Independent Project Final Draft Script [redacted] & [redacted]
BIO 295 April 21, 2014

**The Wolfpack of Isle Royale**

Räikkönen, J., Vucetich, J. A., Peterson, R. O., & Nelson, M. P. (2009). Congenital bone deformities and the inbred wolves (Canis lupus) of Isle Royale. Biological Conservation, 142(5), 1025-1031.

## Introduction

For almost 60 years, populations of wolves and moose have been monitored on the island of Isle Royale, which is found near the edge of Lake Superior, close to the US-Canada border. The two species have provided excellent insight into predator-prey interactions and carrying capacity of each individual population in an island ecosystem. Researchers are beginning to look at how an abundance of natural factors is having a negative effect on the wolf population in particular. These factors include the lack of selection and migration prevention due to climate change. Both of these factors are contributing to the abundance of inbreeding in the population of wolves on the island, which as a result has had many negative consequences.

One of the primary consequences seen in the wolves over the past 30 years is the congenital malformations of the vertebrae, which is affecting their predator ecology. In this particular research, biologist examined the vertebral columns of thirty-six wolves that had lived on the island. A large percentage of the wolves exhibited either more vertebrae than normal or a failure of certain vertebrae to fuse. Both of these problems can decrease the attacking efficiency of the wolves amongst other movement problems.

## Concepts

### 1. Founder effect and limits on gene flow/migration

a. Premating factors, one of the three barriers that prevent the exchange of genes between populations, contains two subsets. Forms of ecological isolation occur when potential mates don't meet because they either, breed at different times, temporal isolation, or they breed in different habitats, habitat isolation. Forms of behavioral isolation occur when potential mates meet but don't mate due to behavioral or pollinator isolation. Founder effect can be seen as the movement of a subset of a population into a new physical location, thus starting a new genetically isolated colony. This natural phenomenon can cause loss of genetic diversity, because the subset of individuals from the original population can only carry a certain portion of the alleles that made up the original populations gene pool.

b. The founder effect can be seen for both the moose and wolf populations, but the effect has been more drastic for wolves due to their smaller population that migrated from the mainland. The original or founder population of moose came across the land bridge from Canada in 1910, and the wolves came across thirty years later in 1940. Gene flow and migration are limited to times when the ice bridge freezes over which occurred in 1997 and 2008 most

recently. Even with the possibility of the addition of individuals to the island population or at least exchange of genes through reproduction, scientists hypothesized that that the wolves from the mainland did not migrate onto Isle Royale or exchange genes with the island population, likely due to premating factors. The founder effect arises due to the small population size and the relatively low number of wolves on the island, usually consisting of twenty to thirty individuals. Because of the low number of individuals contributing to the gene pool, the population is expected to have lost approximately 80% of its genetic diversity between 1950 and 2008. To increase the effect that the lack of alleles is having on the wolf population, global warming seems to be increasing the time between deep freezes which allow for the exchange of individuals or alleles if they were actually occurring.

**2. Inbreeding and its results**

a. Mating between individuals that are more closely related to each other than would naturally occur due to chance can cause genetic problems within the population. Inbreeding in a population tends to cause an increase in the number of homozygotes for a particular trait as well as a decrease in the number of heterozygotes. While inbreeding does not always produce negative results, the occurrence of negative results such as deleterious recessives, or homozygous recessive traits that are harmful to an individual, occur much more often in inbreeding situations. Offspring who inherit deleterious recessives due to breeding between closely related individuals are known as inbreds.

b. The presence of inbreeding and the lack of genetic diversity in the population of Isle Royale have led to morphological deformities in the wolves. We see this selection with the finches of the Galapagos Islands, but with no strong selection occurring for this small population of wolves on Isle Royale, the inbreeding is proving to be detrimental. A large percentage of the wolves have exhibited either more vertebrae than normal or a failure of certain vertebrae to fuse. These deformities can cause paresis, paralysis, inability to voluntary move the tail, loss of muscle tone, as well as problems with hip joint development and lower back pain. Problems outside of the vertebrae are also seen due to inbreeding, such as syndactyly or partial fusion of foot bones. One of these problems was seen in 58% of the surveyed wolves, and the problems appeared more often in the more recently dead wolves. Each of these can decrease the attacking efficiency of the wolves, which may explain why the number of moose needed to support the wolf population has gone up. If inbreeding is occurring as this data collected by our researched study seems to show, some form of selection and mutation must be present to assure that the population's gene pool is changing.

**3. Island Specifics**

a. There is a set of five attributes that allow most islands to be excellent study systems of many species for evolutionary biologists. Many of these attributes such as small size, distinct boundaries, and simplified biotas are relatively self-explanatory. If the inhabitants of the island are abundant and tame, this also contributes to the ability of researchers to study it, by allowing the interpretation of evolutionary patterns to be easier. In addition if the island is relatively small with considerable geographical isolation to keep rates of colonization and number of species low, it becomes easier to study for biologists. Lastly the presences of replicates in population lineages on the island allow biologists to distinguish between general evolutionary patterns and unique evolutionary outcomes.

b. Isle Royale has a couple of these required attributes and therefore exemplifies what makes it such an excellent study system.

1. Small with distinct boundaries

Isle Royale is approximately 210 square miles, most equivalent to the island of Santiago in the Galapagos. The last time there was a land bridge from Isle Royale to the mainland was in 2008 and before that it was in 1997. This means that no external factors in the form of space, other animals, or gene flows from other populations are occurring, keeping the boundaries distinct from other land masses.

3. Simplified Biotas

The three main interacting species of the island are the wolves, the moose, and the fir trees that the moose feed on. Animals such as ticks also live on the island, but their presence does not have an effect on the moose and wolf interactions.

4. Age & Geographical Isolation

The populations on Isle Royale are relatively young. The original population of moose came across the land bridge from Canada in 1910, and the wolves came across thirty years later in 1940. The last time there was a bridge from Isle Royale to the mainland was in 2008, and before that was in 1997. Therefore, the populations present have lived relatively undisturbed for only seventeen years, approximately 15 miles away from the mainland.

**Movie**

For our project we have set up a news show/NPR show spoof, based roughly on work seen on SNL. This form of video will allow us to inform the audience on what is going on with the Isle Royale situation, including the basic terminology and concepts, while also entertaining them through clever comedy. The majority of the information is conveyed in an interview with the second author of our primary literature, John Vucetich. We have explained how this island study system and others work. We have then explained the past work that has been done with the wolves and moose and how this has impacted our views of ecology. We later looked at the current dilemma facing the wolves and how this affects their populations. In addition, we show how the changes in the wolf population are affecting the other populations (moose & fir) on Isle Royale. Lastly, we have discussed the possibilities of how this situation can be handled. The film also includes a comedic commercial advertising vitamins for wolf osteoporosis.

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**FEEDBACK FROM INSTRUCTOR:**

Hi [redacted] & [redacted],

You did an excellent job on the **movie**. You included all elements I asked for and satisfied the criteria indicated in the rubric. You earned full credit for your movie.

Your movie was quite elaborate, you used many different media tools and it was quite evident that you put a lot of effort into making it. Well done!

A few things I noted:
You presented several graphs, which was good, but you didn't explain them. It was not very clear what they were showing and I think it would have been beneficial to either mention and explain the graphs specifically in the interview or take the viewer through them by using text annotations or animations.

But as I said, overall excellently done!

Here's what your peers said about your movie:

- *Concepts are explained really well and clearly*
- *Very well organized, interview was a good idea*
- *VERY WELL DONE*
- *Good idea and presentation*
- *Professional, humorous and informative*
- *Nice job on choosing a study that actually has an island*
- *I love the ideas they brought to the screen. It was humorous and all together very fun to watch and informative.*
- *Quality music, chose an island – nice, quality B-reel*
- *Incorporated many different media and cool clips*
- *Does a good job of keeping the video feeling like a newscast*
- *Dramatic and presented in a clear way*
- *I liked the humor*

Overall, you did an excellent job on the **final script**. You included all elements I asked for and satisfied all the criteria indicated in the rubric. You earned full credit on this assignment.

You did a particularly nice job on explaining theory concepts and linking them to the paper. Well done!

Best,
D. Magdalena Sorger