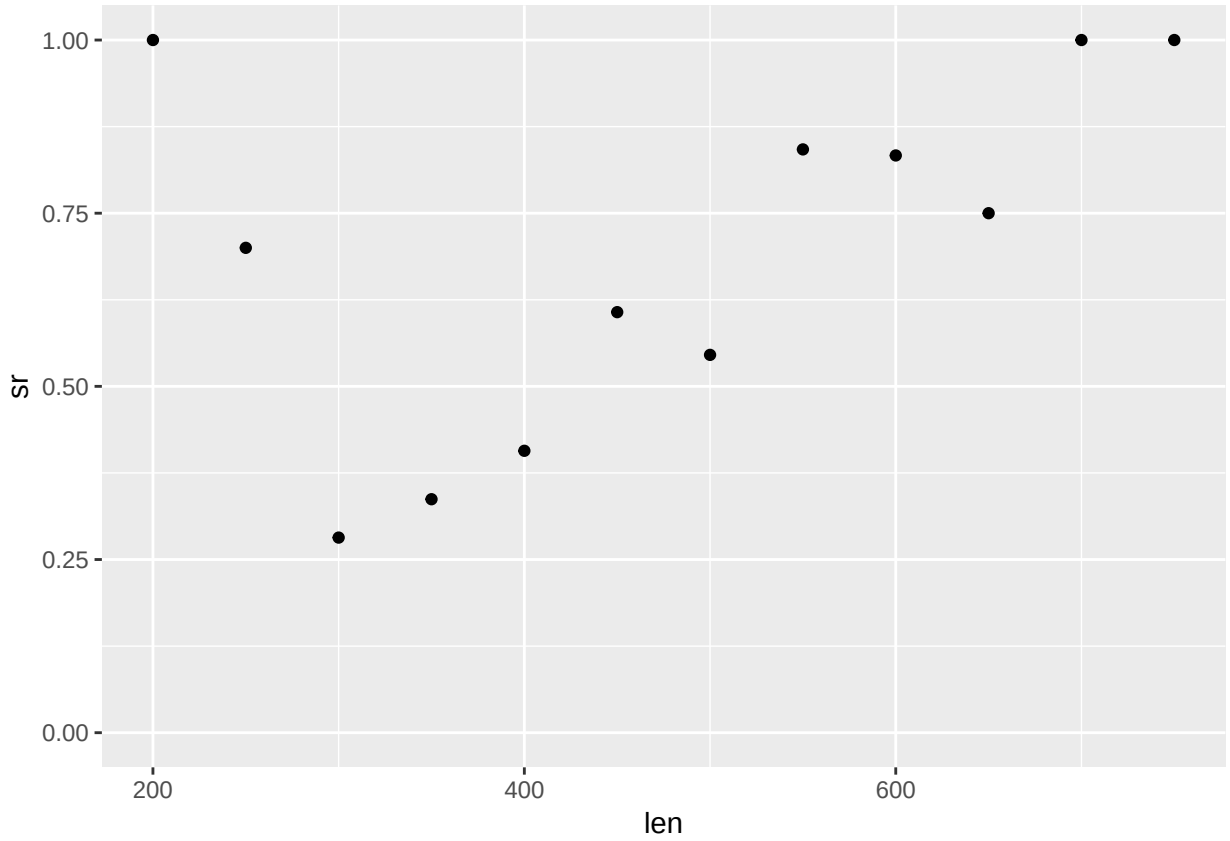
Biological data

The MI has no age data but quite a few observations of sex, maturity and individual weight:

```
## # A tibble: 12 x 7
## # Groups:   dataType [?]
##    dataType dataSource total  aged   sex   mat    wt
##    <fct>    <fct>      <int> <int> <int> <int> <int>
##  1 Survey   IAMS2016      16     0    16    16    16
##  2 Survey   IAMS2017      13     0    13    13    13
##  3 Survey   IBES2017       2     0     2     2     2
##  4 Survey   IGFS2009      26     0    26    26    26
##  5 Survey   IGFS2010      45     0    45    45    45
##  6 Survey   IGFS2011      35     0    35    35    35
##  7 Survey   IGFS2012      37     0    37    37    37
##  8 Survey   IGFS2013      22     0    22    22    22
##  9 Survey   IGFS2014      39     0    39    39    39
## 10 Survey   IGFS2015      44     0    44    44    44
## 11 Survey   IGFS2016      58     0    58    58    58
## 12 Survey   IGFS2017      36     0    36    36    36
```

Growth by sex

We have no age data but might be worth looking at sex to see if they grow/die at different rates



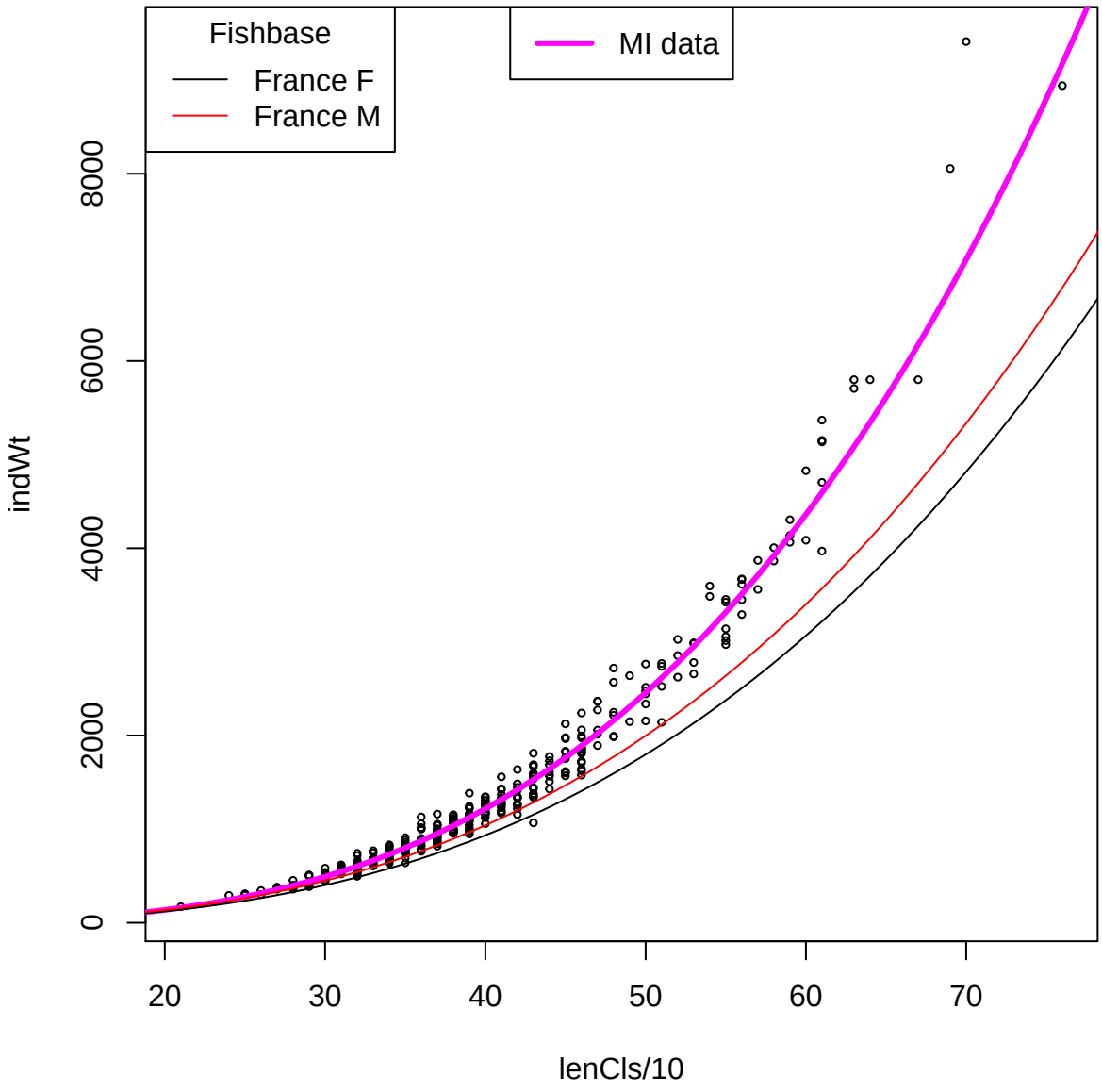
Yes. All large turbot are females, that means that either the males die before they get big or that they grow slower or stop growing sooner.

Length-weight

Fit a linear model

```
##
## Call:
## lm(formula = log(indWt) ~ log(lenCls/10))
##
## Coefficients:
##    (Intercept)  log(lenCls/10)
##         -4.500           3.146
```

Compare this to fishbase

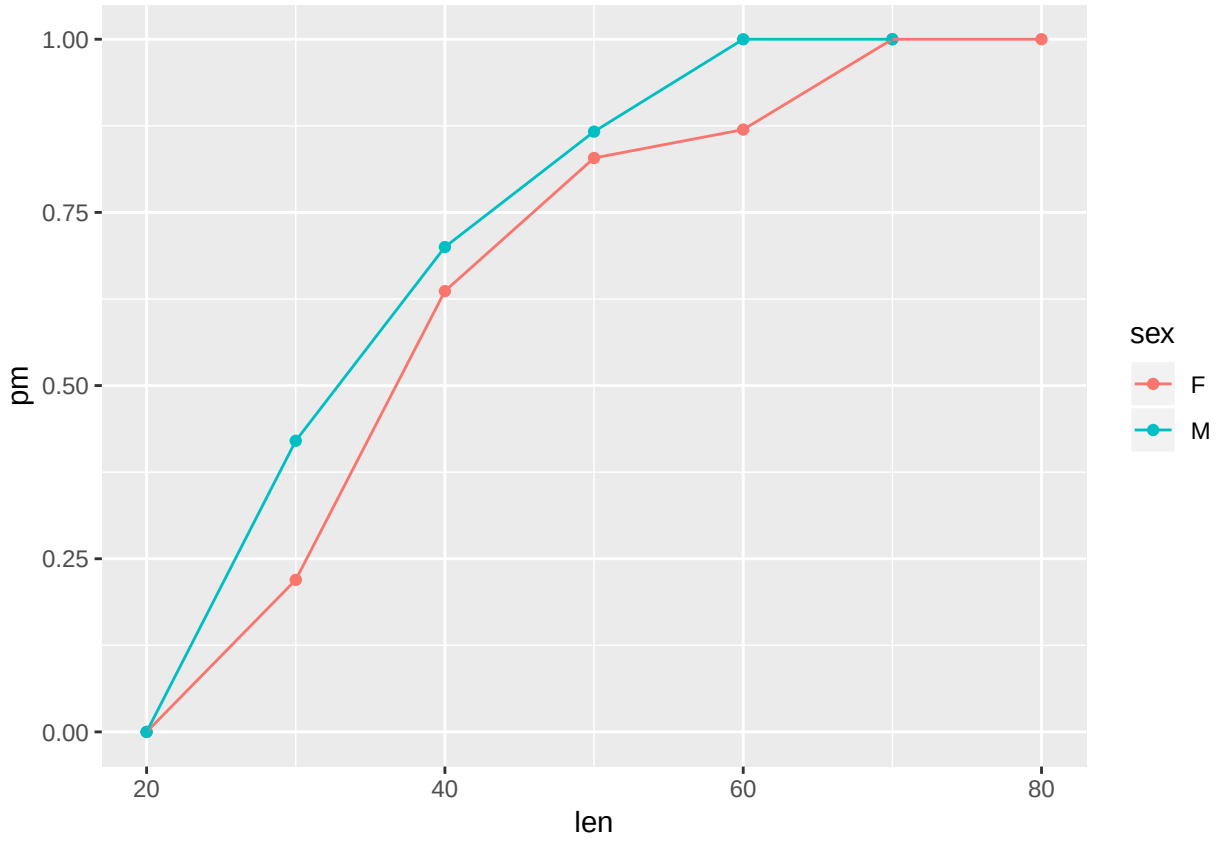


French data dont look so good. Lets just use the MI data.

Conclusion: the suggested final length-weight parameters are: a = 0.01111; b = 3.15

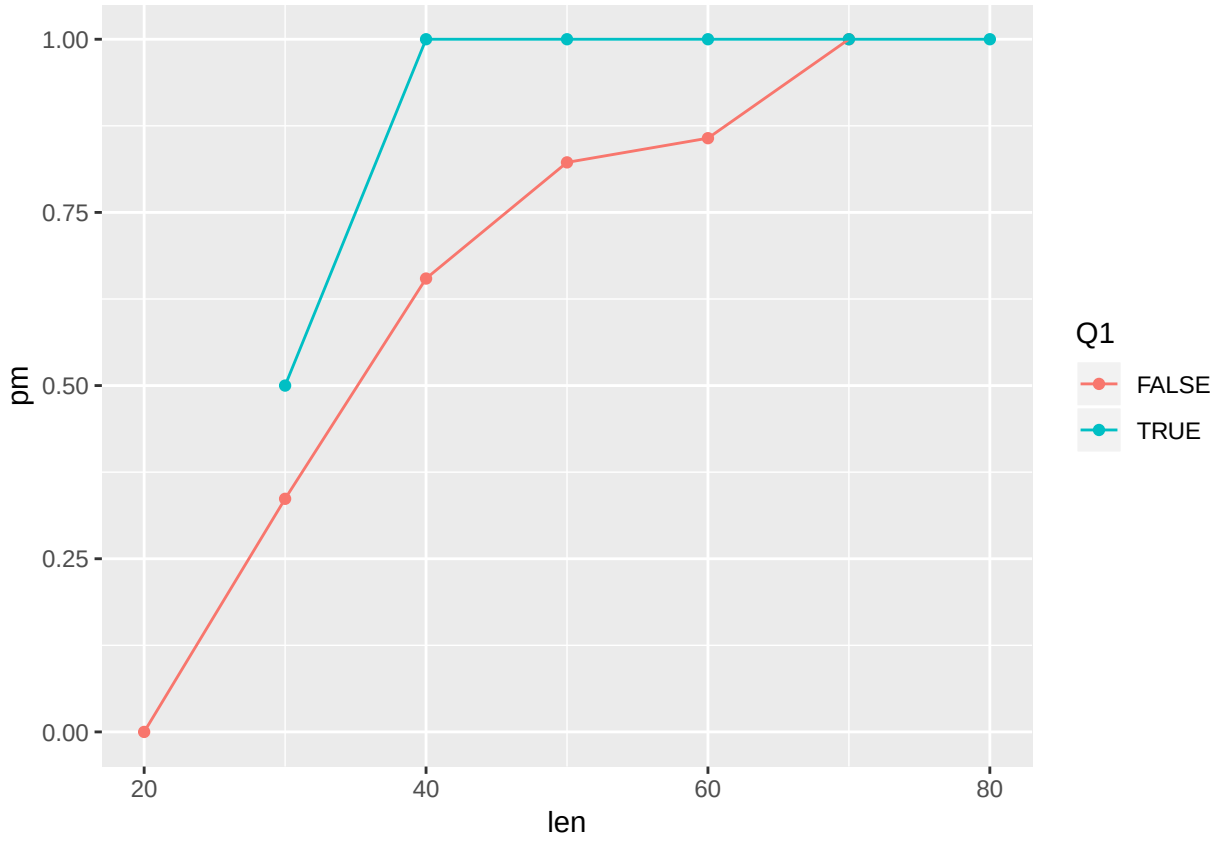
Maturity

All data



You get different results in spring, compared to Q4, it is probably only possible to tell the difference between virgin and spent in spring. But not much data. Best guess: L50 around 30cm. Maybe best just to use fishbase

```
## # A tibble: 6 x 4
## # Groups:   len [6]
##     len Q1       pm count
##   <dbl> <lgl> <dbl> <int>
## 1    30 TRUE    0.5     6
## 2    40 TRUE    1      11
## 3    50 TRUE    1       5
## 4    60 TRUE    1       7
## 5    70 TRUE    1       1
## 6    80 TRUE    1       1
```



Summary

Growth parameters: Average from fishbase seems reasonable after removing outliers and data from Med and Baltic but note difference between male and female.

Both sexes: Linf = 59.1, k = 0.28 and t0 = -0.4.

Female only: Linf = 67.5, k = 0.25 and t0 = -0.6.

Male only: Linf = 53.2, k = 0.3 and t0 = -0.3.

Length-weight parameters: a = 0.01111; b = 3.15

Maturity: 30cm? Fishbase is probably better.