POTENTIAL USE OF TRACK-PELLET GROUP COUNTS FOR MOOSE CENSUSING

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ABSTRACT: Here we suggest the potential of a within-winter track-pellet group sampling technique for moose censusing. It will not replace aerial censuses in "core" North American moose range, where large, remote areas must be surveyed, but based on previous tests with deer, may be useful in areas that have relatively good winter access. To use this technique one gathers data several days after the end of a snowfall that covers all previous moose tracks and pellets. At that time an observer follows all moose tracks within relatively large (≥ 5 ha) plots (or within strips of a predetermined width) and counts all pellet groups that are visible on the snow surface, found in association with those tracks. Where appropriate the track-pellet group technique offers the following advantages over spring pellet group counts: 1) few if any pellet groups are missed; 2) pellet group age (deposition period) is certain, and groups are discrete; 3) additional biological information can be collected simultaneously; 4) mid-winter defecation rates are expected to be more uniform than those throughout the entire fall-spring period; and 5) sites that could not be examined during normal pellet group counting times, and areas that cannot be easily sampled from the air can be sampled. Disadvantages include: 1) winter access constraints; 2) the need for quite precise on-site monitoring of local snowfall events; 3) much time will be required to visit and survey plots and/or strips; 4) moose may step on or kick snow over pellet groups and hence some may be missed; and 5) the method is restricted to post-snowfall periods when moose behavior, and possibly defecation rate, may be different than during more snow-free periods. We speculate on the relative efficiency of this technique and suggest settings and conditions where it may be useful.

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For moose (*Alces alces*), aerial counting over snow is generally accepted as the most practical inventory procedure (LeResche and Rausch 1974, Timmermann 1974, Jordan and Wolfe 1980, Peek 1982). Aerial counts can provide relatively quick inventories of abundance over extensive areas and also provide information on sex and age composition of the animals seen. The accuracy of even high intensity aerial surveys is limited, however, by numerous variables and interactions among those variables (LeResche and Rausch 1974, Timmerman 1974, Jordan and Wolfe 1980) and ranges widely (LeResche & Rausch 1974).

Spring pellet group counts are commonly used as indices of cervid abundance and to estimate deer (*Odocoileus* spp.), elk (*Cervus canadensis*), and moose population levels (Neff 1968, Timmermann 1974, White and Eberhardt 1980). They are also valuable where overstory cover makes aerial counting impossible or impractical (Jaren 1992). Although Fuller (1991) questioned the value of pellet group counts for estimating white-tailed deer (*O. virginianus*) population density and change in northern Minnesota, White (1992) claimed that Fuller's rejection was unjustified and at odds with his own data. Robinette et al. (1977) found that pellet counts for mule deer (*Odocoileus hemionus)* yielded realistic annual population estimates, and Jordan et al. (1993) found reasonable consistency in trends between independent sampling of moose at Isle Royale, Michigan, by aerial counts and pellet counts.

Although track counts have been used to estimate populations of caribou and moose where these animals migrate (Forbes 1955,

Jaren 1992), and for models intended to predict numbers and distributions (Wright 1951, Tyson 1959 Sittler 1965), in most cases pellet group counts are believed to provide more accurate population estimates (Longhurst and Connolly 1982).

We suggest that a within-winter method that combines pellet group and track data, and is little-described in the literature, may be practical for and could improve moose use and population estimates in some circumstances. This method is more likely to meet the assumptions required for estimates based on "sign" (Longhurst and Connolly 1982, White 1982) than is either method if used alone.

Lautenschlager and Hennessey (1975), and Lautenschlager (1982), described a within-winter "track-pellet group census" for estimating white-tailed deer numbers. Before winter they flagged the outer boundaries of 56 1-acre (0.4 ha) plots. Periodically during winter, several days after a significant snowfall, they followed all fresh tracks found within each plot. As they followed the tracks they counted pellet groups associated with those tracks. The procedure was then repeated, after subsequent snowfalls, on the established plots. The authors concluded that if proper precautions are followed, those using the track-pellet group method can: 1) eliminate the problem of missed groups; 2) expect to find discrete groups; 3) determine pellet group age with certainty; 4) sample wet and swampy areas, which are unaccessible in spring; 5) eliminate errors associated with washing, insect attack, and inadequate leaf cover. The objective of this paper is to examine the potential of the track-pellet group count for documenting moose habitat use and densities during winter.

The Track-Pellet Group Count

The track-pellet group method relies on tracks made during a quite precisely known period, i.e., from the end of a significant snowfall until an observer reaches the plot. It confines searching to the snow over which the animals have travelled. In their study, Lautenschlager and Hennessey (1975) used 1-acre (0.4 ha) plots, randomly placed within identified stratified segments of 2 study areas, to census white-tailed deer. Track-pellet group surveys of these areas were made on the same plots at 3 separate times, between 28 and 47 hours after the recorded end of several snowfalls. (However they recommended that observers wait at least 36 hours from the end of the snowfall until entering a survey plot.) This required knowing when the last snowfall stopped in the area and recording the time, to the minute, of arrival at each plot, and then walking the perimeter of each plot until tracks were encountered entering or leaving the plot. All tracks were followed into the plots and pellet groups found in association with tracks within the plots were counted, then buried beneath the snow by the observer to eliminate possible recounting. Finally, the total number of pellet groups found and the time elapsed since the end of the snowfall were tallied for each plot separately, and means and SEs for the area, based on all plots within an area, were calculated. Population estimates were based on procedures similar to those outlined by Overton and Davis (1969), who used days since pellets were removed or covered, but refined time estimates (hours and minutes) were used to determine the number of deer/acre. The final population estimate was based on the average of densities calculated for 3 separate observation periods on each area.

Track-Pellet Group -- Potential for Moose Census

The major requirement for successful use of the track-pellet group count is periodic accumulations of snow, a condition commonly met on most moose ranges. While 0.4 ha plots seemed appropriate for deer (the SE, based on 6 surveys (3 each in 2 areas) of 56 plots, averaged 57% of the estimated mean

(track-pellet group) and 33% (spring pellet group counts on 240 0.01 acre plots) Lautenschlager and Hennessey 1975, we suggest that much larger plots (≥ 5 ha) will be required to document moose use and densities on surveyed areas. Plot and sample size should, however, be adjusted to local moose density, variations in their spatial distribution, and expected sample variation.

Strip counts may also provide a useful sampling unit. Strip counts would eliminate the need for and time associated with establishing permanent plots. Randomized strip plots could be established once and reused during the winter, or established separately during each post-snowfall entry. A large number of these strip transects, stratified by habitat type, could be examined during the course of a few days.

The track-pellet group count method could reduce or eliminate problems associated with missed pellet groups. Unlike spring pellet group counts in areas of high animal concentration, pellets found on snow, in association with tracks, remain relatively discrete, and their age is certain. Sites that would be under water in spring can be sampled using this method. Moose mid-winter defecation rates are expected to be more uniform than those extending from fall through spring (Andersen et al. 1992), and hence this method may reduce sample variability. This technique also may be appropriate in areas where vegetative cover makes aerial observations impractical (Jaren 1992), or where aerial surveys are limited by consistently dangerous winds, weather conditions and/or topographic relief. Taken together these advantages should increase the accuracy of pellet group counts and related population and/or habitat use estimates. In addition track-pellet group counts provide an opportunity to collect other data, such as bedding, browsing, or urination rates, or to take urine and fecal samples.

This technique, however, requires relatively good winter access, and on-site recording of the end of local snowfalls. Other potential disadvantages are: possible differences in pellet group deposition rate following a storm vs. that in non-stormy weather; possible coverage of pellet groups by windblown snow or snow falling from tree limbs, or moose stepping on or kicking snow over deposited groups; the time required to reach census plots and survey those plots; problems associated with differential moose habitat use both within and among winters (Rolley 1982, Jaren 1992); and the potential for variations in winter severity to affect range use and hence the distribution of pellet groups (Fuller 1991).

CONCLUSIONS

Although the track-pellet group method is likely only appropriate in smaller, relatively easily accessible areas, we believe it offers advantages that may be valuable to those responsible for moose research and/or management. In addition it could be combined with aerial census work to document moose use of areas identified as having high or low winter densities, or to supplement aerial counts in areas where heavy coniferous cover makes seeing moose on the ground difficult. We agree with Timmermann 1974, that "the diversity of moose ranges across North America in itself suggests that methods of census should be designed to fit the situation".

Clearly, before relying on the track-pellet group count for moose habitat use and/or densities estimates, it should be compared with some other census method(s), preferably in areas with known populations. With white-tailed deer, the track-pellet group count compared favourably with spring pellet group counts made in the same area (Lautenschlager and Hennessey 1975). If moose density estimates are the goal, accurate estimates of moose daily pellet group production during the winter, by range type and season, will be required. That, however, seems to be as much of a problem today as when it was identified by

Timmermann (1974). One problem with spring pellet group counts is that they reflect mean defecation rates, but those rates decrease from fall to spring as forage quality decreases (Andersen *et al.* 1992). Mid-winter defecation rates are expected to be more uniform, and therefore counts at this time could lower sample variation. For comparisons of use between or among areas, however, means based on the total number of pellet groups counted may suffice.

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