Pollock life-history parameters for MYAS project

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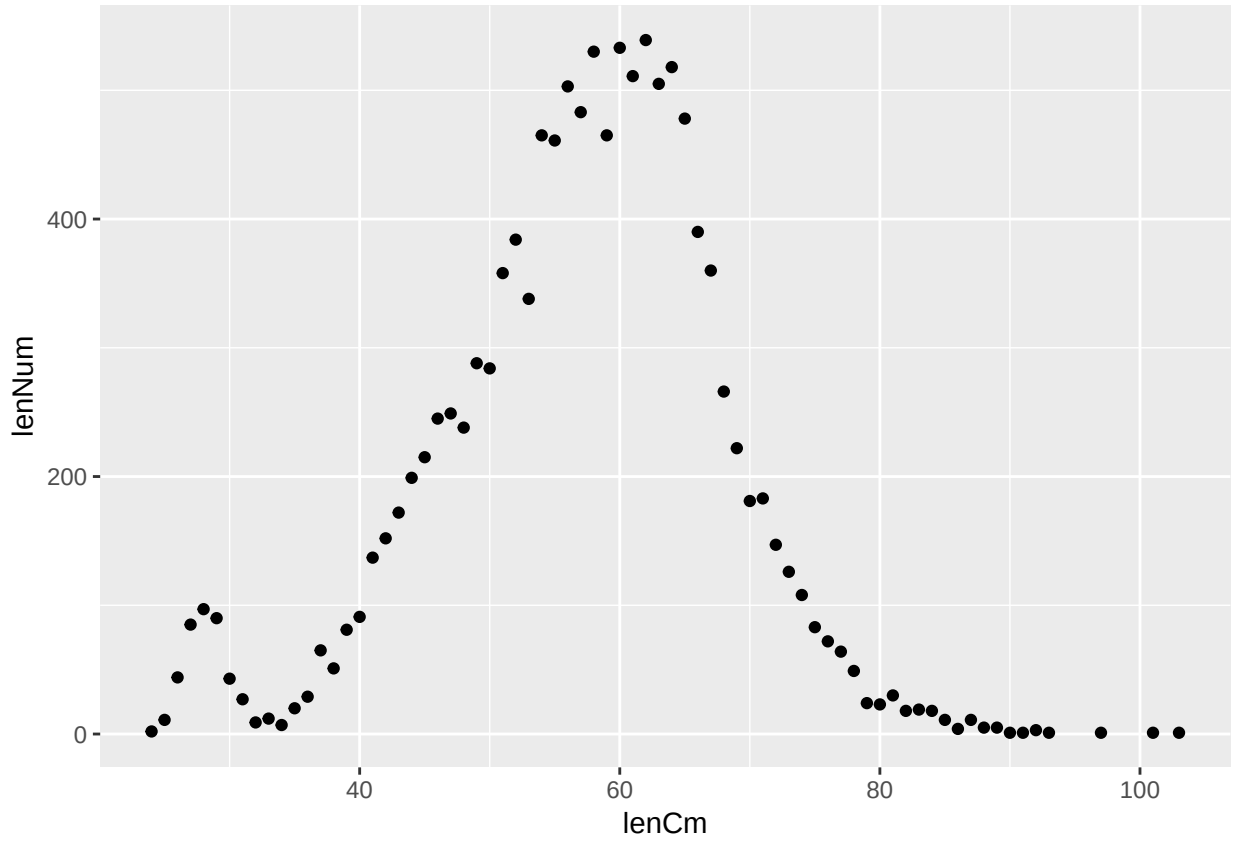
26 November 2018

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.

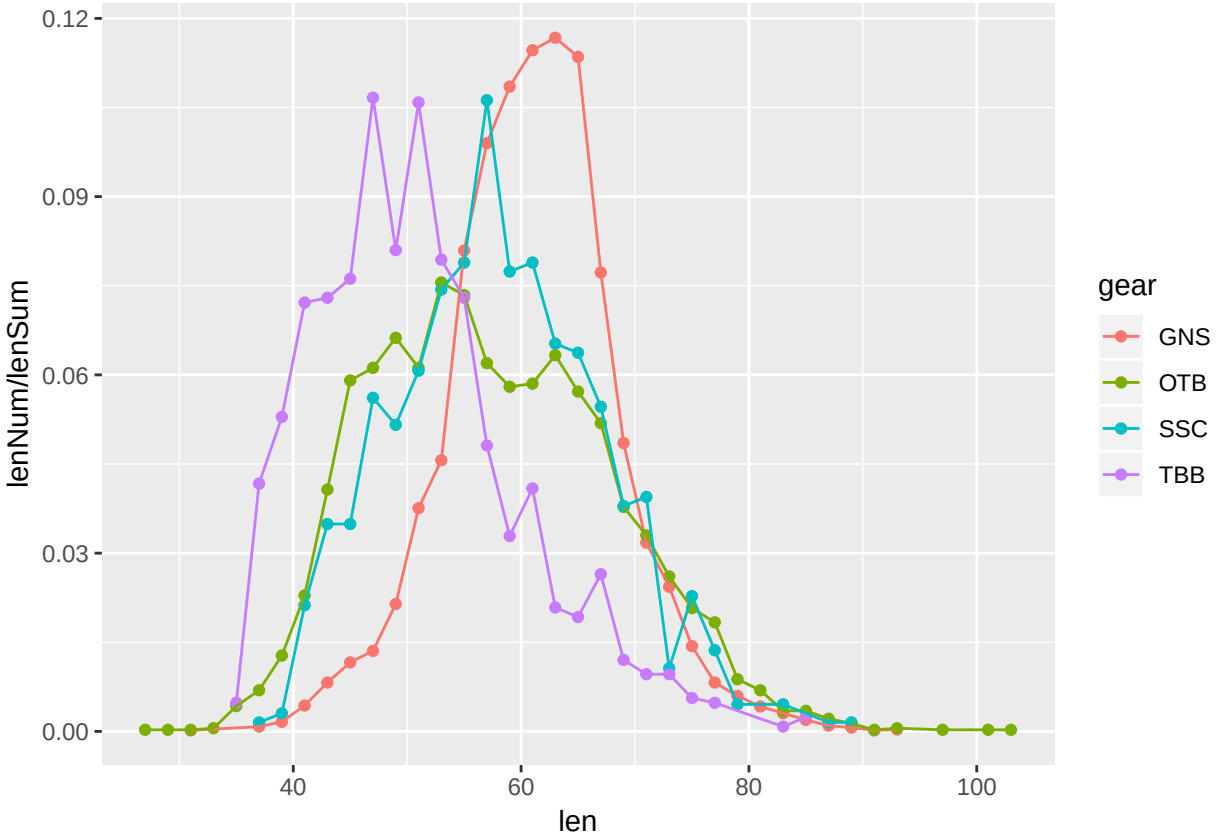
Length frequency of the landings



The largest observed fish is 103 cm. That can tell us something about Linf. If growth flattens 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 80cm.

Note that there are some fish below 30cm. It turns out that these are all from a single sample; could well be species mis-identification.

Length-frequency by gear



Most of the landings are from gillnets, other gears seem to catch relatively more fish below 50cm suggesting the gillnets may have a higher L50 for gear selectivity. (or they operate in areas where smaller fish are not available) There is no obvious difference in the selectivity of the larger fish (with gillnets you expect a dome-shaped selection). Perhaps otter trawls and seines catch a few more fish >70 relative to gillnets.

There is also the issue of availability; the younger fish simply do not seem to be available to the commercial fishery. Beam trawls seem to catch the smallest pollack.

Biological data

We have aged fish from the landings in 2016-17, from the IAMS (anglerfish) surveys in 2016-17, a couple from IBES (beam trawl) 2016-17 and from IGFS (ibts) in 2016-17. Also some individual weights and maturity from other IGFS surveys.

```
## # A tibble: 16 x 7
## # Groups:   dataType [?]
##    dataType dataSource total  aged   sex   mat    wt
##    <fct>    <fct>      <int> <int> <int> <int> <int>
##  1 Landings Lan2015        4     0     4     4     4
##  2 Landings Lan2016      438   436     0    NA   438
##  3 Landings Lan2017      646   645     0    NA   646
##  4 Landings Lan2018      623     0     0    NA   621
##  5 Survey   IAMS2016      36    36    36    36    36
##  6 Survey   IAMS2017      39    39    39    39    39
```

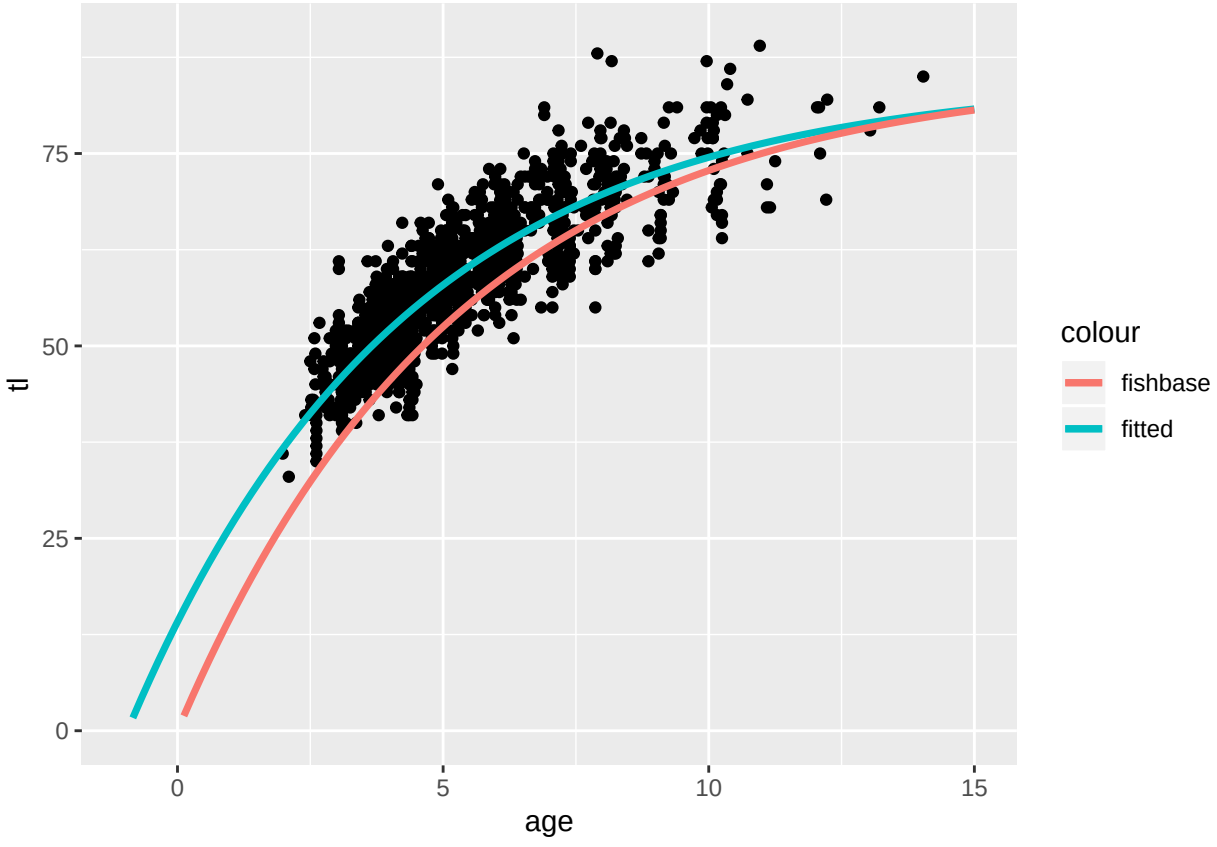
```
##  7 Survey   IBES2016       1     1     1     1     1
##  8 Survey   IBES2017       3     2     3     3     3
##  9 Survey   IGFS2010      38     0    38    38    38
## 10 Survey   IGFS2011      38     0    38    38    38
## 11 Survey   IGFS2012      23     0    23    23    23
## 12 Survey   IGFS2013      82     0    82    82    82
## 13 Survey   IGFS2014      42     0    41    42    42
## 14 Survey   IGFS2015       9     0     9     9     9
## 15 Survey   IGFS2016      24    24    24    24    24
## 16 Survey   IGFS2017      18    18    18    18    18
```

Growth

Fitting a VBGF to the raw age data gives the parameters below. Note that there may be some bias due to length-stratified sampling.

```
##       Linf          K         t0
## 84.6191408  0.1941284 -0.9428006
```

These parameters are very close to those given by fishbase (Linf=85.6,k=0.19,t0=0) except for t0. The fishbase parameters do not fit very well, because of the difference in t0.

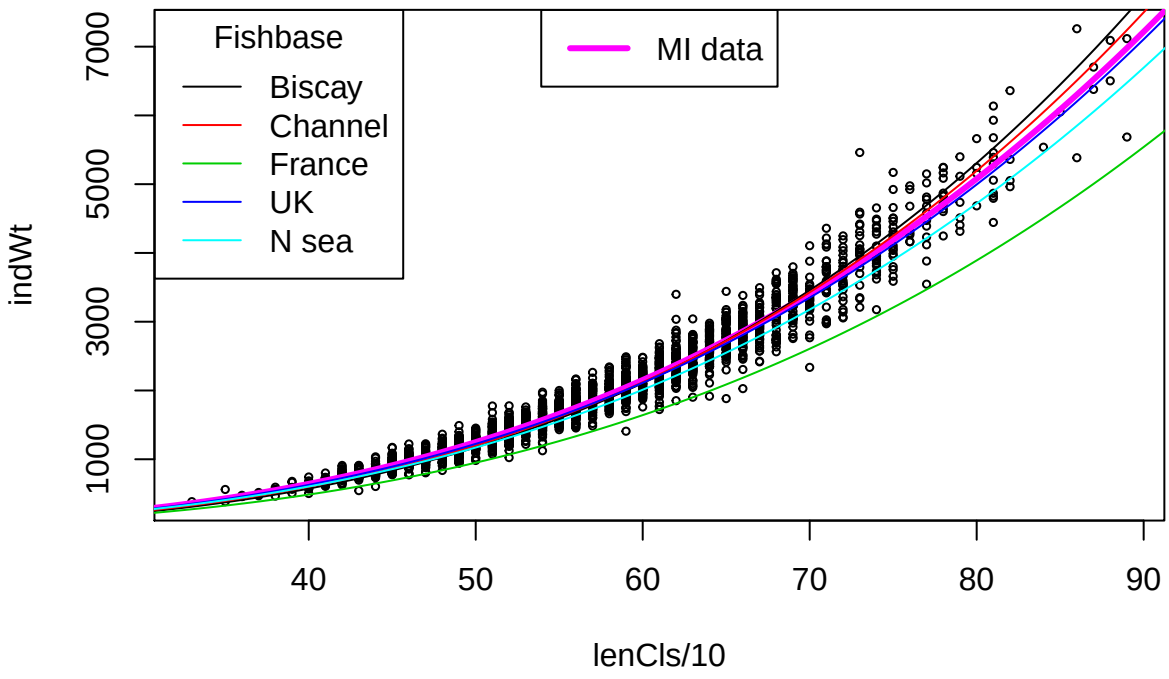


Conclusion: do not use the fishbase parameters but those based on MI data: Linf = 84.6; k = 0.19; t = -0.94

Length-weight

```
##
## Call:
## lm(formula = log(indWt) ~ log(lenCls/10))
##
## Coefficients:
##    (Intercept)  log(lenCls/10)
##         -4.541           2.984
```

Compare MI data to fishbase

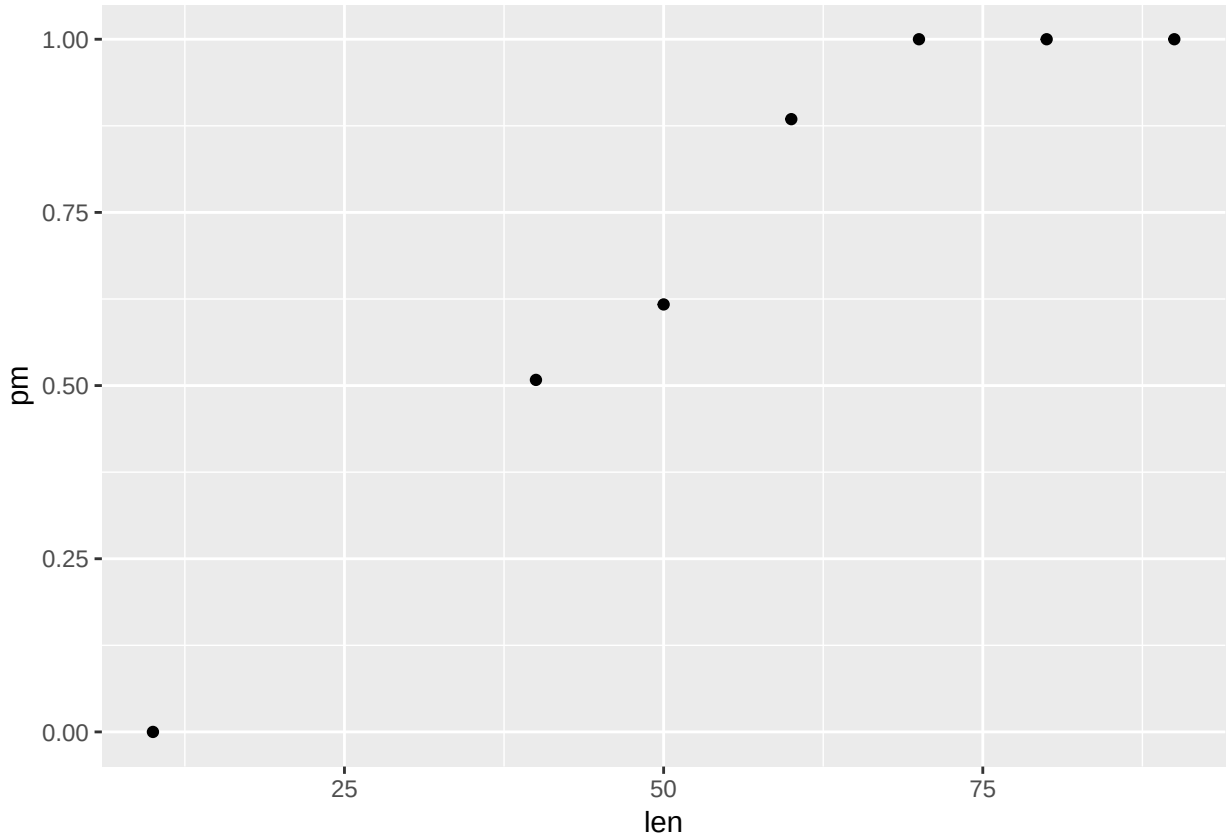


The data from France in fishbase looks wrong; this may be gutted weight? The MI data seems as good as any of the others.

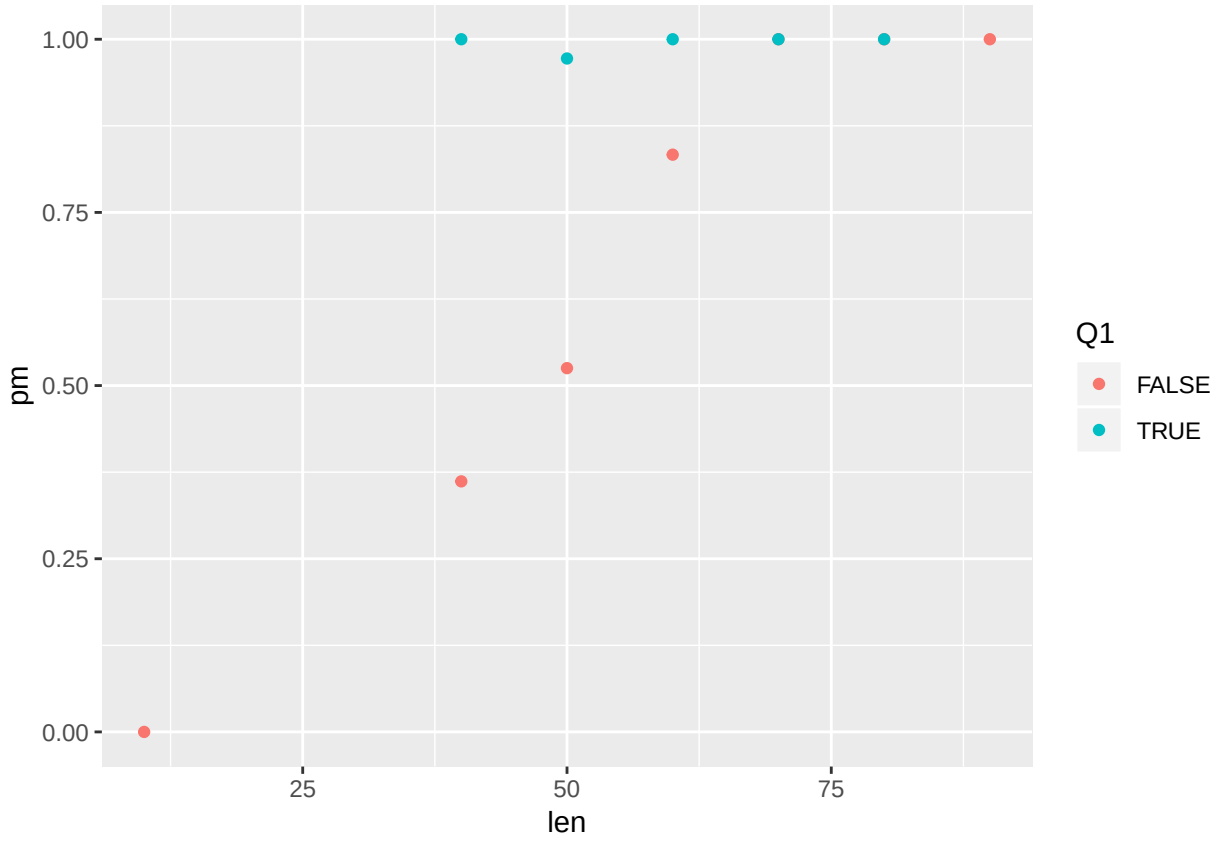
Conclusion: the suggested final length-weight parameters are: a = 0.0107; b = 2.98

Maturity

There seems to be an increasing number of mature fish up to 60cm when all data is included



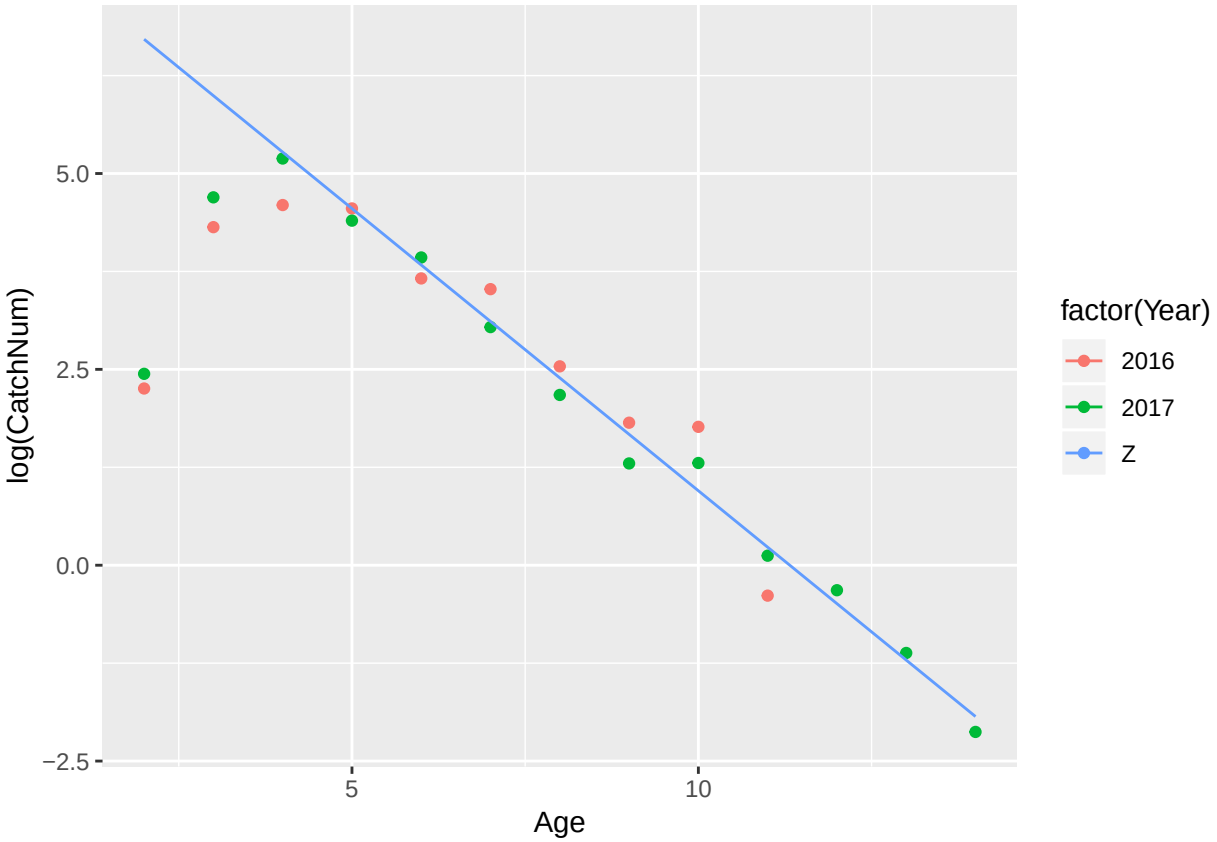
But it turns out that all the immature fish are from the Q4 surveys. At that time of year it is difficult to distinguish virgin from recovered fish. The data from the start of the year (spawning time) suggests nearly 100% mature fish in the catches



Conclusion: all fish caught in the spring surveys are mature; immature fish may not be available to the surveys. The assumed age of first maturity is 3. (Is this right Katie?)

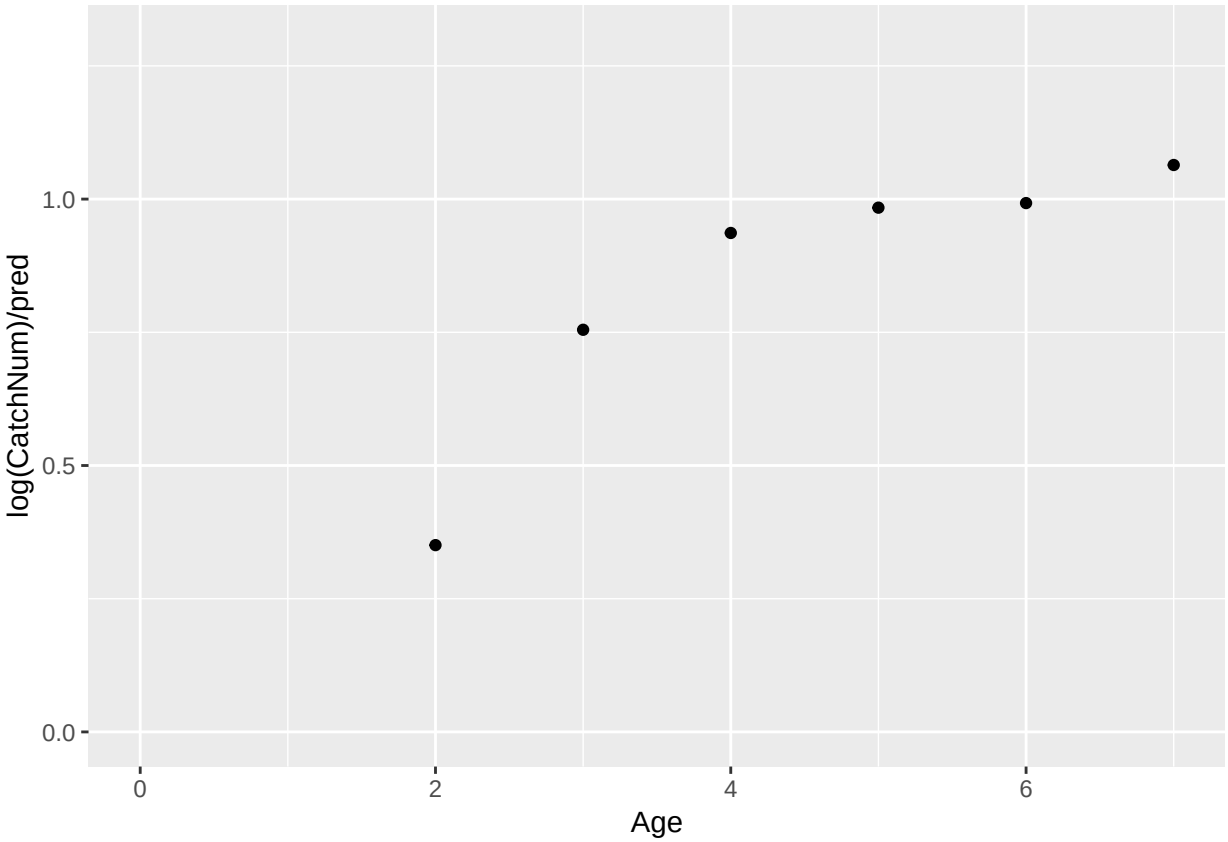
Total mortality and selectivity

If we apply the age length key data to the length frequency data we can get the numbers-at-age in the landings. We can then use this to see how quick they die from one age to the next. This is a rough measure of the total mortality (Z). If you substract the natural mortality from this, you get a ballpark figure of F.



The slope in the plot above is fitted over the average landings numbers at ages 5 to 9 in the two years. The slope is -0.72 which suggests that F might be in the ballbark of 0.52, which is pretty high; quite possibly above Fmsy

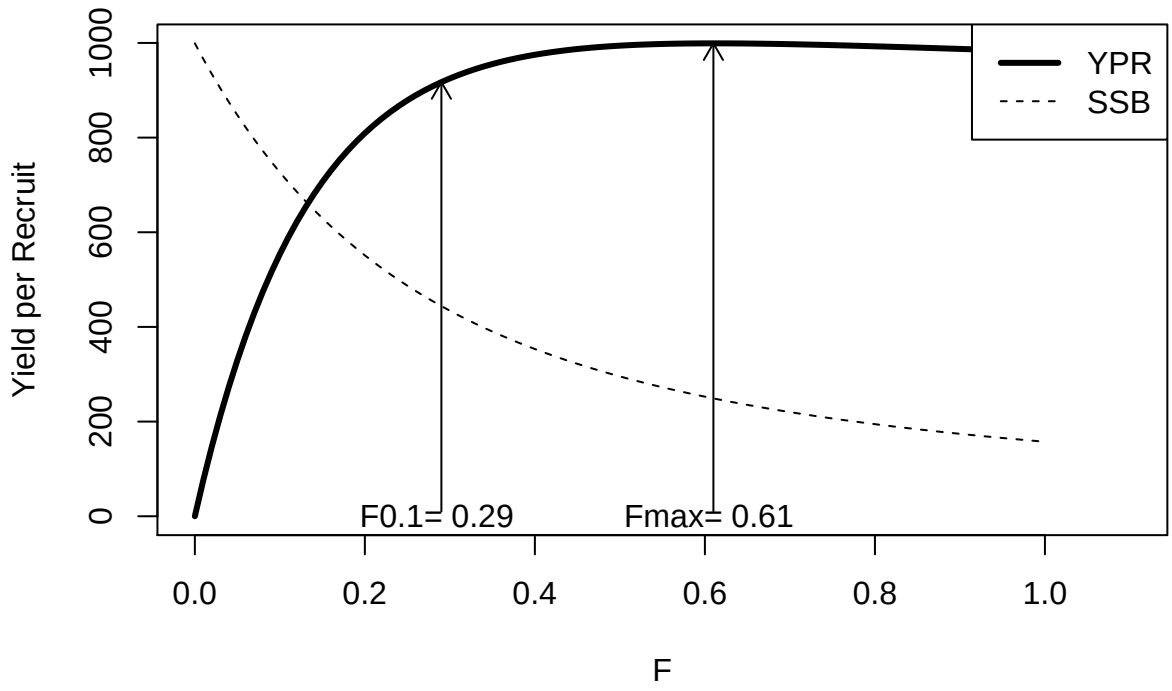
The other nice thing about estimating Z is that you can extrapolate Z over the younger ages to see how many you would expect if selectivity and Z were the same for all ages:



Conclusion: it looks like the age at 50% selectivity is somewhere between 2 and 3.

Thompson-Bell yield-per recruit

You can do a rough yield per recruit using the approach by Thompson and Bell (1934). For now assuming M=0.2, kife-edge maturity at age 3 and selectivity as above.



F01 can be used as a proxy for Fmsy. The F=Z-0.2 estimate of 0.52 is well above that. However F0.1 is quite conservative and F is below Fmax. The YPR is very flat-topped.

Summary

Growth parameters: Linf = 84.6; k = 0.19; t = -0.94

Length-weight parameters: a = 0.0107; b = 2.98

Maturity: knife edge at age 3 (?)

Selectivity: A50 between ages 2 and 3

Z: 0.72

F01: 0.29