Problem Set #2

1. As part of your work with Idaho Fish and Game, you have been tasked with evaluating whether or not active wolf packs reduce the fertility rates of resident female elk. To this end, you have identified six elk herds within Lochsa River drainage that do not have resident wolf packs and six elk herds that do have resident wolf packs. Using aerial surveys you have estimated the average total fertility of female elk in these herds over the past four seasons. Your data is shown in the table below:

	Study population					
	1	2	3	4	5	6
Wolf	2.13	2.45	1.87	2.07	1.21	0.98
No wolf	3.14	2.06	1.67	2.45	3.12	2.67

Based on an analysis of your data, is there evidence that the presence of an active wolf pack reduces elk fertility?

2. As part of your work with Conservation International, you have been instructed to estimate the average population size of an endangered amphibian living in Papua New Guinea. Specifically, your goal is to determine whether the local population size exceeds the critical threshold of N=246 individuals required to maintain what previous studies have shown to be a sufficient level of genetic variation for the long-term viability of the population. As a starting point, you have identified 6 streams, each of which is inhabited by an essentially independent population of the amphibian. Within each stream you have conducted a census and your data on population sizes deduced from these censuses are shown in the table below:

	Population					
	1	2	3	4	5	6
Population size	252	145	323	265	276	234

Based on an analysis of this data, does it appear that the local population size of the amphibian is sufficient to guarantee its long-term persistence?

3. Working as part of a team of researchers funded by the Gate's Foundation, you are investigating whether distributing bed nets that exclude mosquitoes effectively reduces the rate of infection by the parasite, *Plasmodium falciparum*, which causes Malaria and is vectored by mosquitoes in the genus, *Anopheles*. Your study design is simple, and compares rates of infection (measured as number of independent clinical diagnoses of Malaria per day) in six villages in which bed nets have been distributed and their use adopted with six additional villages in which bed nets have not been distributed. The data on average rates of infection in these villages is shown in the table below:

	Village					
	1	2	3	4	5	6
Bed nets	1.23	1.34	1.54	0.96	0.86	1.07
No bed nets	2.23	1.87	1.78	2.45	2.12	1.78

Based on this data, does it appear that bed nets represent an effective strategy for reducing the infection rate by Malaria?

4. As part of your dissertation research you have been studying competition between two species of seed eating bird. Your initial research showed that the size of seeds consumed by an individual bird was strongly correlated with the depth of its beak, and that substantial competition exists for a limited number of seeds. These observations led you to hypothesize that in those regions where the two bird species live in sympatry, competition would be fierce and drive the evolution of divergent beak depths in the two species (character displacement). In contrast, in regions where the species occur in allopatry, you hypothesized that no such divergence in beak depth would occur. In order to evaluate your hypothesis, you measured the beak depth of six birds of Species X and six birds of Species Y in a population where the two species are sympatric. Your data is shown in the table below:

	Bird					
	1	2	3	4	5	6
Species X Bill Depth (mm)	4.23	4.34	4.54	4.96	4.86	4.07
Species Y Bill Depth (mm)	3.23	3.87	3.78	3.45	3.12	3.78

Does your data support your hypothesis that the beak depth of the two species is diverging in sympatry?