Bruno Franco
BIOL 603
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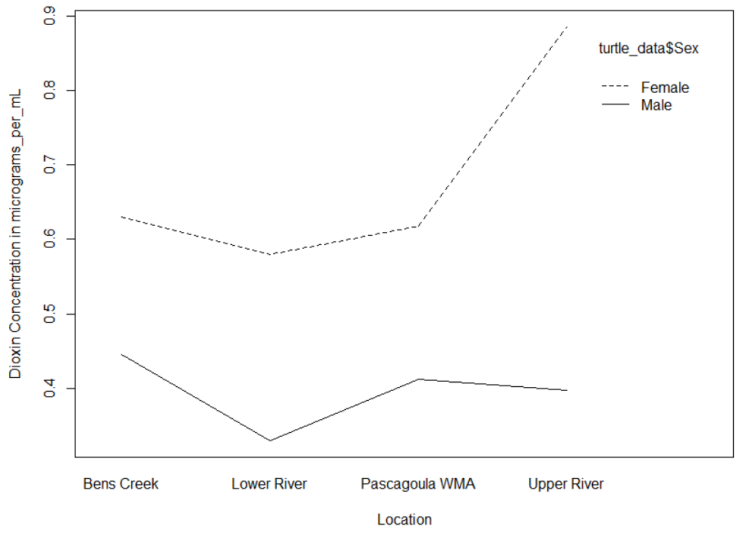
Homework 7

1) Model Statement:
   Total variation in turtle dioxin concentration = sex + location + (sex * location) + error

2) I tested the simultaneous effect of specifically-chosen localities and sex on dioxin levels in Federally-threatened adult yellow-botched map turtles (*Graptemys flavimaculata*). I first randomly selected 4 males and 4 females from four different sites along the Pascagoula river in Mississippi: Lower River, Ben's Creek, Pascagoula WMA, and Upper River. The total number of different combinations of gender and locality is 8 with 4 turtles in each combination. The total number of replicates is 32 turtles (16 males and 16 females divided into 4 different locations). The 2 levels of sex and 4 levels of location made this a 2 x 4 factorial design. I used a fixed-effects, two-way ANOVA to test the effects of location and sex as the independent variables on dioxin concentration as the dependent variable. Dioxin concentration was measured in micrograms per milliliter after obtaining blood samples from the turtles. Alpha was set to 0.05.

   I used RStudio (version 1.1.463) to calculate my results. Both location (df = 3, F = 5.37, P = 0.005) and sex (df = 1, F = 70.81, P = $1.27e^{-8}$) had a significant effect on dioxin concentration. There was also an interaction effect between location and sex (df = 3, F = 4.35, P = 0.0139). The interaction plot (Fig. 1) confirms that females had higher dioxin levels than males at all 4 locations. There is a synergistic interaction that takes place for females at the Upper River, where the average dioxin concentration is higher than expected (i.e., female dioxin concentration increases from Pascagoula WMA to Upper River rather than decreases as seen for male dioxin concentration and has the highest mean value of 0.89 micrograms/mL). The lines in the interaction plot are not parallel, the line for female dioxin levels diverges away from the male dioxin levels line at the Upper River, indicating a synergistic interaction here between female and Upper River. Assumptions did not need to be tested. This study will be followed-up with a multiple comparisons test.

Figure 1 Interaction Plot



Analysis of Variance Table

Response: Dioxin

	Df	Sum Sq	Mean Sq	F value	Pr(>F)	
Location	3	0.14461	0.04820	5.3702	0.005672	**
Sex	1	0.63563	0.63563	70.8139	1.274e-08	***
Location:Sex	3	0.11718	0.03906	4.3517	0.013903	*
Residuals	24	0.21542	0.00898			
