PART A – NUMERIC DESCRIPTIVE CHARACTERISTICS ANALYSIS

With the given BullTroutRML2 dataset, evidentially, the two different lakes and both time periods are factors that need to be taken into consideration while analyzing bull trout.

```
> rbind(BullTrout[1:3,],BullTrout[(n-2):n,])
    X age  fl     lake     era
1   1  14 459 Harrison 1977-80
2   2  12 449 Harrison 1977-80
3   3  10 471 Harrison 1977-80
94 94   4 298   Osprey 1997-01
95 95   3 279   Osprey 1997-01
96 96   3 273   Osprey 1997-01
```

Although, in order to better understand the descriptive statistics and relationships in age and length, we need to constrict our dataset by controlling some variables. Below is a summary of the filtered data for the trout in Harrison Lake only. Looking at the five-number summary for both age and length columns, the distribution of age is slightly right skewed. While length, on the other hand, with a median much higher than the mean, it is highly negatively skewed.

```
> summary(HarrisonBullTrout)
       X              age              fl
 Min.   : 1   Min.   : 0.000   Min.   : 20
 1st Qu.:16   1st Qu.: 3.000   1st Qu.:221
 Median :31   Median : 6.000   Median :372
 Mean   :31   Mean   : 5.754   Mean   :319
 3rd Qu.:46   3rd Qu.: 8.000   3rd Qu.:425
 Max.   :61   Max.   :14.000   Max.   :480
```

```
> sd_h.age
[1] 3.334945
> nor.sd_h.age
[1] 0.5795773
> sd_h.fl
[1] 128.6174
> nor.sd_h.fl
[1] 0.4031893
```

In contract, Bull Trout in Osprey Lake are, with a much higher minimum length, generally longer in size. They are also quite uniform in sizes, comparing to Harrison Trout, with the standard deviation only being 0.22. 688mm max length seems like an outlier here. Age of Osprey Trout are not as spread out either.

```
> summary(OspreyBullTrout)
       X              age              fl
 Min.   :62.0   Min.   : 3.0   Min.   :221.0
 1st Qu.:70.5   1st Qu.: 4.0   1st Qu.:305.5
 Median :79.0   Median : 6.0   Median :332.0
 Mean   :79.0   Mean   : 5.8   Mean   :338.5
 3rd Qu.:87.5   3rd Qu.: 7.0   3rd Qu.:360.0
 Max.   :96.0   Max.   :11.0   Max.   :688.0
```

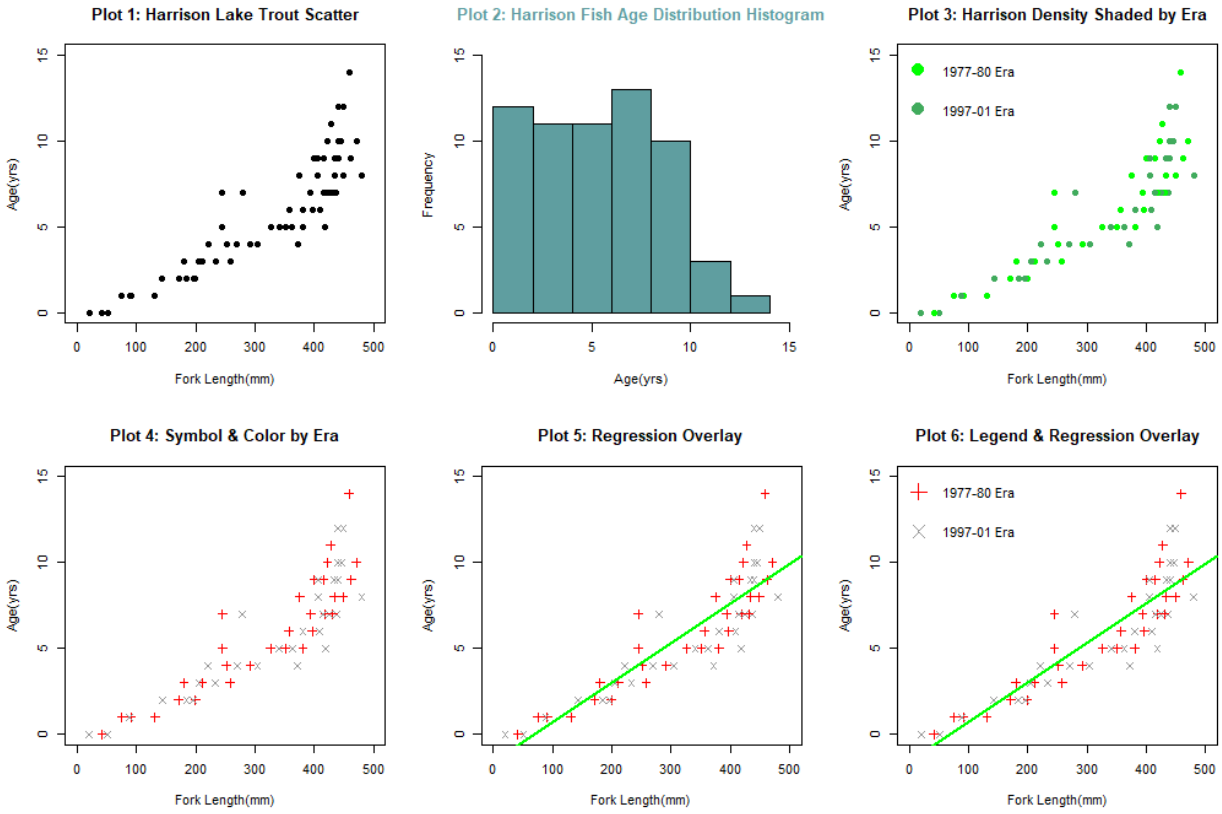
```
> sd_o.age
[1] 2.069385
> nor.sd_o.age
[1] 0.3567905
> sd_o.fl
[1] 75.72643
> nor.sd_o.fl
[1] 0.2237023
```

One thing that I've noticed throughout this dataset is that there were 61 samples taken from Harrison Lake, but Osprey Lake only has 35 samples, the huge difference in sample size might lead to bias. Thus, it is suggested to have the same number of samples taken from Osprey Lake for comparison.

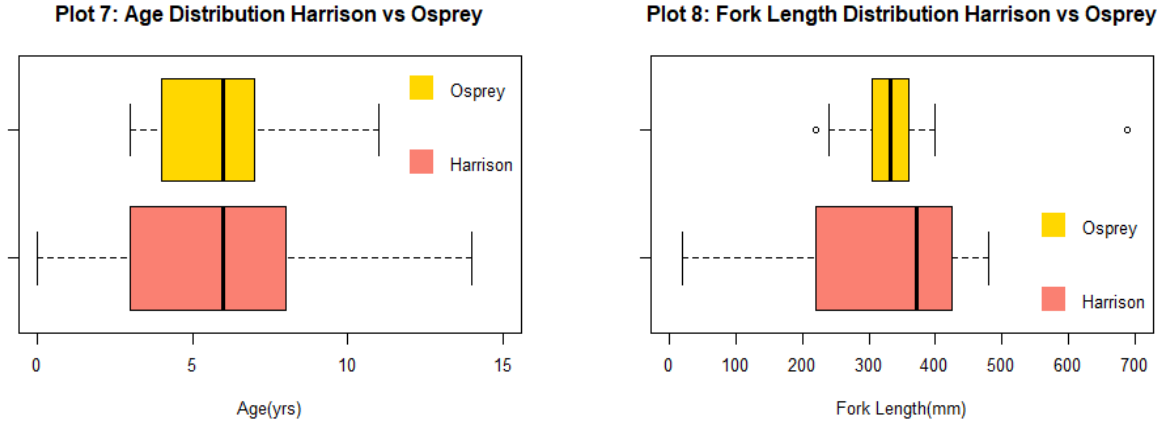
PART B – GRAPHIC DESCRIPTIVE CHARACTERISTICS ANALYSIS

In this section, we will be interpreting some graphic descriptive character using the following plots, where more information can be revealed in regards of how Bull Trout are distributed within each of the two lake farm, as well as how farming location and species are affecting the growth of Bull Trout. These will help in making strategical decision of cultivating and harvesting Bull Trout.

Based on the samples taken from Harrison Lake, the 6 graphs below were plotted. Scattered plots are showing the age in relationship of length, longer Harrison Trout are generally older and vice versa. The linear regression has a correlation less than 1, This means as them get older, they grow faster in length. The age distribution histogram indicates that Harrison Lake has more Trout between age 0 -10, and they are fairly spread out, but not many are at older age.

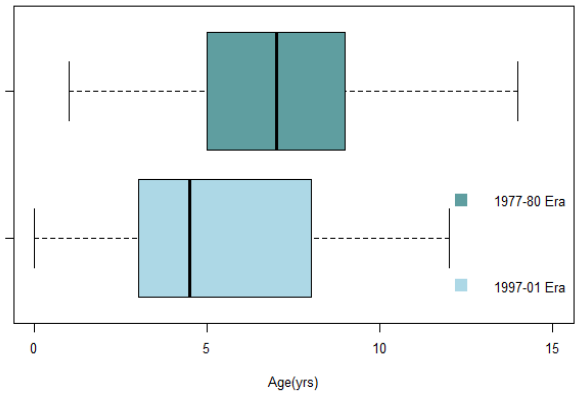


Furthermore, we will look at a series of comparison of the Trout from different lakes and era. The following two boxplots show a drastic difference in both age and length of Trout from the two lakes. Trout from Osprey are pretty middle aged, and despite the outliers on both ends, they have a very dense population between the length of 250mm - 400mm. Harrison Trout on the other hand, have a huge variance in both age and size.

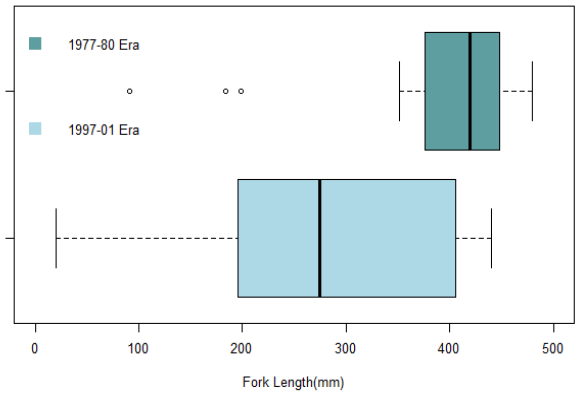


By studying the two species of Trout from different era within each lake, it does not seem like era of specimen is a crucial factor for determination in size and age of the Trout in Osprey Lake. Species from 1997-2001 era of the Osprey Trout are only slightly bigger and mature than the ones from 1977-1980. Although, interestingly, different story at Harrison Lake, era indeed made a huge difference for the Trout there. Species from 1977-1980 era are much longer in size and greater in uniformity than the ones from 1997-2001 era, in Harrison Lake specifically.

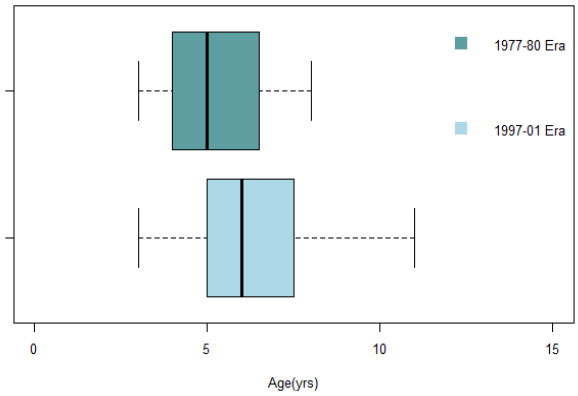
Plot 7: Age Distribution 1977-80 vs 1997-01 in Harrison River



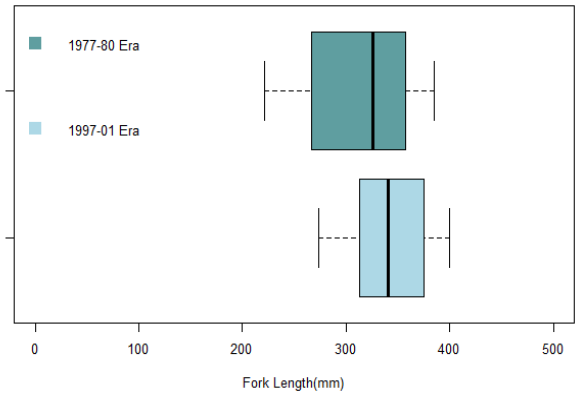
Plot 8: Length Distribution 1977-80 vs 1997-01 in Harrison River



Plot 9: Age Distribution 1977-80 vs 1997-01 in Osprey River



Plot 10: Length Distribution 1977-80 vs 1997-01 in Osprey River



SUMMARY

Therefore, Osprey Lake would be a better lake farm, between the two, for harvesting Bull Trout. There will be higher chances to catch more mature Bull Trout with bigger size at Osprey, yet the Trout at Harrison Lake are mostly still at very young age. Also, species from 1977-1980 era seems to grow much better and a lot bigger in Harrison Lake. Thus, it is suggested to all hatcheries at Harrison Lake cultivate species from 1977-1980 era, and have more 1997-2001 era species to be cultivated at Osprey Lake hatcheries.