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# EFFECT OF WOLF POPULATION LEVELS IN YELLOWSTONE NATIONAL PARK ON THE ELK POPULATION

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## ABSTRACT

In 1995, gray wolves (*Canis lupus*) were reintroduced to Yellowstone National Park to decrease the elk (*Cervus canadensis*) population levels. However, hunters complain that the wolves will kill too many of the elk, so this has become a heated debate between conservationists and hunters. While a new predator or competitor may initially decrease the population of another species, animal species can adapt to changes in their environment after a couple of years. Originally the elk population declined because of the reintroduction of the gray wolf. This study was conducted to see if the elk population in Yellowstone is still decreasing, or if it is increasing or stabilized. To acquire my data set, I searched on the internet for population numbers of elk and gray wolves in Yellowstone National Park. Then, I created a line graph for the elk population counts, and a line graph for the wolf population counts. My data indicated that the population level for elk is still decreasing. However, the decreasing population may be caused by another factor because my data found that wolf population levels have stabilized.


*Key words: Elk (*Cervus canadensis*), Gray Wolf (*Canis lupus*), population, reintroduction Yellowstone,*

## INTRODUCTION

In 1926, gray wolf (*Canis lupus*) packs were extirpated from Yellowstone National Park (National Park Service, 2020, February 13th). With the wolves gone, Elk (*Cervus canadensis*) no longer had a natural predator and their population skyrocketed. This affected the Yellowstone grasslands. The elk were overgrazing the open valleys (Peglar, 2019). Overgrazing can desecrate landscapes and it causes food shortages for many species. In 1995, wolves were reintroduced to Yellowstone National Park to decrease the elk population levels (National Park Service, 2020). However, hunters complain that the wolves will kill too many of the elk and ruin the elk hunting season (Peglar, 2019). This is a heated debate between conservationists and hunters (Peglar, 2019). To keep track of the elk population, a winter count is done each year since 1960 (National Park Service, 2020, February 19th). The elk population has declined since the introduction of wolves (National Park Service, 2020, February 19th). However, is the elk population still declining, or has its population stabilized? While a new predator or competitor may initially decrease the population of another species, animal species can adapt to changes in their environment after a couple of years. The gray wolf was a new predator to the elk in 1995, but now it has been 24 years since the wolves were reintroduced to Yellowstone. The elk population may have adapted to the wolves as predators and adjusted behaviors accordingly. To determine if the elk have adapted it

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needs to be determined if the population of elk is stable, decreasing, or increasing. I predict that after the initial decline in the elk population, the population will stabilize and become a steady count with few spikes and dips because of the elk adapting to the new predators. Decreases in elk population will most likely be caused by other circumstances, such as harsh winters. Predation on elk will be compensatory and not additive.

## FIELD SITE

The data was collected in Yellowstone National Park. The total area of Yellowstone National Park is about 3, 472 square miles (National Park Service, 2019, September 6th). The park's land is 5 percent water, 15 percent grassland, and 80 percent forests (National Park Service, 2019, September 6th). Yellowstone's annual precipitation fluctuates between 10 inches in the northern corner and 80 inches in the southwestern corner (National Park Service, 2019, September 6th). Average temperatures in Yellowstone National Park vary by season. In the spring and fall daytime temperatures are usually between 30ºF and 60ºF (National Park Service, 2019, December 19th). In the summer, daytime temperatures stay around 70ºF, though they do occasionally raise to 80ºF (National Park Service, 2019, December 19th). In the winter, daytime temperatures vary between 0ºF and 20ºF (National Park Service, 2019, December 19th). Yellowstone National Park contains a lake called Yellowstone Lake (National Park Service, 2019, September 6th). Yellowstone Lake has a surface area of 131.7 square miles and an average depth of 138 feet (National Park Service, 2019, September 6th). The park is on top of an active volcano (National Park Service, 2019, September 6th). Between 1,000 and 3,000 earthquakes occur annually (National Park Service, 2019, September 6th). There are also 500 active geysers in the park (National Park Service, 2019, September 6th). Yellowstone National Park is inhabited by 67 species of mammals, 285 species of birds, 16 species of fish, 5 species of amphibians, and 6 species of reptiles (National Park Service, 2019, September 6th). There are 9 species of conifers, more than 1,000 species of native flowering plants, 225 invasive plants, and 186 species of lichens (National Park Service, 2019, September 6th). Lodgepole Pine makes up more than 80 percent of Yellowstone's forests (National Park Service, 2019, September 6th).

## METHODS AND MATERIALS

To acquire my data set, I searched on the internet for population numbers of elk and gray wolves in Yellowstone National Park. I entered "wolf population count in Yellowstone National Park for [insert year]" into the google search bar. I repeated this step until I had collected data from 1994 to 2019. All of my data for the gray wolf population came from the Yellowstone Wolf Project Reports. These reports are written every year. Then, I entered "elk population count in Yellowstone National Park for [insert year]" into the google search bar. I repeated this step until I had collected data from 1993 to 2019. I had to use various different sources to gather as much data on elk as I could find because there were no written reports on elk for every year like there was for wolves. I collected population number from 1993, which is two years before gray wolves were reintroduced to Yellowstone National Park, to 2019. Each population count was taken in December of that year or January of the following year. For example, the population count for 1993 was completed in January of 1994. For elk, I wasn't able to find reliable population counts for every year. Bad weather and limited aircraft availability caused some years to not have an official elk count (Maughan, 2006). There is missing data for the wolf population count in 1996. I found a report combining 1995 and 1996 for the wolf population report, but no population count for the end of 1996 was given in the report (Phillips and Smith, 1997). After I had gathered all of my data, I made a table to hold all of the data collected (Table 1). Then, I created a line graph for the elk population counts (Figure 1) and a line graph for the wolf population counts (Figure 2). Each line graph has markers at the population level for each year. On both line graphs, I added a trendline and equation to see if the populations are following a trend. Then, I compared the line graphs to each other to analyze my data.

## RESULTS

*Table 1: Elk and wolf population counts in Yellowstone National Park from 1993 to 2019. The blank spaces in the table are where no count occurred because of poor flying conditions or limited aircraft availability (Maughan, 2006). Multiple sources were used to gather the data.*

| Year | Elk Population Number | Gray Wolf Population Number |
|---|---|---|

| | | |
|---|---|---|
| 1993 | 19,045 | 0 |
| 1994 | 16,791 | 14 |
| 1995 | No data | 40 |
| 1996 | No data | No data |
| 1997 | 13,400 | 86 |
| 1998 | 11,742 | 112 |
| 1999 | 14,538 | 118 |
| 2000 | 13,400 | 177 |
| 2001 | 11,969 | 218 |
| 2002 | 9,215 | 272 |
| 2003 | 8,335 | 174 |
| 2004 | 9,545 | 171 |
| 2005 | No data | 118 |
| 2006 | 6,738 | 136 |
| 2007 | 6,279 | 171 |
| 2008 | 7,109 | 124 |
| 2009 | No data | 96 |
| 2010 | 4,635 | 97 |
| 2011 | 4,174 | 98 |
| 2012 | No data | 83 |
| 2013 | 3,915 | 95 |
| 2014 | 4,850 | 104 |
| 2015 | 4,844 | 98 |
| 2016 | 7,510 | 108 |
| 2017 | 7,579 | 97 |
| 2018 | 5,800 | 80 |
| 2019 | No data | 94 |

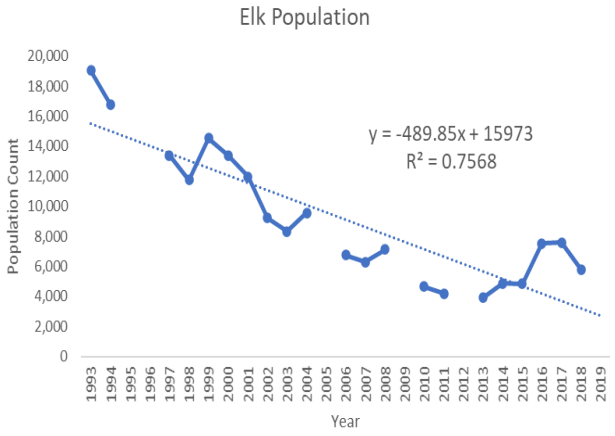


*Figure 1: Line graph of the Elk population count in Yellowstone National Park from 1993 to 2019 with trend line and equation.*

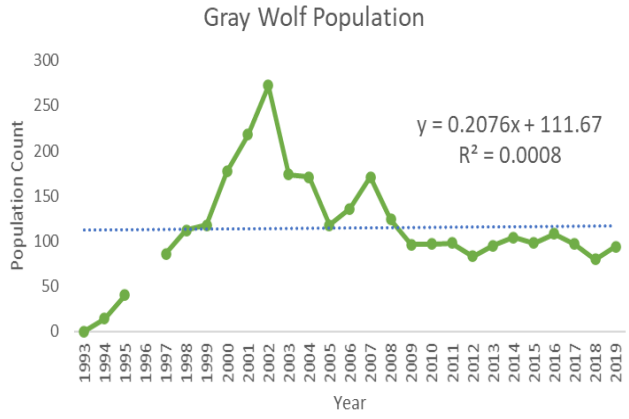


*Figure 2: Line graph of the Gray Wolf population count in Yellowstone National Park from 1993 to 2019 with trend line and equation.*

## DISCUSSION

According to my results, the elk population at Yellowstone is still decreasing. There are spikes in the data when the elk populations increase dramatically, but overall figure 1 shows a decreasing population trend. Therefore, my hypothesis is incorrect. The elk population has not stabilized, but the decreases in the population may not be caused by wolves. In recent years, the gray wolf population in

Yellowstone has stabilized. There have not been any enormous spikes or dips in the population since 2009 (Figure 2). Since the wolf population is steady and not increasing or decreasing, I would assume the elk population would be steady as well since there is not a drastic change in their predator numbers. Therefore, the elk's population may not be decreasing because of the wolves. If this is the case then half of my hypothesis is correct because it means the elk have adapted to the wolves existing in the elk's habitat. To figure out if the elk's population is being affected by other factors, other studies should be developed. Perhaps there have been some harsh winters in recent years that have decreased the population of elk. A study researching weather conditions in Yellowstone may be valuable in figuring out why the elk population has decreased when the wolf population has been stable. Competition could also be a cause for a decrease in the elk population. A different study could find if any new ungulates have entered Yellowstone or if other ungulate populations have increased causing increased competition over grazing areas. More research needs to be done before a proper conclusion can be drawn about why the elk population in Yellowstone is decreasing. My research, however, has determined that gray wolves cannot be the only factor affecting the elk population.

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