Using Alternative Models to Estimate Bighorn Population Size in the Santa Rosa Mountain Range

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Dr. Oz Garton

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By
Ken Pirkle

Introduction

Bighorn sheep (*Ovis canadensis)* have always been present in Nevada, and in the past have been at high population numbers. However, throughout the years, bighorn sheep numbers have been dwindling (Hansen, 1967). No one knows for sure why the bighorn sheep population has diminished, but some have speculated that hunting has ~~attributed~~ contributed to the decline (Hansen, 1967). Historic ram to ewe ratios were 100:100, but with the introduction of hunting some have speculated that the ram to ewe ratio has dropped to 23:100 (Hansen, 1967). Wild bighorn sheep are born in all months throughout the year, but lambing normally occurs in February, March and April (Hansen, 1965). For the most part, survival is high with a lamb to ewe ratio of 70:100 at birth to one month and 35:100 from one month to six months and then about 15:100 at the yearling stage (Hansen, 1967). Primarily, bighorn sheep tend to be long lived, up to 16 years, again suggesting that bighorns have a high survival rate (Hansen, 1967).

On March 23, 1978, Jim Jeffers, a wildlife biologist for the Nevada Division of Wildlife (NDOW) in Humboldt County, first reintroduced California bighorn sheep into the Santa Rosa Mountain range. The initial release was at Eight Mile Canyon in the Santa Rosa range. The composition

of that herd consisted of four rams ranging in age from yearling lambs to three years of age, and eight ewes ranging from yearling lambs to seven years of age. The ram to ewe ratio was 50:100, and the lamb to ewe ration was 37.5:100.

Since the initial relocation of these sheep, there have been three augmentations to the population. The first augmentation was conducted in February of 1987 at the top of Andorno Creek Drainage; it consisted of five individuals 3 females and 2 males. The females were all adults, and the males ranged from lambs to two and a half years of age. The composition of this group of individuals consists of a ram to ewe ratio of 66:100. The lamb to ewe ration was 33:100.

The second augmentation was on January 21, 1989, consisting of twenty individuals, three rams ranging from one to three years of age, and seventeen ewes ranging from yearling lamb to seven years of age all released on Sawtooth Mountain. The composition of rams to ewes in this herd was 18:100 and lamb to ewe ratio was 12:100.

The third augmentation was January 28, 1998. This augmentation consisted of the reintroduction of 12 individuals, 2 rams ranging from yearling lamb to 3 years of age, and 10 ewes, ranging from yearling lambs to

6 years of age. The composition of rams to ewes in this herd was 20:100 and the lamb to ewe ratio was 20:100. This population was released at Indian Creek, in the Santa Rosa range (personal communication with Jim Jeffers wildlife biologist for Humboldt County Nevada Division of Wildlife).

Since this population of bighorns is a reintroduced population close records must be kept on its status. Hunting has been allowed since 1985, and a close account must be kept of hunting mortality to ensure that hunting does not have a negative effect on this population. I am proposing to use a modified life table to calculate the current status of this population and show how it has changed over time. I will also demonstrate within these life tables how the role of hunting affects this population. 10/10

Description of the Study Area

The Santa Rosa Mountain range is located in the northwestern corner of Nevada. This mountain range runs north and south, and ranges in elevation from approximately 5,000 feet to 10,000 feet. Steep rocky slopes with limited vegetative cover characterizes it. The vegetation

predominantly is consistent of a desert montane ecosystem, characterized by sagebrush and cheat grass.

The bighorns tend to stay within the area that they were initially released. In this particular case, the Santa Rosa population of bighorn sheep all localize within a few drainages and one mountain. These include Indian Creek, Andorno Creek, Eight Mile Creek, and Sawtooth Mountain, all of which are in the Santa Rosa Mountain range (See appendix one for a maps of the study area). 10/10

Methodology

Normally, wildlife biologists rarely have the opportunity to collect all of the data necessary, due to many regulating factors. The data that they prefer to collect would enable them to have accurate data on population size, survival, mortality and fecundity rates. With this data wildlife biologists could properly manage wildlife and the area that they are in charge of.

One reason that the wildlife biologists are not able to collect accurate data, especially wildlife biologists for the Nevada Division of Wildlife, is budget restraints. NDOW is the smallest game agency in the United States, having an inadequate budget, which means few hours of helicopter flying

time, if any at all. Another reason that they are not always able to collect adequate data is because of poor weather. Weather in Nevada is constantly changing, usually including high winds, which limits a helicopter's flying ability. Much of the time, population observations have to be taken on a limited basis, and even in some cases from the ground (personal communication with Jim Jeffers wildlife biologist for Humboldt County Nevada Division of Wildlife). Jim also stated that much of the time one must estimate variables such as survival, mortality, and recruitment in order to estimate populations.

With all this in consideration, a wildlife biologist faced with these problems must formulate a way to compensate for the lack of data and still be able to see what the population is doing year to year. One way around this is to create new estimation models, based on proven models, which will correspond with the new data to provide answers. A new life table model will be created, based on a proven life table, which I will work with using raw data that I have received on the Santa Rosa bighorn population, courtesy of Jim Jeffers wildlife biologist for Humboldt County Nevada Division of Wildlife. The data that I have is composition data such as sex ratios and lamb to ewe ratios. The life table that I am going to use incorporates total

rams and ewes seen each year, along with an estimate of survival and mortality rates. It will account for hunting mortality to predict a representative population estimate for the entire population of bighorn sheep in the Santa Rosa mountain range.

Your model isn't usually called a life table model but rather a Leslie-matrix or age-structured model. 3 complications that you might consider are 1) Incorporating known(or estimated) hunting mo
2) Survival and fecundity rates may change with population density
3) " " " " " " " weather from year to ye

It would be great if you could figure out how to incorporate these 3 modifications/improvements into age- or stage-structured model.

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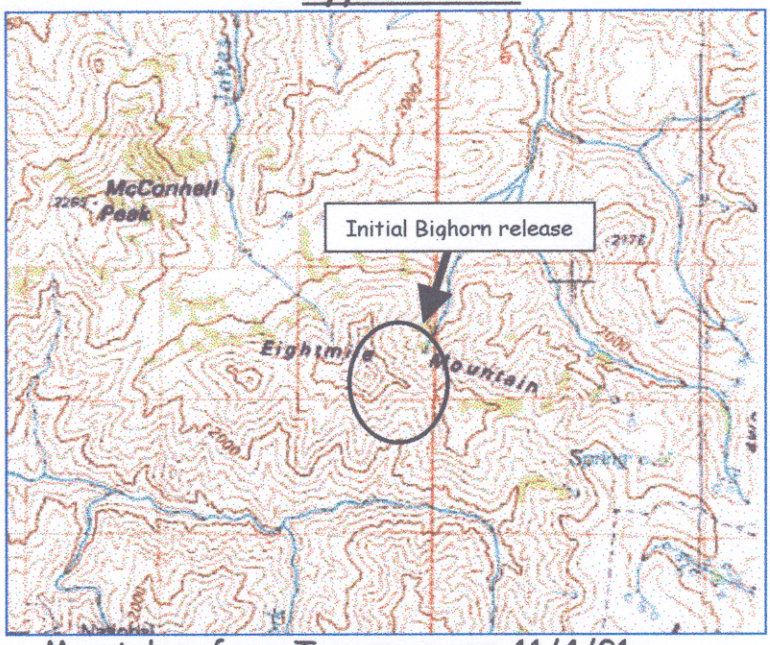
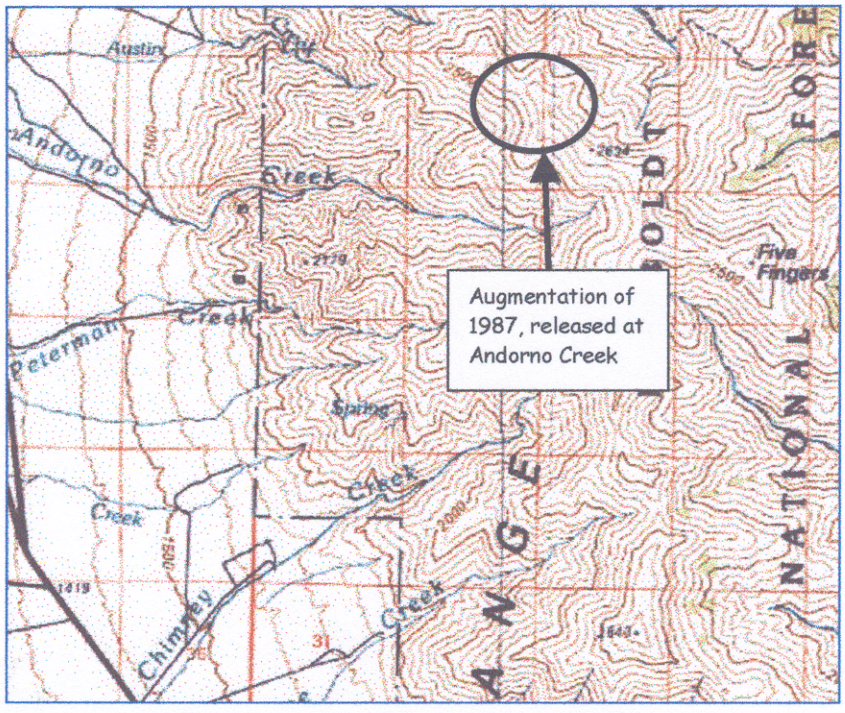
Overall Impression: Excellent. 5/5

Appendix One



Map taken from Topozone.com 11/4/01



Map taken From Topozone.com 11/4/01

Literature Cited

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