Addendum to:

Elk Inventory in the East Kootenay Trench, 1992
by Keith Simpson, March 1992

and

A Population Assessment of Rocky Mountain Elk
in the East Kootenay Trench, 1980-92
by Ian Hatter, Anna Fontana, and Keith Simpson
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Background

In February 1994, a preliminary population assessment was performed on elk wintering within the East Kootenay Trench (MU's 402-405, 420-422, 424-426) (Hatter et al. 1994). The assessment used cohort analysis (also called VPA or virtual population analysis) to reconstruct elk population trends from harvest age composition data and a winter population estimate in 1992. Several limitations were identified with the preliminary assessments, which are outlined below:

1) The 1992 elk survey used an older version of the Idaho elk sightability model to correct survey estimates for visibility bias. This model did not consider snow cover as a significant variable influencing sightability. A newer version of the model has this modification.

2) The analysis was performed without benefit of known elk natural mortality rates within the East Kootenay Trench. A contract has recently been completed which summarizes the mortality data from radio collared elk (see Jalkotzy, M. 1994. Elk in the East Kootenay Trench: An analysis of radio telemetry data 1986-1993).

3) The assessment was performed prior to collation of the 1993 harvest data.

This assessment has reanalysed the 1992 winter elk survey data using the newer Idaho model, and also incorporates the 1993 harvest data. Unfortunately, there was not sufficient radio-collared elk mortality data available to provide estimates of elk mortality rates within

the Trench. Thus, this revised assessment uses the same age-specific natural mortality rates and wounding losses, as in the preliminary assessment.

The 1992 Revised Survey Elk Population Estimate

The original survey estimate on select winter ranges within the East Kootenay Trench was 8941 ± 714 (90% CI's) elk and included 1451 bulls, 5962 cows, and 1518 calve (Table 1). The newer version of the elk sightability model increased the survey estimate to 9694 ± 746 and included 1530 bulls, 6433 cows, and 1707 calves (Tables 2 and 3). The revised estimate resulted in an overall sightability correction of 16.7%, almost twice as high as the original 9% correction. The extrapolated winter estimate (including all elk wintering within Class 1, 2, 3 and 4 winter ranges of the East Kootenay Trench) was approximately 11,040 elk and included 1852 bulls, 7269 cows and 1918 calves (Table 4).

The 1992 Revised Model Population Estimate

The starting (1991) posthunt population for the cohort analysis was estimated from the extrapolated winter survey estimate using the same methodology as described in the preliminary assessment (MALEWINT.XLS, FEMLWINT.XLS). It was assumed that the survey estimate was most reliable for cows, calves and yearling bulls, and least for mature bulls. The starting age structure for adult males and females were estimated from the 1991 harvest age structure. For males, yearlings were calculated to be 4%, 2.5 - 4.5 year-olds as 68%, and 5.5 year-olds as 78% as vulnerable to hunting as 6.5+ year-olds. All age-classes of cows were considered to be nearly equally vulnerable.

The 1991 posthunt bull estimate (1+ years-old) of 3824 was 22% higher than the preliminary model estimate. This increase resulted from the higher survey estimate for yearling males (1086). The 1991 posthunt population for cow elk was 11,855 or 30% higher than the preliminary model cow estimate. This increase resulted primarily from a modification of the 'tuning' procedure used to fit the cow and calf estimates to the bull estimate. In the original assessment, the calf sex ratio was assumed to be even (100 male calves/100 female calves). In this assessment, the prehunt calf sex ratio averaged 87.6 male calves/100 female calves which approximates the observed calf harvest sex ratio (87.4 calves/100 female calves from 1981-91). The yearling prehunt sex ratio averaged 86.3 males/100 females (FIGURE7B.XLS). The estimated posthunt adult sex ratio ranged from 31 bulls/100 cows in 1992 to 39 bulls/100 cows in 1984.

Elk Population Reconstruction: 1980-93

The cohort analysis suggested a gradual decline (2.1%/year) in the posthunt elk population from 24,360 in 1980 to 19,275 in 1991 (FIGURE7A.XLS). Adult bull numbers decreased by 26% and cow numbers by 21% during this period. Harvest rates were estimated at 22% for bulls (28% for 2+ year-old bulls), 2% for cows and 17% for calves during the 1991/92 hunting season (FIGURE8B.XLS).

The 1991 posthunt population was also projected forward to 1993 using the recent harvest data and a density dependent calf-cow relationship observed from the reconstructed data (CALFRECR.XLS). The 1993 posthunt population estimate was 19,868 including 3893 bulls, 12,065 cows and 3910 calves. Thus, the revised VPA suggested that the posthunt elk population declined from 1981-1991 and then slightly increased. The two years of increase (1992, 1993) were associated with a marked reduction in the harvest (FIGURE7A.XLS).

Comparison of Population Reconstructions

The preliminary model estimate for bulls in 1991 (Hatter et al. 1994), a CAGEAN[1] population estimate and the revised bull estimate reported here were compared to see how well they performed with the estimated 1992 and 1993 age-specific harvests (VPA_CAGN.XLS). The preliminary model estimate suggested that essentially all 4.5 year-olds had been removed from the population, and required an additional 64 5.5-year-old bulls to support the estimated age-specific harvests. The revised model estimate produced surviving bulls in all age-classes, although only 22 5.5 year-olds remained. The CAGEAN estimate performed the poorest as it required an additional 200 4.5-year-olds and 142 5.5-year-olds to support the harvest. Thus, of the 3 scenarios examined, the revised bull estimate appeared to be the most compatible with the recent harvest data. It should be noted, however, that there could have been considerable error associated with the calculation of age-specific harvests, which was not taken into consideration in the analysis. These values were developed from the 'Tooth Return Program' which has had low sample sizes in recent years, and which may also represent a biased elk tooth sample from hunters.

Discussion

The revised 1991 posthunt model population estimate was almost 30% higher than the preliminary estimate reported by Hatter et al. (1994). The bull estimate was 22% higher, while the cow estimate was 30%. While the bull elk population estimate was well defined (particularly from 1980 to 1985), the cow population estimate was not. As shown in the preliminary assessment (Hatter et al. 1992), the cow elk reconstruction was very sensitive to the natural mortality rate assumed. This analysis also revealed it was sensitive to the calf sex ratio. Thus, little confidence can be placed on either the annual cow/calf population estimates or bull/cow ratios.

The model posthunt elk estimate (19,275) also differed markedly from the revised survey estimate (11,040). The modelled bull estimate was 2.0-fold higher than the survey

[1]CAGEAN is a statistical catch-at-age model which also reconstructs population numbers from harvest data, but which has slightly different assumptions than VPA.

estimate, and the modelled cow elk was 63% higher. Originally, it was hoped than the survey estimate could be used directly in the cohort analysis. However, population projection of bulls indicated that more bulls would be required than estimated from the survey to support the observed harvest. Thus, this analysis suggests the winter survey methodology underestimated elk numbers. The reasons for this are not clear. Perhaps the sightability model, which was parameterized in Idaho does not adequately reflect southeastern B.C. survey conditions. Alternatively, there may have been substantial errors involved with extrapolating the survey estimate to the entire East Kootenay Trench. Still another possibility was that some of the bull elk summering within MU's 402-405, 420-422 and 424-426 may have wintered within other MU's

Recommendations

While some progress has been made towards defining recent elk population numbers and trends within the East Kootenay Trench by using cohort analysis, there still remains much uncertainty about elk absolute abundance, particularly with regard to the antlerless component of the population. The following are recommended to improve population statusing of elk within the East Kootenay Trench and to determine sustainable harvest levels, consistent with population management objectives:

1. Repeat the 1992 winter elk survey in 1995, or alternatively in 1997.
2. Increase sample size and reduce bias in elk teeth submitted through the Tooth Return Program.
3. Maintain and monitor a 'pool' of 25 to 50 radio-collared elk (bulls and cows) for documenting harvest and non-hunting mortality rates and seasonal movement patterns.
4. Develop a relative abundance index for monitoring elk population trends.
5. Investigate alternative methods for tuning the VPA analysis for bulls.