



**NORTHEASTERN UNIVERSITY**

Toronto, Canada

## **Executive Summary of Module 2**

Introduction to Data Analysis  
(ALY6000)

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## Key Findings:

- In the following report, the analysis of data is of BullTroutRML2 in which assigned ages and fork lengths of Bull Trout from two Rocky Mountain (Harrison and Osprey) lakes in Alberta, CAN before and after a regulation change.

- For narrowing the analysis of Harrison Lake, we need to filter out other data except for Harrison Lake. So, the program to perform

Input:

```
Harrisonlake<-filter(BullTroutRML2, lake=="Harrison")  
Harrisonlake
```

- If there is a specific sort of data which you want to do analysis of other than the whole data, it is also done by creating a object in which we can load data.

For example, I want to make different set of data for first and last 3 records of main data then an object is created and that records are inserted in the object.

Input:

```
tmp <- headtail(Harrisonlake,3)
```

```
> tmp  
  age   f1      lake era  
1  14  459 Harrison  1  
2  12  449 Harrison  1  
3  10  471 Harrison  1  
59  7  245 Harrison  2  
60  7  279 Harrison  2  
61  5  245 Harrison  2
```

where tmp is the new object.

- To access one variable from a particular set of data, we can get it with the \$ symbol.

```
> tmp$era  
[1] 1 1 1 2 2 2  
>
```

- Different kind of vectors are also created, and those vectors can also be initiated into the values of the data.

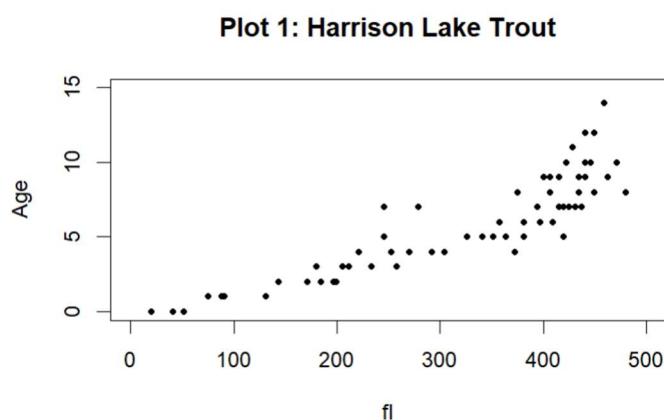
```
> #14. Create pchs vector
> pchs <- c("+", "x")
> pchs
[1] "+" "x"
> #15. Create cols vector
> cols<-c("red", "gray60")
> cols
[1] "red"     "gray60"
> #17. Combine cols vector to tmp era values
> cols[tmp$era]
[1] "red"     "red"      "red"      "gray60"  "gray60"  "gray60"
> |
```

- To understand the data properly, graphs are plotted to visualize the data clearly and have a better acknowledgement of the data.

The different types of graphs are shown below:

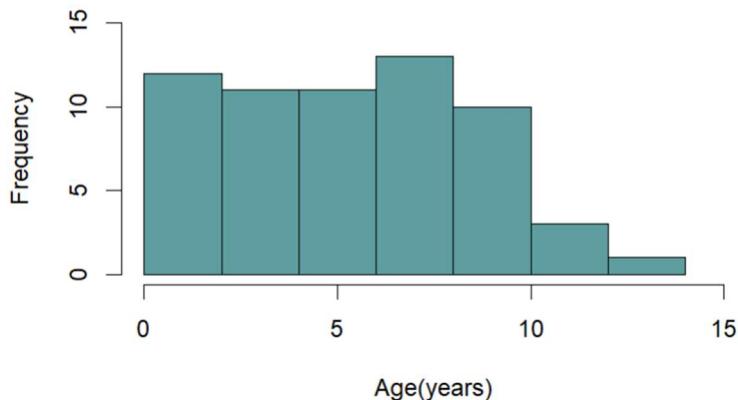
#### Plot 1:

The following scatterplot depicts the graph between age and fork length of the distinct fishes over the years in Harrison Lake Trout.

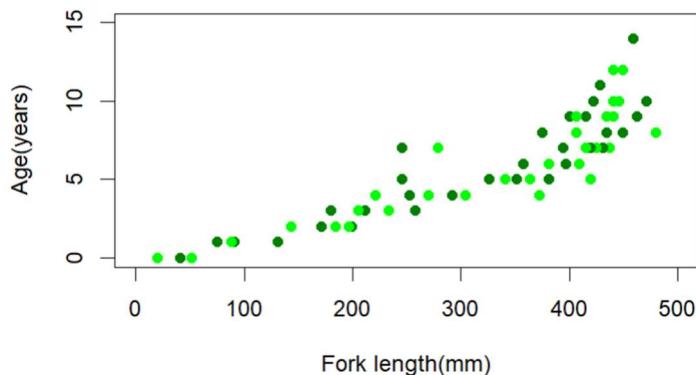


#### Plot 2:

This is a histogram of the age of the fish over the years with the frequency.

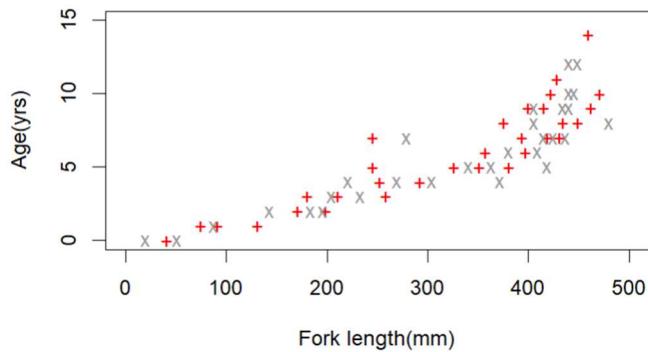
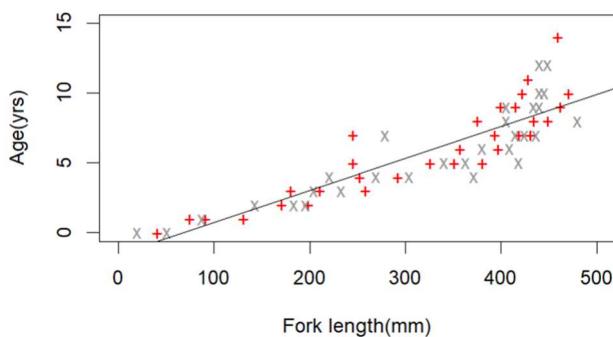
**Plot 2: Harrison Fish Age Distribution****Plot 3:**

This graph is same as the first graph except for the colours by which the graph is shaded. There are two different shades to understand the two different eras.

**Plot 3: Harrison Density Shaded by era****Plot 4 and 5:**

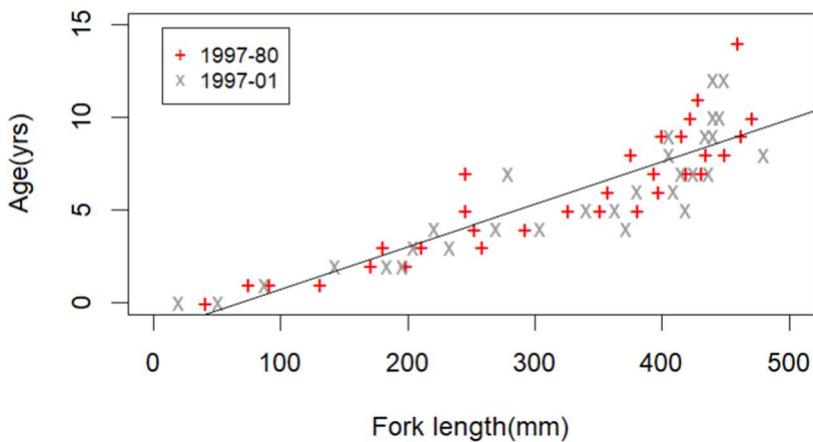
In 4<sup>th</sup> graph different values are assigned to different eras for much better understanding and in 5<sup>th</sup> one, a regression line is added which gives comprehensive analysis of the graph.

A regression line is used to predict the value of y for a given value of x.

**Plot 4: Symbol and Color by Era****Plot 5: Regression Overlay**

➤ **Plot 6:**

This is the final graph from which we can have the full understanding from the graph that fork length of fish increases with their age and even in different time era. Here we have mentioned the value of the dots which are plotted in the graph which are different timeframes.

**Plot 6: Legend overlay**

## Summary

- All the descriptive statistics which includes mean, median, variance etc are key findings in recognizing the pattern of the dataset.
- Scatterplots, histograms, frequency and probability distributions, bar plots (bar charts) are different types of graphs taken into consideration for explaining the visuals thoroughly.
- Visualization of data through R makes it so easy for analysts to get the clear picture of the dataset.
- In this assignment, the graphical representation of dataset gives a clear and proper understanding of the data.

## Bibliography

- <https://www.rdocumentation.org/packages/dplyr/versions/0.7.8/topics/filter>
- <https://libraryguides.mcgill.ca/c.php?g=699776&p=4968546>
- <https://www.statmethods.net/graphs/scatterplot.html>
- <https://www.datacamp.com/community/tutorials/make-histogram-basic-r>
- <https://www.geeksforgeeks.org/how-to-create-a-scatterplot-with-a-regression-line-in-r/>
- <http://www.sthda.com/english/wiki/add-legends-to-plots-in-r-software-the-easiest-way>

My GitHub repository : <https://github.com/dhruvang186/Module2>

# DhruvangPatel\_M2\_Project2.R

dhruvang

2022-01-25

```
#name
print("Plotting Basics:Dhruvang Patel")

## [1] "Plotting Basics:Dhruvang Patel"

r=getOption("repos")
r["CRAN"]="http://cran.us.r-project.org"
options(repos=r)
install.packages("vcd")

## Installing package into 'C:/Users/dhruvang/Documents/R/win-library/4.1'
## (as 'lib' is unspecified)

## package 'vcd' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##   C:\Users\dhruvang\AppData\Local\Temp\RtmpYvAedw\downloaded_packages

library(vcd)

## Loading required package: grid

#install plyr package
install.packages("plyr")

## Installing package into 'C:/Users/dhruvang/Documents/R/win-library/4.1'
## (as 'lib' is unspecified)

## package 'plyr' successfully unpacked and MD5 sums checked

## Warning: cannot remove prior installation of package 'plyr'

## Warning in file.copy(savedcopy, lib, recursive = TRUE): problem copying C:
##   \Users\dhruvang\Documents\R\win-library\4.1\00LOCK\plyr\libs\x64\plyr.dll to C:
##   \Users\dhruvang\Documents\R\win-library\4.1\plyr\libs\x64\plyr.dll: Permission
##   denied

## Warning: restored 'plyr'
```

```

## 
## The downloaded binary packages are in
##   C:\Users\dhruvang\AppData\Local\Temp\RtmpYvAedw\downloaded_packages

library(plyr)

#install FSA package
install.packages("FSA")

## Installing package into 'C:/Users/dhruvang/Documents/R/win-library/4.1'
## (as 'lib' is unspecified)

## package 'FSA' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##   C:\Users\dhruvang\AppData\Local\Temp\RtmpYvAedw\downloaded_packages

library(FSA)

## ## FSA v0.9.1. See citation('FSA') if used in publication.
## ## Run fishR() for related website and fishR('IFAR') for related book.

##
## Attaching package: 'FSA'

## The following object is masked from 'package:plyr':
## 
##     mapvalues

#install FSADATA package
install.packages("FSADATA")

## Installing package into 'C:/Users/dhruvang/Documents/R/win-library/4.1'
## (as 'lib' is unspecified)

## package 'FSADATA' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##   C:\Users\dhruvang\AppData\Local\Temp\RtmpYvAedw\downloaded_packages

library(FSADATA)

## ## FSADATA v0.3.8. See ?FSADATA to find data for specific fisheries analyses.

#install magrittr package
install.packages("magrittr")

## Installing package into 'C:/Users/dhruvang/Documents/R/win-library/4.1'
## (as 'lib' is unspecified)

```

```

## package 'magrittr' successfully unpacked and MD5 sums checked

## Warning: cannot remove prior installation of package 'magrittr'

## Warning in file.copy(savedcopy, lib, recursive = TRUE):
## problem copying C:\Users\dhruvang\Documents\R\win-
## library\4.1\00LOCK\magrittr\libs\x64\magrittr.dll to C:
## \Users\dhruvang\Documents\R\win-library\4.1\magrittr\libs\x64\magrittr.dll:
## Permission denied

## Warning: restored 'magrittr'

## 
## The downloaded binary packages are in
## C:\Users\dhruvang\AppData\Local\Temp\RtmpYvAedw\downloaded_packages

library(magrittr)

#install dplyr package
install.packages("dplyr")

## Installing package into 'C:/Users/dhruvang/Documents/R/win-library/4.1'
## (as 'lib' is unspecified)

## package 'dplyr' successfully unpacked and MD5 sums checked

## Warning: cannot remove prior installation of package 'dplyr'

## Warning in file.copy(savedcopy, lib, recursive = TRUE): problem copying C:
## \Users\dhruvang\Documents\R\win-library\4.1\00LOCK\dplyr\libs\x64\dplyr.dll
## to C:\Users\dhruvang\Documents\R\win-library\4.1\dplyr\libs\x64\dplyr.dll:
## Permission denied

## Warning: restored 'dplyr'

## 
## The downloaded binary packages are in
## C:\Users\dhruvang\AppData\Local\Temp\RtmpYvAedw\downloaded_packages

library(dplyr)

## 
## Attaching package: 'dplyr'

## The following objects are masked from 'package:plyr':
## 
##     arrange, count, desc, failwith, id, mutate, rename, summarise,
##     summarise

```

```

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union

#install plotrix package
install.packages("plotrix")

## Installing package into 'C:/Users/dhruvang/Documents/R/win-library/4.1'
## (as 'lib' is unspecified)

## package 'plotrix' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##   C:\Users\dhruvang\AppData\Local\Temp\RtmpYvAedw\downloaded_packages

library(plotrix)

#install ggplot2 package
install.packages("ggplot2")

## Installing package into 'C:/Users/dhruvang/Documents/R/win-library/4.1'
## (as 'lib' is unspecified)

## package 'ggplot2' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##   C:\Users\dhruvang\AppData\Local\Temp\RtmpYvAedw\downloaded_packages

library(ggplot2)

#install moments package
install.packages("moments")

## Installing package into 'C:/Users/dhruvang/Documents/R/win-library/4.1'
## (as 'lib' is unspecified)

## package 'moments' successfully unpacked and MD5 sums checked
##
## The downloaded binary packages are in
##   C:\Users\dhruvang\AppData\Local\Temp\RtmpYvAedw\downloaded_packages

library(moments)

#Load the dataset
data(BullTroutRML2)
BullTroutRML2

```

```
##      age   fl     lake    era
## 1     14 459 Harrison 1977-80
## 2     12 449 Harrison 1977-80
## 3     10 471 Harrison 1977-80
## 4     10 446 Harrison 1977-80
## 5      9 400 Harrison 1977-80
## 6      9 440 Harrison 1977-80
## 7      9 462 Harrison 1977-80
## 8      8 480 Harrison 1977-80
## 9      8 449 Harrison 1977-80
## 10     7 437 Harrison 1977-80
## 11     7 431 Harrison 1977-80
## 12     7 425 Harrison 1977-80
## 13     7 419 Harrison 1977-80
## 14     6 409 Harrison 1977-80
## 15     6 397 Harrison 1977-80
## 16     5 419 Harrison 1977-80
## 17     5 381 Harrison 1977-80
## 18     5 363 Harrison 1977-80
## 19     5 351 Harrison 1977-80
## 20     4 372 Harrison 1977-80
## 21     2 199 Harrison 1977-80
## 22     2 184 Harrison 1977-80
## 23     1  91 Harrison 1977-80
## 24    12 440 Harrison 1997-01
## 25    11 428 Harrison 1997-01
## 26    10 440 Harrison 1997-01
## 27    10 422 Harrison 1997-01
## 28     9 434 Harrison 1997-01
## 29     9 415 Harrison 1997-01
## 30     9 406 Harrison 1997-01
## 31     8 434 Harrison 1997-01
## 32     8 406 Harrison 1997-01
## 33     8 375 Harrison 1997-01
## 34     7 415 Harrison 1997-01
## 35     7 394 Harrison 1997-01
## 36     6 381 Harrison 1997-01
## 37     6 357 Harrison 1997-01
## 38     5 341 Harrison 1997-01
## 39     5 326 Harrison 1997-01
## 40     4 304 Harrison 1997-01
## 41     4 292 Harrison 1997-01
## 42     4 270 Harrison 1997-01
## 43     4 252 Harrison 1997-01
## 44     4 221 Harrison 1997-01
## 45     3 258 Harrison 1997-01
## 46     3 233 Harrison 1997-01
## 47     3 211 Harrison 1997-01
## 48     3 205 Harrison 1997-01
## 49     3 180 Harrison 1997-01
## 50     2 196 Harrison 1997-01
## 51     2 171 Harrison 1997-01
## 52     2 143 Harrison 1997-01
## 53     1 131 Harrison 1997-01
```

```

## 54   1  88 Harrison 1997-01
## 55   1  75 Harrison 1997-01
## 56   0  51 Harrison 1997-01
## 57   0  41 Harrison 1997-01
## 58   0  20 Harrison 1997-01
## 59   7 245 Harrison 1997-01
## 60   7 279 Harrison 1997-01
## 61   5 245 Harrison 1997-01
## 62   8 360  Osprey 1977-80
## 63   8 357  Osprey 1977-80
## 64   7 357  Osprey 1977-80
## 65   7 329  Osprey 1977-80
## 66   6 385  Osprey 1977-80
## 67   6 323  Osprey 1977-80
## 68   5 369  Osprey 1977-80
## 69   5 326  Osprey 1977-80
## 70   4 357  Osprey 1977-80
## 71   4 326  Osprey 1977-80
## 72   4 258  Osprey 1977-80
## 73   4 239  Osprey 1977-80
## 74   3 221  Osprey 1977-80
## 75   3 258  Osprey 1977-80
## 76   3 276  Osprey 1977-80
## 77  11 688  Osprey 1997-01
## 78  10 369  Osprey 1997-01
## 79   9 400  Osprey 1997-01
## 80   8 381  Osprey 1997-01
## 81   8 332  Osprey 1997-01
## 82   7 394  Osprey 1997-01
## 83   7 388  Osprey 1997-01
## 84   7 354  Osprey 1997-01
## 85   7 320  Osprey 1997-01
## 86   6 320  Osprey 1997-01
## 87   6 347  Osprey 1997-01
## 88   6 360  Osprey 1997-01
## 89   5 354  Osprey 1997-01
## 90   5 335  Osprey 1997-01
## 91   5 313  Osprey 1997-01
## 92   5 289  Osprey 1997-01
## 93   4 313  Osprey 1997-01
## 94   4 298  Osprey 1997-01
## 95   3 279  Osprey 1997-01
## 96   3 273  Osprey 1997-01

```

```

#4. Print first and last three records
head(BullTroutRML2,3)

```

```

##   age   fl     lake    era
## 1 14 459 Harrison 1977-80
## 2 12 449 Harrison 1977-80
## 3 10 471 Harrison 1977-80

```

```

tail(BullTroutRML2, 3)

##      age   fl    lake     era
## 94      4 298 Osprey 1997-01
## 95      3 279 Osprey 1997-01
## 96      3 273 Osprey 1997-01

#5. Remove all except Harrison Lake
Harrisonlake<-filter(BullTroutRML2, lake=="Harrison")
Harrisonlake

##      age   fl    lake     era
##  1     14 459 Harrison 1977-80
##  2     12 449 Harrison 1977-80
##  3     10 471 Harrison 1977-80
##  4     10 446 Harrison 1977-80
##  5      9 400 Harrison 1977-80
##  6      9 440 Harrison 1977-80
##  7      9 462 Harrison 1977-80
##  8      8 480 Harrison 1977-80
##  9      8 449 Harrison 1977-80
## 10     7 437 Harrison 1977-80
## 11     7 431 Harrison 1977-80
## 12     7 425 Harrison 1977-80
## 13     7 419 Harrison 1977-80
## 14     6 409 Harrison 1977-80
## 15     6 397 Harrison 1977-80
## 16     5 419 Harrison 1977-80
## 17     5 381 Harrison 1977-80
## 18     5 363 Harrison 1977-80
## 19     5 351 Harrison 1977-80
## 20     4 372 Harrison 1977-80
## 21     2 199 Harrison 1977-80
## 22     2 184 Harrison 1977-80
## 23     1  91 Harrison 1977-80
## 24    12 440 Harrison 1997-01
## 25    11 428 Harrison 1997-01
## 26    10 440 Harrison 1997-01
## 27    10 422 Harrison 1997-01
## 28     9 434 Harrison 1997-01
## 29     9 415 Harrison 1997-01
## 30     9 406 Harrison 1997-01
## 31     8 434 Harrison 1997-01
## 32     8 406 Harrison 1997-01
## 33     8 375 Harrison 1997-01
## 34     7 415 Harrison 1997-01
## 35     7 394 Harrison 1997-01
## 36     6 381 Harrison 1997-01
## 37     6 357 Harrison 1997-01
## 38     5 341 Harrison 1997-01
## 39     5 326 Harrison 1997-01
## 40     4 304 Harrison 1997-01
## 41     4 292 Harrison 1997-01

```

```
## 42  4 270 Harrison 1997-01
## 43  4 252 Harrison 1997-01
## 44  4 221 Harrison 1997-01
## 45  3 258 Harrison 1997-01
## 46  3 233 Harrison 1997-01
## 47  3 211 Harrison 1997-01
## 48  3 205 Harrison 1997-01
## 49  3 180 Harrison 1997-01
## 50  2 196 Harrison 1997-01
## 51  2 171 Harrison 1997-01
## 52  2 143 Harrison 1997-01
## 53  1 131 Harrison 1997-01
## 54  1  88 Harrison 1997-01
## 55  1  75 Harrison 1997-01
## 56  0  51 Harrison 1997-01
## 57  0  41 Harrison 1997-01
## 58  0  20 Harrison 1997-01
## 59  7 245 Harrison 1997-01
## 60  7 279 Harrison 1997-01
## 61  5 245 Harrison 1997-01
```

```
#6. Display first and last 5 records of new dataset
#first 5
head(Harrisonlake,5)
```

```
##   age   fl     lake    era
## 1 14 459 Harrison 1977-80
## 2 12 449 Harrison 1977-80
## 3 10 471 Harrison 1977-80
## 4 10 446 Harrison 1977-80
## 5  9 400 Harrison 1977-80
```

```
#last 5
tail(Harrisonlake,5)
```

```
##   age   fl     lake    era
## 57  0  41 Harrison 1997-01
## 58  0  20 Harrison 1997-01
## 59  7 245 Harrison 1997-01
## 60  7 279 Harrison 1997-01
## 61  5 245 Harrison 1997-01
```

```
#7. Structure of a dataset
structure(Harrisonlake)
```

```
##   age   fl     lake    era
## 1 14 459 Harrison 1977-80
## 2 12 449 Harrison 1977-80
## 3 10 471 Harrison 1977-80
## 4 10 446 Harrison 1977-80
## 5  9 400 Harrison 1977-80
## 6  9 440 Harrison 1977-80
```

```
## 7 9 462 Harrison 1977-80
## 8 8 480 Harrison 1977-80
## 9 8 449 Harrison 1977-80
## 10 7 437 Harrison 1977-80
## 11 7 431 Harrison 1977-80
## 12 7 425 Harrison 1977-80
## 13 7 419 Harrison 1977-80
## 14 6 409 Harrison 1977-80
## 15 6 397 Harrison 1977-80
## 16 5 419 Harrison 1977-80
## 17 5 381 Harrison 1977-80
## 18 5 363 Harrison 1977-80
## 19 5 351 Harrison 1977-80
## 20 4 372 Harrison 1977-80
## 21 2 199 Harrison 1977-80
## 22 2 184 Harrison 1977-80
## 23 1 91 Harrison 1977-80
## 24 12 440 Harrison 1997-01
## 25 11 428 Harrison 1997-01
## 26 10 440 Harrison 1997-01
## 27 10 422 Harrison 1997-01
## 28 9 434 Harrison 1997-01
## 29 9 415 Harrison 1997-01
## 30 9 406 Harrison 1997-01
## 31 8 434 Harrison 1997-01
## 32 8 406 Harrison 1997-01
## 33 8 375 Harrison 1997-01
## 34 7 415 Harrison 1997-01
## 35 7 394 Harrison 1997-01
## 36 6 381 Harrison 1997-01
## 37 6 357 Harrison 1997-01
## 38 5 341 Harrison 1997-01
## 39 5 326 Harrison 1997-01
## 40 4 304 Harrison 1997-01
## 41 4 292 Harrison 1997-01
## 42 4 270 Harrison 1997-01
## 43 4 252 Harrison 1997-01
## 44 4 221 Harrison 1997-01
## 45 3 258 Harrison 1997-01
## 46 3 233 Harrison 1997-01
## 47 3 211 Harrison 1997-01
## 48 3 205 Harrison 1997-01
## 49 3 180 Harrison 1997-01
## 50 2 196 Harrison 1997-01
## 51 2 171 Harrison 1997-01
## 52 2 143 Harrison 1997-01
## 53 1 131 Harrison 1997-01
## 54 1 88 Harrison 1997-01
## 55 1 75 Harrison 1997-01
## 56 0 51 Harrison 1997-01
## 57 0 41 Harrison 1997-01
## 58 0 20 Harrison 1997-01
## 59 7 245 Harrison 1997-01
## 60 7 279 Harrison 1997-01
```

```
## 61 5 245 Harrison 1997-01
```

```
#8. Summary of a dataset  
summary(Harrisonlake)
```

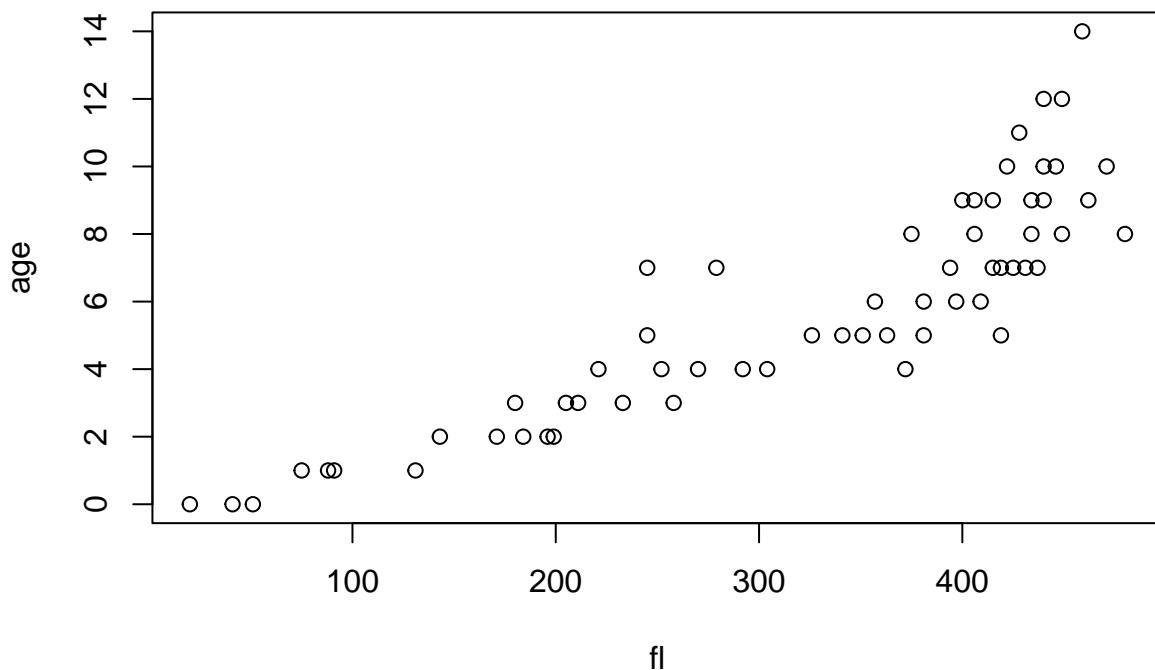
```
##      age          fl         lake        era  
##  Min.   : 0.000   Min.   : 20   Harrison:61   1977-80:23  
##  1st Qu.: 3.000   1st Qu.:221   Osprey   : 0   1997-01:38  
##  Median : 6.000   Median :372  
##  Mean   : 5.754   Mean   :319  
##  3rd Qu.: 8.000   3rd Qu.:425  
##  Max.   :14.000   Max.   :480
```

```
#9. Create a scatterplot with specifications
```

```
#assign values  
fl<-Harrisonlake$fl  
age<-Harrisonlake$age  
#plot the data  
par("mar")
```

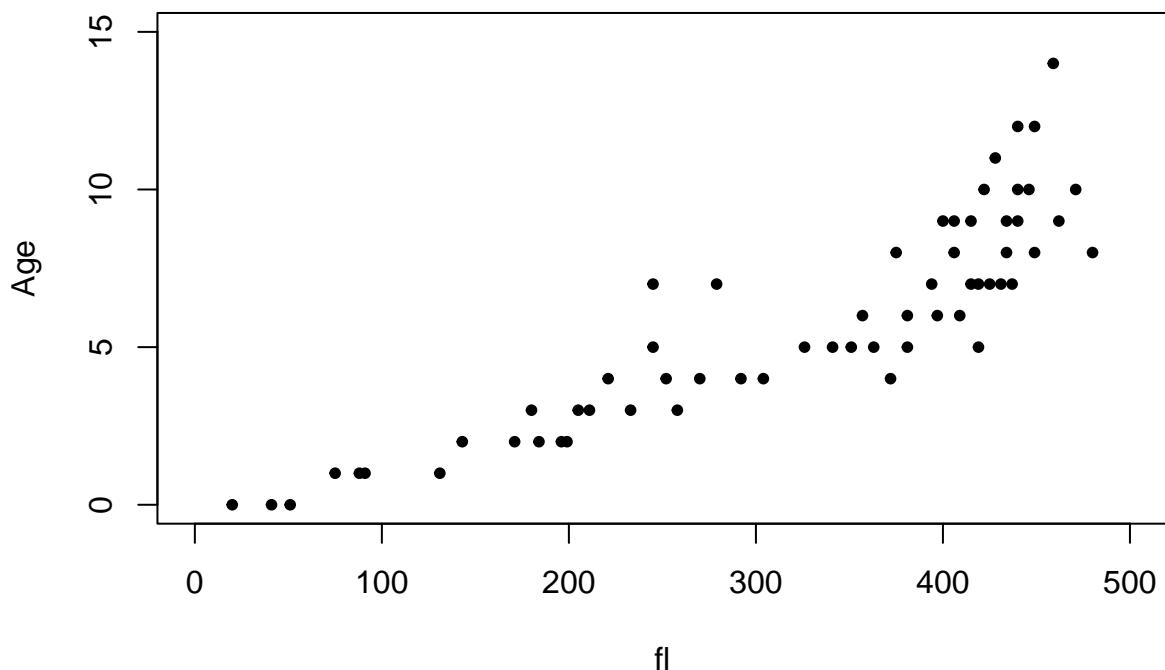
```
## [1] 5.1 4.1 4.1 2.1
```

```
par(mar=c(5.1,4.1,4.1,2.1))  
plot(age~fl)
```



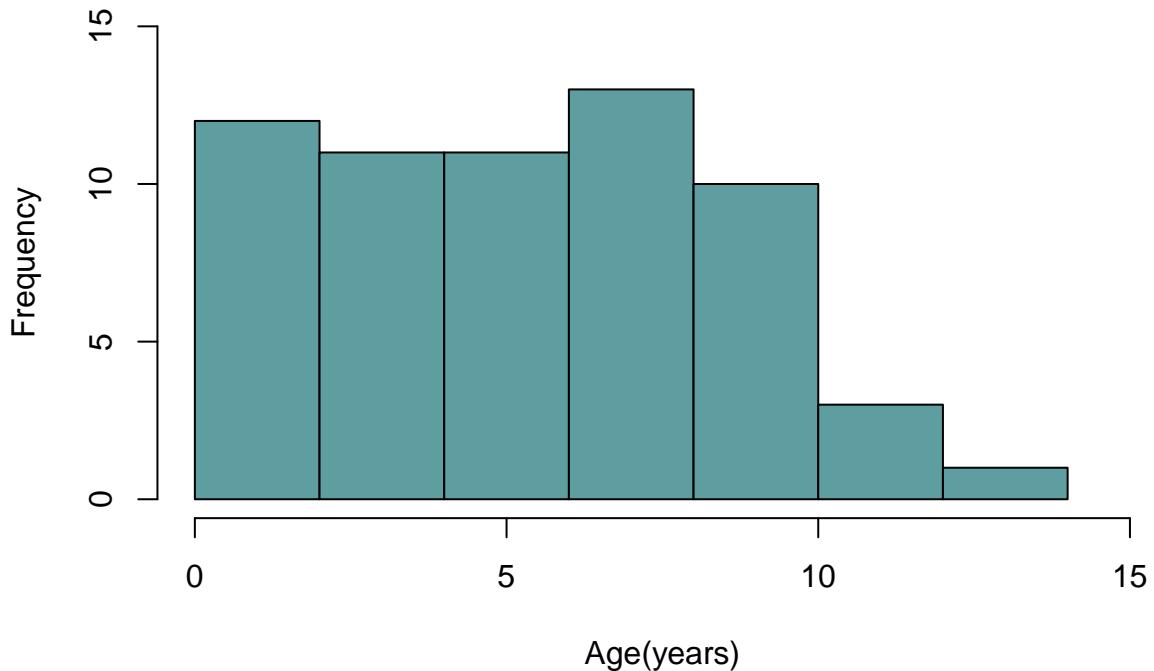
```
#plot with specifications
plot(age~fl,
      data = Harrisonlake,
      xlim=c(0,500), ylim=c(0,15),
      main="Plot 1: Harrison Lake Trout",
      xlab="fl", ylab="Age",
      pch=20)
```

**Plot 1: Harrison Lake Trout**



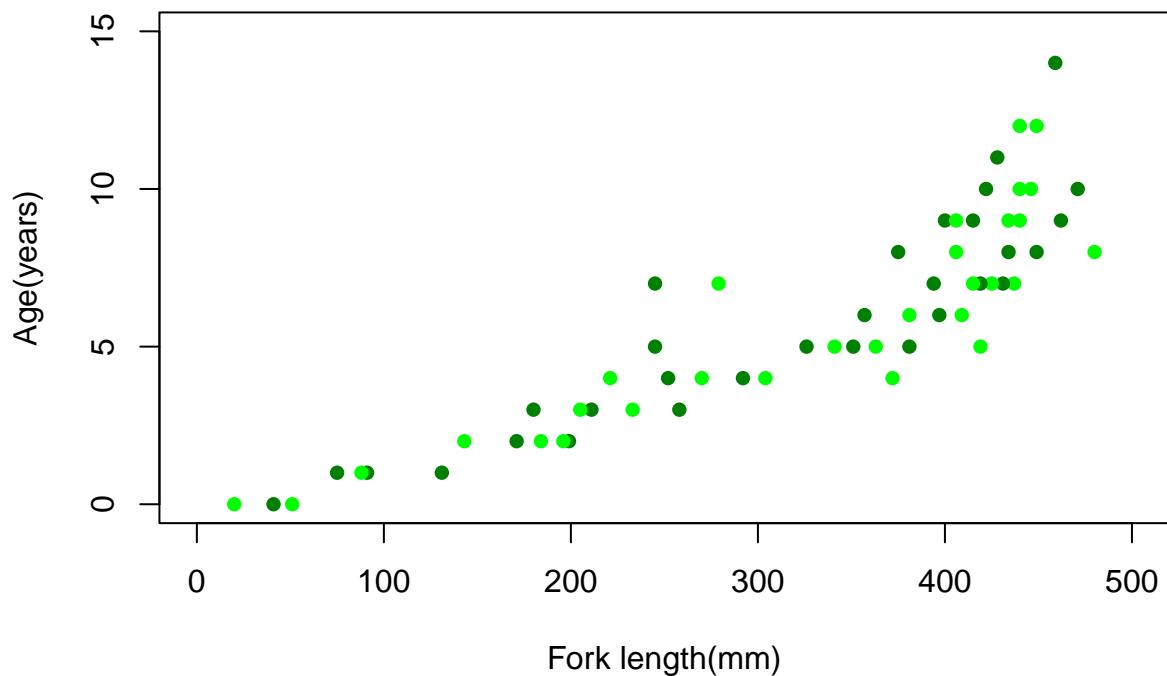
```
#10. Plot a Histogram
hist(Harrisonlake$age,
      xlab = "Age(years)",
      ylab = "Frequency",
      main = "Plot 2: Harrison Fish Age Distribution",
      xlim=c(0,15),
      ylim=c(0,15),
      col = "cadetblue",
      col.main="cadetblue")
```

## Plot 2: Harrison Fish Age Distribution



```
#11. Overdense plot with specifications
plot(age~f1,
      main="Plot 3: Harrison Density Shaded by era",
      ylab = "Age(years)",
      ylim=c(0,15),
      xlab="Fork length(mm)",
      xlim=c(0,500),
      pch = 16,
      col=rgb(0,(1:2)/2,0))
```

### Plot 3: Harrison Density Shaded by era



```
#12. New object tmp for first and last 3 records
tmp <- headtail(Harrisonlake, 3)
tmp
```

```
##      age     fl    lake    era
## 1    14 459 Harrison 1977-80
## 2    12 449 Harrison 1977-80
## 3    10 471 Harrison 1977-80
## 59     7 245 Harrison 1997-01
## 60     7 279 Harrison 1997-01
## 61     5 245 Harrison 1997-01
```

```
#13. Display era column from tmp
tmp$era
```

```
## [1] 1977-80 1977-80 1977-80 1997-01 1997-01 1997-01
## Levels: 1977-80 1997-01
```

```
#14. Create pchs vector
pchs <- c("+", "x")
pchs
```

```
## [1] "+" "x"
```

```

#15. Create cols vector
cols<-c("red", "gray60")
cols

## [1] "red"      "gray60"

#16. Convert era to numeric
tmp$era <- as.numeric(tmp$era)
tmp$era

## [1] 1 1 1 2 2 2

is.numeric(tmp$era)

## [1] TRUE

#17. Combine cols vector to tmp era values
cols[tmp$era]

## [1] "red"      "red"      "red"      "gray60"   "gray60"   "gray60"

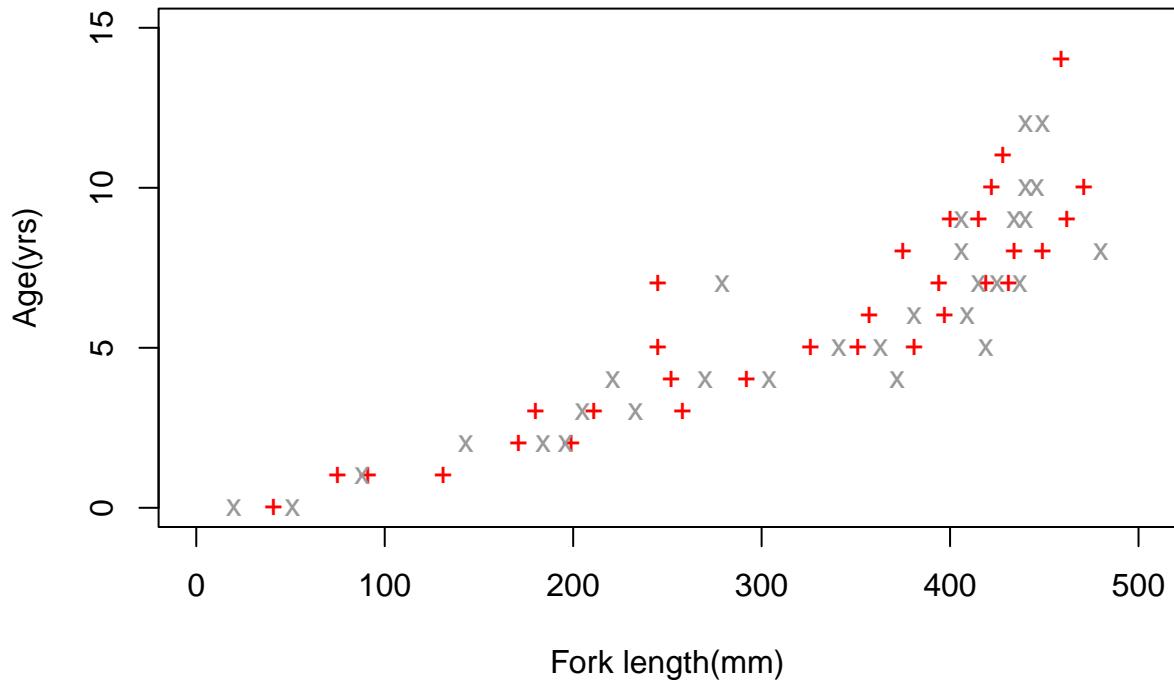
#18. Create plot with specifications
par("mar")

## [1] 5.1 4.1 4.1 2.1

par(mar=c(5,4,4,2))
plot(age~fl,
     data = Harrisonlake,
     main="Plot 4:Symbol and Color by Era",
     xlim=c(0,500),
     ylim=c(0,15),
     ylab="Age(yrs)",
     xlab = "Fork length(mm)",
     pch=pchs,
     col=cols)

```

## Plot 4:Symbol and Color by Era

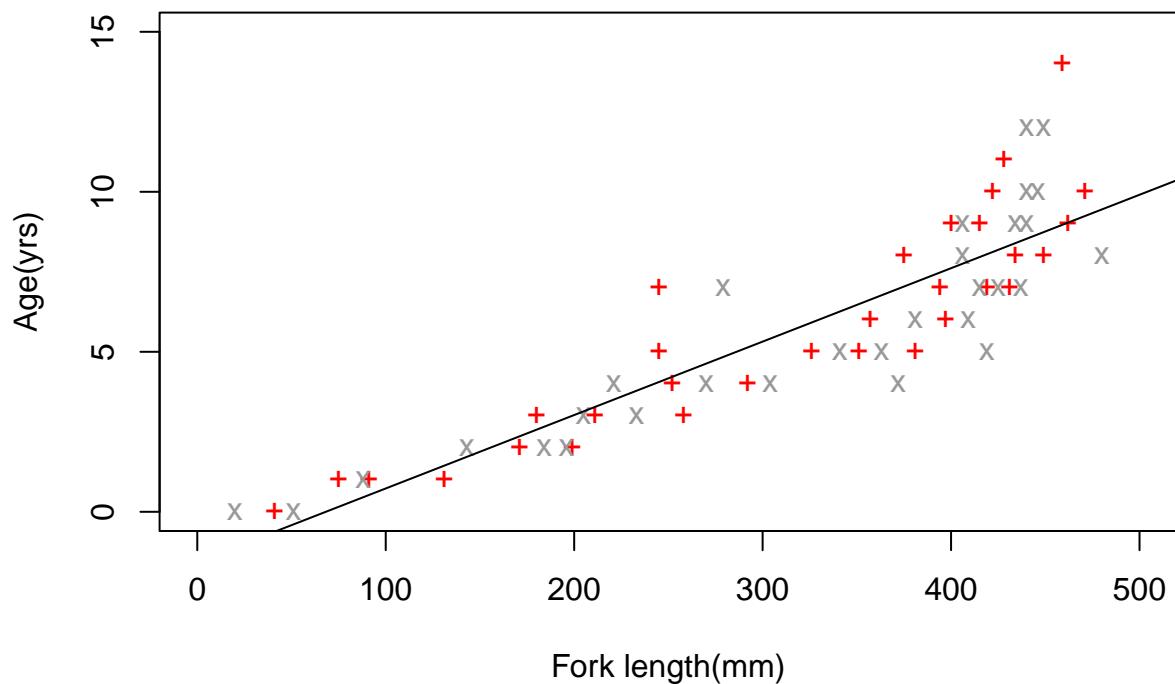


```
#19. Plot regression line
lm(age~fl, data = Harrisonlake)
```

```
##
## Call:
## lm(formula = age ~ fl, data = Harrisonlake)
##
## Coefficients:
## (Intercept)          fl
## -1.56505      0.02294
```

```
plot(age~fl,
     data = Harrisonlake,
     main="Plot 5: Regression Overlay",
     xlim=c(0,500),
     ylim=c(0,15),
     ylab="Age(yrs)",
     xlab = "Fork length(mm)",
     pch=pchs,
     col=cols)
abline(lm(age~fl, data = Harrisonlake))
```

### Plot 5: Regression Overlay



```
#20. Placing a legend
plot(age~f1,
      data = Harrisonlake,
      main="Plot 6: Legend overlay",
      xlim=c(0,500),
      ylim=c(0,15),
      ylab="Age(yrs)",
      xlab = "Fork length(mm)",
      pch=pchs,
      col=cols)
abline(lm(age~f1, data = Harrisonlake))
legend("topleft", inset = 0.05,
       legend = c("1997-80","1997-01"),
       bty = "1",
       cex = 0.8,
       pch = pchs,
       col = cols)
```

**Plot 6: Legend overlay**

