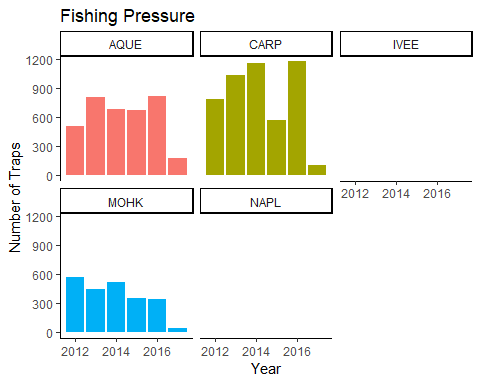
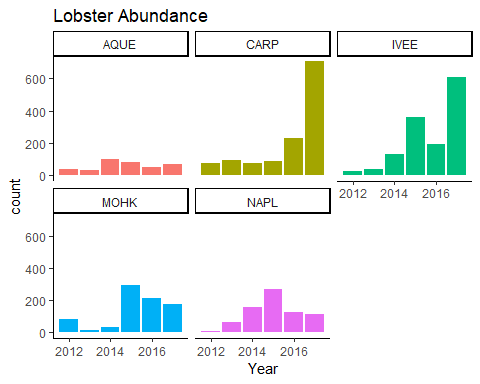
Assignment4\_Lobsters

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November 13, 2018



Site

Mean Lobster Size (mm)

Standard Deviation of Size (mm)

Abundance

AQUE

71.00

10.15

38

CARP

74.36

14.62

78

IVEE

66.08

12.09

26

MOHK

77.25

10.59

83

NAPL

73.00

11.75

6

## Levene's Test for Homogeneity of Variance (center = median)  
## Df F value Pr(>F)   
## group 4 8.3893 1.065e-06 \*\*\*  
## 1663   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## Df Sum Sq Mean Sq F value Pr(>F)   
## SITE 4 2355 588.6 3.424 0.0085 \*\*  
## Residuals 1663 285871 171.9   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = SIZE ~ SITE, data = lobster\_case\_format2017)  
##   
## $SITE  
## diff lwr upr p adj  
## CARP-AQUE -1.6657352 -6.24294710 2.911477 0.8582355  
## IVEE-AQUE -2.4433772 -7.05292315 2.166169 0.5968998  
## MOHK-AQUE -1.8955224 -7.02720717 3.236162 0.8514711  
## NAPL-AQUE 2.3366205 -3.19311600 7.866357 0.7775633  
## IVEE-CARP -0.7776420 -2.76097123 1.205687 0.8216104  
## MOHK-CARP -0.2297872 -3.23309697 2.773523 0.9995765  
## NAPL-CARP 4.0023556 0.36042398 7.644287 0.0228728  
## MOHK-IVEE 0.5478548 -2.50450730 3.600217 0.9882889  
## NAPL-IVEE 4.7799976 1.09751057 8.462485 0.0037001  
## NAPL-MOHK 4.2321429 -0.08607271 8.550358 0.0579286

Site

Mean Lobster Size (mm)

Standard Deviation of Size (mm)

Abundance

AQUE

73.90

11.89

67

CARP

72.23

13.21

705

IVEE

71.45

14.32

606

MOHK

72.00

9.28

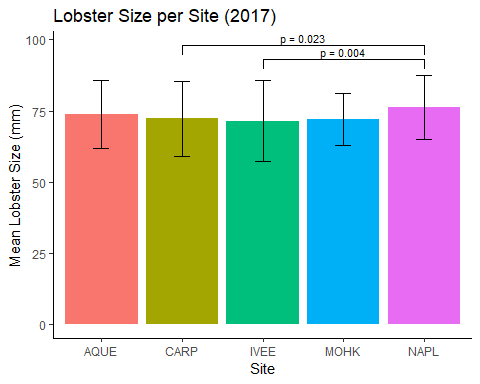
178

NAPL

76.23

11.39

112



##   
## F test to compare two variances  
##   
## data: lobster\_NAPL\_2012$SIZE and lobster\_NAPL\_2017$SIZE  
## F = 1.064, num df = 5, denom df = 111, p-value = 0.7685  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.3966019 6.4626426  
## sample estimates:  
## ratio of variances   
## 1.064048

##   
## F test to compare two variances  
##   
## data: lobster\_IVEE\_2012$SIZE and lobster\_IVEE\_2017$SIZE  
## F = 0.71311, num df = 25, denom df = 605, p-value = 0.307  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.4322948 1.3698611  
## sample estimates:  
## ratio of variances   
## 0.713111

##   
## F test to compare two variances  
##   
## data: lobster\_AQUE\_2012$SIZE and lobster\_AQUE\_2017$SIZE  
## F = 0.72863, num df = 37, denom df = 66, p-value = 0.2986  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.419142 1.327868  
## sample estimates:  
## ratio of variances   
## 0.7286314

##   
## F test to compare two variances  
##   
## data: lobster\_MOHK\_2012$SIZE and lobster\_MOHK\_2017$SIZE  
## F = 1.3015, num df = 82, denom df = 177, p-value = 0.1509  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.9085131 1.9131403  
## sample estimates:  
## ratio of variances   
## 1.301535

##   
## F test to compare two variances  
##   
## data: lobster\_CARP\_2012$SIZE and lobster\_CARP\_2017$SIZE  
## F = 1.2244, num df = 77, denom df = 704, p-value = 0.2043  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.896208 1.750406  
## sample estimates:  
## ratio of variances   
## 1.224405

##   
## Two Sample t-test  
##   
## data: lobster\_NAPL\_2012$SIZE and lobster\_NAPL\_2017$SIZE  
## t = -0.67636, df = 116, p-value = 0.5002  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -12.697051 6.232765  
## sample estimates:  
## mean of x mean of y   
## 73.00000 76.23214

##   
## Two Sample t-test  
##   
## data: lobster\_IVEE\_2012$SIZE and lobster\_IVEE\_2017$SIZE  
## t = -1.885, df = 630, p-value = 0.0599  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -10.9750916 0.2246473  
## sample estimates:  
## mean of x mean of y   
## 66.07692 71.45215

##   
## Two Sample t-test  
##   
## data: lobster\_AQUE\_2012$SIZE and lobster\_AQUE\_2017$SIZE  
## t = -1.2622, df = 103, p-value = 0.2097  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -7.445357 1.654312  
## sample estimates:  
## mean of x mean of y   
## 71.00000 73.89552

##   
## Two Sample t-test  
##   
## data: lobster\_MOHK\_2012$SIZE and lobster\_MOHK\_2017$SIZE  
## t = 4.0689, df = 259, p-value = 6.276e-05  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## 2.710776 7.795248  
## sample estimates:  
## mean of x mean of y   
## 77.25301 72.00000

##   
## Two Sample t-test  
##   
## data: lobster\_CARP\_2012$SIZE and lobster\_CARP\_2017$SIZE  
## t = 1.3361, df = 781, p-value = 0.1819  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -0.998958 5.257332  
## sample estimates:  
## mean of x mean of y   
## 74.35897 72.22979

##   
## Cohen's d  
##   
## d estimate: -0.2834216 (small)  
## 95 percent confidence interval:  
## inf sup   
## -1.1141889 0.5473456

##   
## Cohen's d  
##   
## d estimate: -0.3775177 (small)  
## 95 percent confidence interval:  
## inf sup   
## -0.77136540 0.01633002

##   
## Cohen's d  
##   
## d estimate: -0.2563169 (small)  
## 95 percent confidence interval:  
## inf sup   
## -0.6606014 0.1479675

##   
## Cohen's d  
##   
## d estimate: 0.5408116 (medium)  
## 95 percent confidence interval:  
## inf sup   
## 0.2749635 0.8066597

##   
## Cohen's d  
##   
## d estimate: 0.1594364 (negligible)  
## 95 percent confidence interval:  
## inf sup   
## -0.07493682 0.39380971

##   
## F test to compare two variances  
##   
## data: lobster\_MPA\_2012$SIZE and lobster\_nonMPA\_2012$SIZE  
## F = 0.95857, num df = 31, denom df = 198, p-value = 0.9306  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.5875826 1.7418980  
## sample estimates:  
## ratio of variances   
## 0.958571

##   
## F test to compare two variances  
##   
## data: lobster\_MPA\_2017$SIZE and lobster\_nonMPA\_2017$SIZE  
## F = 1.261, num df = 717, denom df = 949, p-value = 0.0008682  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 1.099982 1.447439  
## sample estimates:  
## ratio of variances   
## 1.260969

##   
## F test to compare two variances  
##   
## data: lobster\_MPA\_2012count$COUNT and lobster\_nonMPA\_2012count$COUNT  
## F = 0.15132, num df = 29, denom df = 154, p-value = 1.607e-07  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.09046774 0.28284551  
## sample estimates:  
## ratio of variances   
## 0.1513157

##   
## F test to compare two variances  
##   
## data: lobster\_MPA\_2017count$COUNT and lobster\_nonMPA\_2017count$COUNT  
## F = 0.32029, num df = 442, denom df = 445, p-value < 2.2e-16  
## alternative hypothesis: true ratio of variances is not equal to 1  
## 95 percent confidence interval:  
## 0.2658382 0.3859245  
## sample estimates:  
## ratio of variances   
## 0.3202926

##   
## Two Sample t-test  
##   
## data: lobster\_MPA\_2012$SIZE and lobster\_nonMPA\_2012$SIZE  
## t = -3.202, df = 229, p-value = 0.001558  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -12.19530 -2.90395  
## sample estimates:  
## mean of x mean of y   
## 67.37500 74.92462

##   
## Welch Two Sample t-test  
##   
## data: lobster\_MPA\_2017$SIZE and lobster\_nonMPA\_2017$SIZE  
## t = -0.16104, df = 1442.5, p-value = 0.8721  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -1.402988 1.190110  
## sample estimates:  
## mean of x mean of y   
## 72.19777 72.30421

##   
## Welch Two Sample t-test  
##   
## data: lobster\_MPA\_2012count$COUNT and lobster\_nonMPA\_2012count$COUNT  
## t = -3.1061, df = 115.16, p-value = 0.002387  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -0.35571770 -0.07869091  
## sample estimates:  
## mean of x mean of y   
## 1.066667 1.283871

##   
## Welch Two Sample t-test  
##   
## data: lobster\_MPA\_2017count$COUNT and lobster\_nonMPA\_2017count$COUNT  
## t = -3.8207, df = 704.51, p-value = 0.0001448  
## alternative hypothesis: true difference in means is not equal to 0  
## 95 percent confidence interval:  
## -0.7709789 -0.2475758  
## sample estimates:  
## mean of x mean of y   
## 1.620767 2.130045

##   
## Cohen's d  
##   
## d estimate: -0.6098605 (medium)  
## 95 percent confidence interval:  
## inf sup   
## -0.9892805 -0.2304404

##   
## Cohen's d  
##   
## d estimate: -0.008092361 (negligible)  
## 95 percent confidence interval:  
## inf sup   
## -0.10508515 0.08890043

##   
## Cohen's d  
##   
## d estimate: -0.3579647 (small)  
## 95 percent confidence interval:  
## inf sup   
## -0.7532141 0.0372846

##   
## Cohen's d  
##   
## d estimate: -0.2558404 (small)  
## 95 percent confidence interval:  
## inf sup   
## -0.3880284 -0.1236524

##   
## Pearson's Chi-squared test  
##   
## data: lobster\_legal  
## X-squared = 10.99, df = 4, p-value = 0.02668