

IMPACTS OF SEISMIC ACTIVITY ON BIGHORN MOVEMENTS AND HABITAT USE

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Abstract: In April 1982, eight bighorn sheep were radio-collared on the Ford Creek winter range. This range is utilized by the southern segment of the Sun River population. As part of a continuing effort to evaluate effects of gas and oil development on big game populations along the Rocky Mountain Front, the yearround movements of these sheep were monitored for four years. In the fall of 1983, three seismic lines (helicopter porta-drills) were run concurrently across the Ford-Fairview Plateaus which represents the major portion of this herd's fall - winter range. In September-October 1982, prior to disturbance, 71% (10 of 14) of the radio relocations occurred on the Ford-Fairview Plateaus. During the September-October 1983 seismic activity, no relocations occurred on the plateaus. Instead, 100% (17) of the sheep relocations were to the south along the Crown Mountain-Wood Lake Hogback, which is part of their summer range. In September-October 1984, post disturbance, 45% (5 of 11) of the relocations were again on the Ford-Fairview Plateaus. In 1983, average annual home range size declined 28% from 25.9 square miles in 1982 to 18.6 square miles. Following disturbance in 1984, it increased to 29.7 square miles. Data on habitat use for three years is presented.

In October, 1980 a study was initiated along the Rocky Mountain Front in Montana to evaluate impacts of gas and oil activity on bighorn sheep, elk and mule deer populations. As part of this effort, eight bighorn sheep were captured on the Ford Creek winter range and radio-collared. The movements of these animals have been monitored. In the fall of 1983, seismic activity occurred on the Ford-Fairview Plateaus which makes up the major portion of the Ford Creek winter range for bighorn sheep. This paper presents the movements and habitat use of these marked animals, during years previous to, concurrent with, and after the disturbance.

METHODS

Bighorn sheep were captured in April 1982 on the Ford Creek winter range with a net gun fired from a helicopter. Seven adults ewes and one lamb ram were captured and fitted with PVC pipe collars containing radio transmitters. Relocations were obtained primarily from fixed-winged aircraft. Due to the terrain, ground tracking was limited. Aerial tracking was conducted yearround. From the time of capture in April 1982

through August 1982, 60 relocations on eight bighorn sheep were obtained during eight flights. From August 1982 through June 1983, 91 relocations were made on seven bighorn sheep during 15 flights. From July 1983 through June 1984, 56 relocations were made on six bighorn sheep during ten flights. Relocations were plotted on USGS topographic maps. When visual sights were not obtained, locations were plotted to nearest one half mile. Data on percent slope and elevation were recorded from the maps. For each relocation data on topography, cover, and habitat components were recorded according to preselected types (Table 1.). Data on seismic activity were obtained from the Lewis and Clark National Forest seismic activity summary for the Rocky Mountain Ranger District.

RESULTS AND DISCUSSION

Movements:

In 1982, the summer range of this herd was more extensive than previously recorded by Erickson (1972) and Frisina (1974). The sheep made extensive use of the Crown Mountain - Wood Lake Hogback divide during late spring, summer and early fall (Hook, 1985). Individuals made extensive movements throughout this period frequently crossing the Benchmark road from the Ford Creek area to the Crown Mountain divide and back again often within a one to two week period. By mid-September most of the sheep had returned to the Ford-Fairview Plateaus and remained there for the winter. During the fall of 1983, three seismic lines were run across the Ford-Fairview Plateaus (Figure 1.). These lines were run by Frontier Exploration under AMOCO Oils permit. Lines 1-3 were helicopter supported porta-drilling operations. A fourth line was a conventional truck-mounted drilling operation that followed an existing road adjacent to the Plateaus. The porta-drill operation was requested by the United States Forest Service with AMOCO's compliance to reduce the disturbance associated with surface-charge surveys. Weather and equipment problems resulted in a request from the seismic operator to bring in a second crew. The District Ranger approved this request based on his authority under permit clause number 46 which allows concurrent activities closer than the recommended nine mile spacing and the Lewis and Clark Programatic Environmental Assessment for seismic activity which allows "for concurrent activities, if they are close together, because one area is essentially affected and the period of time the company will be working is reduced". The result was at least two seismic lines being run concurrently often within 1-3 miles of each other over approximately a 45 square mile area for a minimum of four weeks (September 9 to October 18).

Figure 2 presents the fall radio relocations for 1982, 1983, and 1984 shown in relation to the 1983 seismic lines. During two

flights in September and October, 1982, ten of 14 (71%) relocations were on the Ford-Fairview Plateaus. Only four relocations (29%), representing four individuals, were on the Crown Mountain-Wood Lake Hogback Divide. All seven individuals were located at least once on the plateaus during the fall of 1982.

During September and October 1983, 17 relocations of six sheep were made during three flights (Figure 2.). All the relocations in 1983 were along the Crown Mountain-Wood Lake Hogback Divide. In the year following the seismic activity, 5 of 11 (45%) relocations were again on the Ford-Fairview Plateaus during the September to November 8, 1984, time period.

Due to the small numbers of seasonal relocations it was impossible to calculate fall home ranges for individual sheep. However, the effect of the seismic activity can be seen in that the average annual home range size significantly ($p < .05$, F test) declined (28%) from an average of 25.9 square miles in 1982 to 18.6 square miles in 1983. Following the disturbance, average home range size significantly increased ($p < .05$, F test) to 29.7 square miles in 1984 (60%) versus 1983 figures. The effect of the seismic activity is further illustrated by the annual home range of adult ewe number 3204 (Figure 3.). The home range for this individual measured 24.3 square miles, 18.3 square miles, and 21.6 square miles in 1982, 1983, and 1984 respectively. The lack of use of the Ford-Fairview Plateaus accounted for the reduced home range size in 1983.

HABITAT USE

Data on habitat use from September-October relocations are presented in Table 1. Elevations and slopes on which sheep were located did not differ significantly among years. Cover type use shows a shift from the open timber type to the rock/bare ground type from 1982 - 1983. This if further increased in 1984. Habitat use in 1984 was considered to be strongly influenced by the severe fall weather conditions encountered. Low temperatures and heavy snowfall affected habitat use with the sheep making extensive use of ridges. Habitat components show 1982 fall use of ridges, talus slopes, and cliffs accounting for 60% of the observations. Mountain grass lands and sidehill parks represented 40% of the sheep observations. In 1983, 94% of the observations were in the rock type components. 1984 data also show predominate use (91%) of these types.

Frisina (1974) found 64% of his fall observations in his Rocky reef habitat type and 34% in his Bunchgrass type. These data would compare closely to the 1982 data from this study.

The Ford-Fairview Plateaus are significantly different land types compared to the Crown Mountain-Wood Lake Hogback Divide. According to United States Forest Service land typing, the Ford-Fairview Plateaus are predominantly fescue grasslands (75%) and mixed limber pine and Douglas fir forest on gently sloping to moderately steep mountain foothills. The major land type along the Crown Mountain-Wood Lake Hogback Divide is very steep limestone rockland and scree supporting open growing stands of Douglas fir, alpine fir, spruce, and white bark pine on forested scree.

CONCLUSIONS

The impact of the 1983 seismic activity can be evaluated in terms of the direct response of the sheep to the disturbance, and in terms of the potential consequences of that response. The decision to allow a second crew and to amend the guidelines to allow lines to be run concurrently (as opposed to the nine mile spacing requirement) resulted in the exclusion of bighorns from a major portion of their traditional fall range. Porta-drill operations have been considered less disturbing than surface charge operations. However, the result of simultaneously operating two crews on three lines over open mountain plateaus dramatically increased helicopter activity. It is this intense helicopter activity that is apparently responsible for the dislocation of bighorns from the plateaus in 1983. Erickson (1972) and Frisina (1974) found the Ford-Fairview Plateaus to be a major component of this herds fall range. 1982 and 1984 data from this study would support those findings. The 1983 data would indicate that the direct response of bighorns to the seismic activity was abandonment of a major portion of their fall range.

The consequences of this change in range use can be seen in the differences between habitats of Crown Mountain-Wood Lake Hogback and Ford-Fairview Plateaus and the potential effects on the population. The Ford-Fairview Plateaus are gently sloping grasslands as compared to the very steep rockland and scree of the Crown Mountain-Wood Lake Hogback Divide. The increased energy costs associated with disturbance, and in negotiation more rugged terrain, may be met with increased forage intake. However, if forage availability is reduced, the increase in energy expenditure results in deteriorating animal condition due to the necessity to draw on body reserves. Forage availability is much higher on the plateaus than the divide. Individual habitat use data shows a shift in cover type and habitat component use from the open grassland types in 1982 to steeper rocky terrain in 1983. During the period of severe climatic conditions in 1984, the shift from grassland to rocky terrain was also evident.

During the fall, bighorns should be improving their body condition by increasing forage intake in preparation for the stress of the coming breeding season and winter. Rams face a period of increased stress associated with the rutting season, and ewes are confronted with the biological demands of breeding and carrying a lamb to full term. The impacts of forcing a population from its most productive range, in terms of over winter survival and reproductive success, could be quite severe. Measuring that response can be difficult, especially since this herd and the entire sheep population on the Front experienced a major die-off during the winter following the seismic disturbance due to a pneumonia - Lungworm outbreak.

As a result of these findings a recommendation was made to the interagency committee overseeing gas and oil activities that the date for termination of gas and oil activities on bighorn winter ranges be moved from November 1 to September 15.

Literature Cited

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- Frisina, M. R. 1974. Ecology of bighorn sheep in the Sun River area of Montana during fall and spring. MS thesis, Montana State University, 68 pp..
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QUESTIONS AND ANSWERS

Wayne Heimer, Alaska: Dan, this isn't so much of a question for you as it is just a comment. I look at the schedule here and see that we may be coming to the end of the helicopter papers. I don't know whether this is fair, but Frank Singer has probably spent more time than any other living man or person inside a helicopter looking out at sheep, and I just wondered if he cared to make a couple of comments about what his impressions are having seen so many Dall sheep from the inside of a helicopter, as opposed from on the ground looking up. I don't know whether that's a fair spot to put you in, Frank, but I know you've got a lot of experience there.

Frank Singer, Wyoming: Well, basically, we did see some big differences between populations. Most of the populations I surveyed were in national parks, a lot of herds weren't hunted or flown over very much, and we got what we thought were acceptable levels of disturbance. We did have a couple of herds, however, one of them was in Noatak National Preserve, and some of those animals did react quite a bit to the helicopter. Did that answer your question, Wayne?

Heimer: I don't know whether it was a question. I just thought it seemed appropriate since you have more experience than anyone else, you might share a few thoughts, if you have an impression, I was just interested in what it was.

Singer: What I guess I'm trying to say is I think the level of hunting on these herds makes a difference, as well as, the types of other disturbance, as to how an individual group is going to react to a helicopter. Back to the mountain goat question - I worked with a herd in the southern tip of Glacier National Park and we did a lot of blasting near those animals, and we did not see much of a reaction. This was along U. S. Highway 2 when it was reconstructed. We concluded at the end of that paper, that based on a review of the literature and some things that Doug Chadwick, for example, observed with a hunted herd that the fact they were unhunted and they weren't harassed much may have them a little amenable to that level of disturbance.

Heimer: Another question I have is do you guys own a U-2 or something to get those beautiful pictures of your study area? How do you guys do that anyway?

Dan Hook: I get mine from John McCarthy - I should give him credit for that.