Review of Basic Statistical Tests

1. Date on the concentration of polychlorinated biphenyl (PCB) residues in a series of lake trout from Cayuga Lake, NY, were reported in Bache et al (1972). The ages of the fish were accurately known because the fish were annually stocked as yearlings and distinctly marked as to year class. Each whole fish was mechanically chopped, ground, and thoroughly mixed, and 5-gram samples taken. The samples were treated and PCB residues in parts per million (ppm) were estimated using column chromatography.

Is there a significant relationship between the age of fish and the accumulated concentration of PCB in muscle tissues?

Are there any outlier individuals that you would suspect of influencing the results?

How much variation in the response variable is accounted for by the predictor variable?

If you randomly sampled a trout from the lake and discovered that the individual was 8.5 years old, how much PCB would you expect to observe in the body tissues?

How would you report the results of your statistical test in your thesis or journal article?

Data = trout\_PCB

Source:

Bache, C. A., Serum, J. W., Youngs, W. D., and Lisk, D. J. (1972). Polychlorinated biphenyl residues: Accumulation in Cayuga Lake trout with age. Science 117, 1192-1193.

2. Jaffe, Parker and Wilson have investigated the concentration of several toxic hydrophobic organic substances in the Wolf River in Tennessee. Measurements were taken 1 km downstream of an abandoned dump site that had previously been used by the pesticide industry to dispose of its waste products.

It was expected that these substances might have a nonhomogeneous vertical distribution in the river because of differences in densities among compounds and because of the adsorption of these compounds into sediments, which could lead to higher concentrations on the bottom. Thirty random samples were taken at various depths and grouped into surface, middepth (5-10 m depth), and bottom (>10 m depth) categories.

The average aldrin and hexachlorobenzene (HCB) concentrations (in nanograms per liter) in these 30 samples are given in the data.

Are there differences in aldrin concentrations among depth categories in the Wolf River?

Are there differences in hexachlorobenzene (HCB) concentrations among depth categories in the Wolf River?

Is there support for the statement that river bottom locations had higher aldrin and HCB loads than middepth or surface locations?

How would you report these results in a manuscript?

Create a bar chart that shows the mean response and 95% CI around the mean for each depth.

Data = Wolf\_river\_pollution

Source:

Jaffe, P. R., Parker, F. L., and Wilson, D. J. (1982). Distribution of toxic substances in rivers. Journal of the Environmental Engineering Division, 108, 639-649.

3. A common observation in ecology is that species diversity decreases as you get further from the equator. To see whether this pattern could be seen on a small scale, we gathered data from the Audubon Society's Christmas Bird Count, in which teams of birders try to count all the birds in a 15-mile diameter area during one winter day.

Is there a significant relationship between latitude and the number of observed species? How do you know?

Based on the equation for the predicted relationship, how many bird species might we predict to see at 38.25 degrees latitude?

Using the format we have discussed in class, provide the results of this analysis as you might read them in a scientific bird journal.

data=bird\_count

4. Temperature effects nearly every aspect of the physiology of amphibians and reptiles. You captured 20 tree frogs from the field and brought them back to the lab to test how temperature effects metabolism. You separated individuals into two groups and kept the groups at different temperatures (20°C or 30°C). You measured the metabolism for each frog by recording CO2 production during normal breathing in a test chamber.

Was frog metabolism (CO2 production) different between 20 and 30°C? How do you know?

Was frog metabolism (CO2 production) different among color morphs of tree frogs at 30°C?

Create a chart showing mean and SEM for each color morph of tree frog at 30°C.

Data = tree\_frogs

5. Iowa, Nebraska, and Wisconsin are renowned for their production of top quality livestock and dairy products (yummy steaks, cheese, milk, bacon, etc.). You are interested in whether residents of these states differ in their blood cholesterol, but you also know that cholesterol itself tends to increase with age.

Is there a difference in blood cholesterol among states after accounting for the effect of age?

Was there a significant interaction between age of residents and the state in which they reside?

Does overall model fit change when considering interaction terms (or not)?

Were there any significant pairwise difference among states?

Data = butter\_battle

6. You are interested in whether an individual’s sex (male or female) has an influence on the concentration of blood cholesterol, but you also know that cholesterol itself tends to increase with age. Production of testosterone is a function of cholesterol, so you hypothesize that sex should influence levels of cholesterol in the blood. Test for sex differences in blood cholesterol after accounting for the fact that cholesterol naturally increases with age.

Is there a difference in blood cholesterol among sexes after accounting for the effect of age?

Was there a significant interaction between the factors of sex and age?

Does overall model fit change when considering interaction terms (or not)?

Were there any significant pairwise difference between the sexes?

How would you report the results of this test in a journal article?

Data = butter\_battle

7. Latta et al. (2012) collected 4,071 different birds in remnant riparian habitat (areas along rivers in with mostly native vegetation) and restored riparian habitat areas (once degraded areas that have had native vegetation re-established). They observed 11 species that occurred in both habitats and lumped together the less common bird species as "uncommon".

Do the bird species differ in their proportional use of remnant vs. restored habitats?

Are the birds using the two habitats in proportion to availability in the environment?

How would you report the results of this test in a journal article?

data = riparian birds