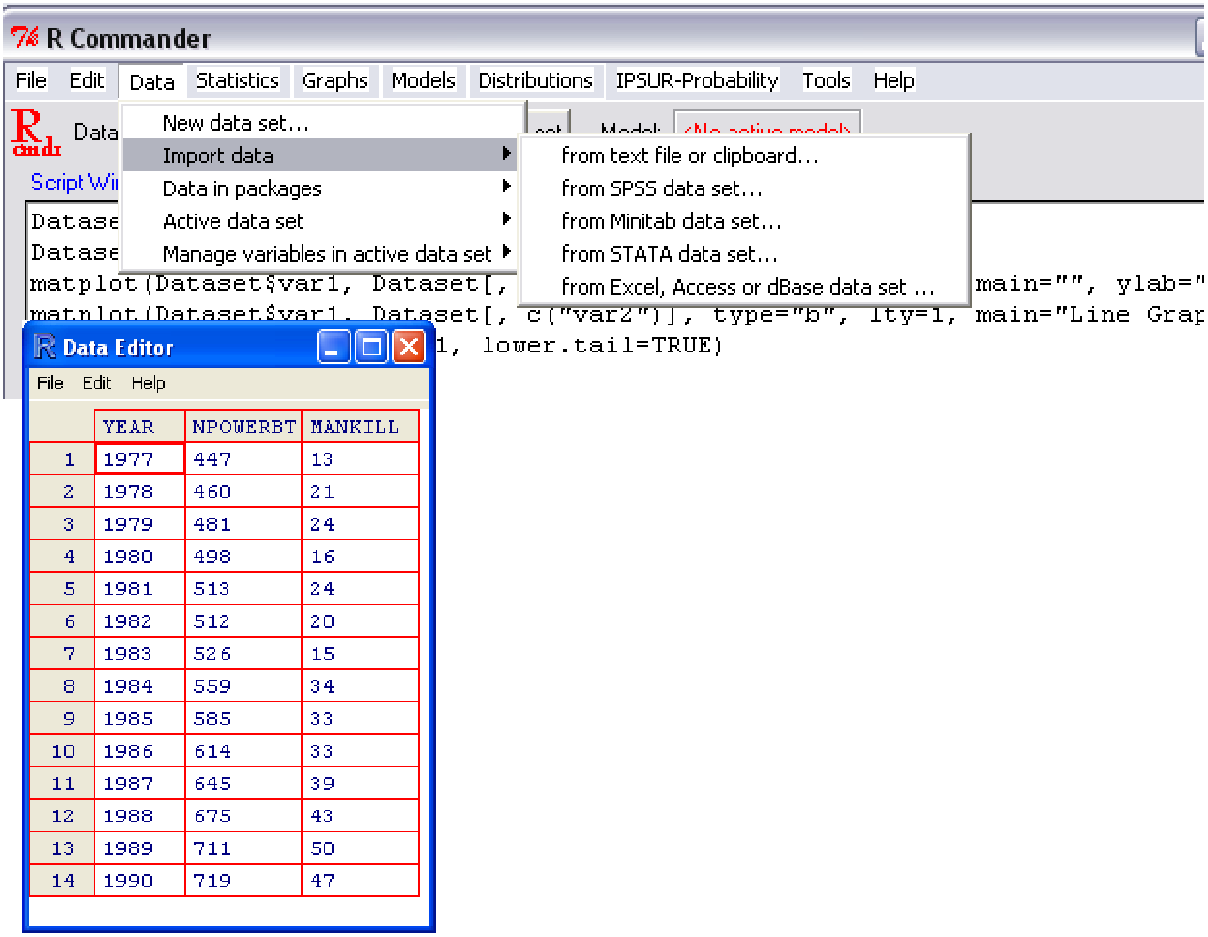
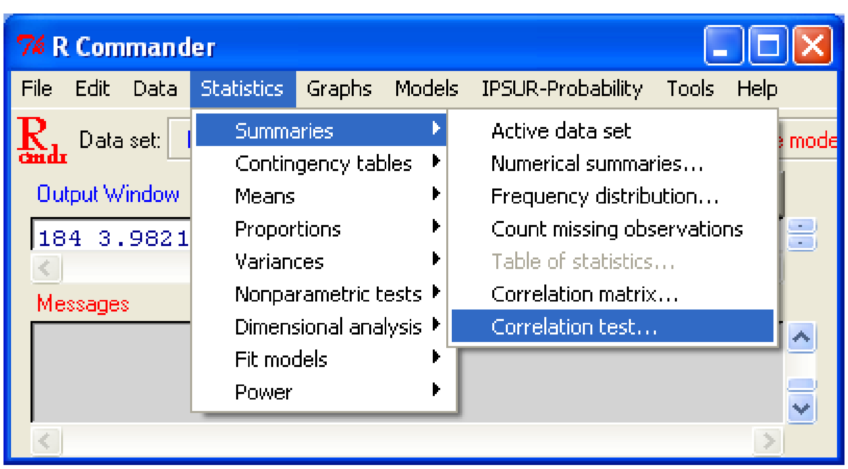
Correlation Test & Linear Regression

Test of Correlation (Testing for $\rho = 0$)

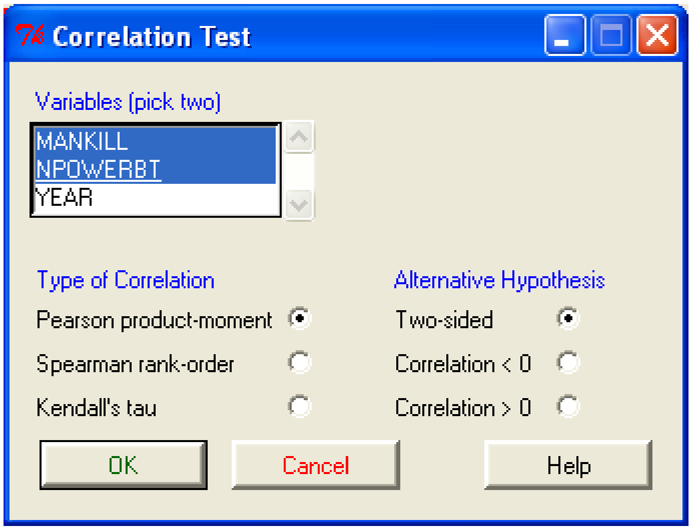
1) First, enter your data in R commander or upload an existing file into R by selecting **Data, New data or Import Data**.



2) In R commander, select Statistics, Summaries, and select Correlation test as show in the following figure.



3) In the correlation dialog box, click and drag mouse to select the two variables, MANKILL and NPOWERBT for computing the correlation, and have the Pearson product-moment bullet checked, and click OK.



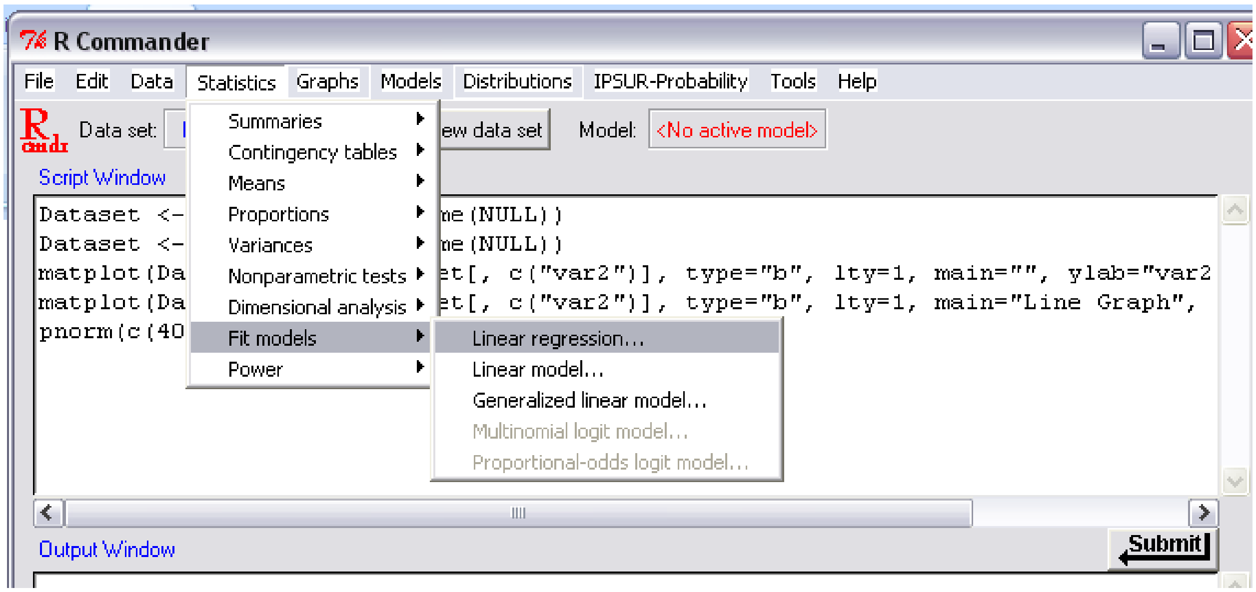
Interpret:

4) The p-value of the test is `p-value = 5.109e-07` which is less than .05, so we can conclude that the correlation is statistically significant different from 0, at 5% level of significance. The **Pearson correlation coefficient** is 0.9414773.

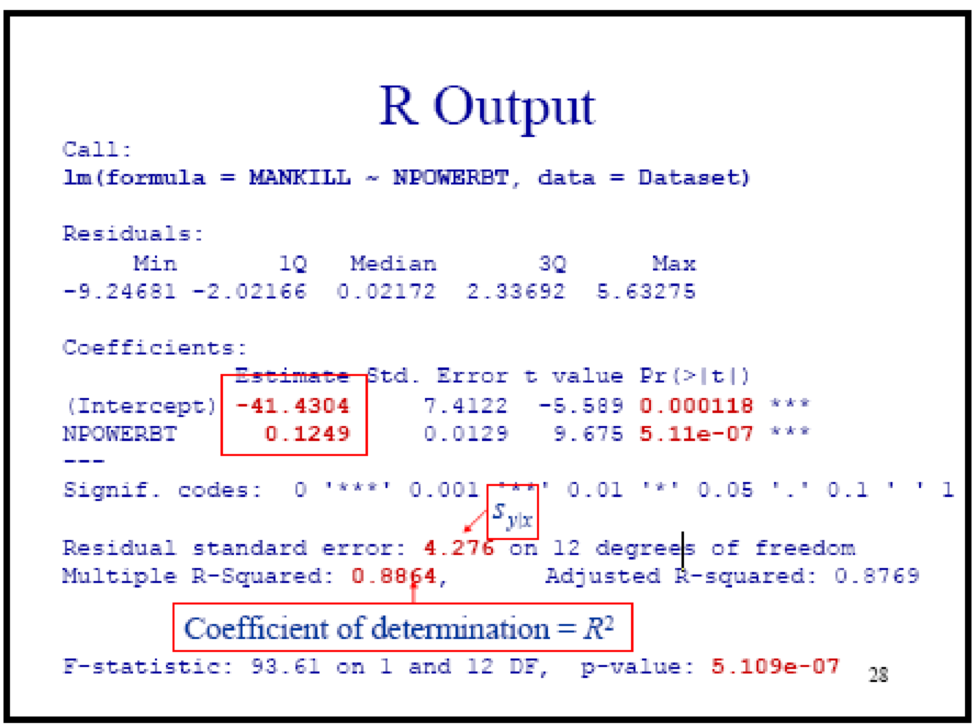
```
Pearson's product-moment correlation

data:  Dataset$MANKILL and Dataset$NPOWERBT
t = 9.6755, df = 12, p-value = 5.109e-07
alternative hypothesis: true correlation is not equal to 0
95 percent confidence interval:
 0.8210214 0.9816797
sample estimates:
      cor
0.9414773
```

Linear Regression: (Using the same data.)

5) From IPSUR, select **Statistics, Fit Models, Linear Regression**



6) The following is the R Output and the necessary numbers needed from it.



Interpret:

7) The Intercept (p-value = .000118)and the beta coefficient (p-value = 5.11e-07) are both significantly different from zero. The following equation is used to find the equation of the regression line, the variables **α** and **β** are highlighted above.

Equation of the regression line:

$$\hat{y} = \hat{\alpha} + \hat{\beta} \cdot x;$$

$$\hat{y} = -41.4304 + .1249 \cdot x$$

8) Example: If at a certain year the number of power boats registered is 700, estimate how many manatee on average would be killed.

To solve this example simply plug 700 into the equation that was found above.

$$\begin{aligned}\hat{y} &= -41.430439 + .124862 \cdot x \\ &= -41.430439 + .124862 \cdot 700 \\ &= 45.973\end{aligned}$$

The average response at $x = 700$ is 45.973.

9) The residual for the data point for year 1978 at x = 460 (see data table in the beginning) would be the actual observed y = 21 (from year 1978) at x = 460 minus the fitted value of y at x = 460 that is $\hat{y}$ =16.006.

Residual at for data point from year 1978 (at x = 460) = 21 – 16.006 = **4.994.**

The residuals for all data points can be obtained using the following R command:

> residuals(LinearModel.1)

```
         1          2          3          4          5          6          7 
-1.3827375  4.9940605  5.3719650 -4.7506838  1.3763908 -2.4987475 -9.2468112 
         8          9         10         11         12         13         14 
 5.6327530  1.3863490 -2.2346401 -0.1053526  0.1487966  2.6537757 -1.3451178 
```