WOLF POPULATION SURVEY

Tetlin National Wildlife Refuge
Game Management Unit 12, eastern Alaska

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ABSTRACT

Snow track surveys are a common method of estimating relative abundance, estimating density, and documenting range use of furbearers and large carnivores. The purpose of this project was to investigate the feasibility of snow track surveys as a tool for monitoring distribution and density of wolves (*Canis lupus*) on Tetlin National Wildlife Refuge (Tetlin Refuge) and adjacent areas. The estimated wolf density (8.1 ± 4.4 wolves/1,000 km^2) was comparable with earlier qualitative reports (7.2 to 9 wolves/1,000 km^2) for the area, although the estimate's precision was low. Improving the stratification should improve precision in future surveys.

INTRODUCTION

Population estimates of large predators such as wolves have become important to the understanding and management of predator-ungulate systems (Becker et al. 1998). Large terrestrial furbearers, such as wolf, wolverine (*Gulo gulo*), and lynx (*Lynx canadensis*) occur at low densities, are secretive, are often nocturnal, and disperse at low densities (Becker et al. 1998). Because of these factors, it is difficult to estimate and monitor changes in their populations. To index population trends over large areas at low cost, managers often use hunter harvests, depredation rates, and track surveys. However, trend estimates from hunter kills and depredation rates are sensitive to hunting effort and reporting rates (Beier and Cunningham 1996) and in Alaska, population trends are monitored through harvest sealing documents, which are slow and insensitive in recognizing population changes (Becker and Gardner 1992). When animals cannot actually be counted, some type of animal sign may be used to assess relative abundance if the sign has a direct relationship to animal numbers (Caughley 1977, Raphael 1994). Track counts are widely used to index the relative abundance of furbearers and aerial surveys allow biologists to quickly sample furbearer populations in large areas with poor access and provide generally adequate indices of relative abundance (Golden 1987). Further, winter track counts are a continuous type of sign (Reid et al. 1987) and have the most potential in areas with appropriate snow conditions, such as the interior and much of south-central Alaska (Golden 1994).

Track counts in the snow are attractive measures because they are (1) repeatable, (2) easy to conduct, (3) independent of harvest data, and (4) applicable to more than one species (Golden 1994). Track counts from the ground are less expensive and are more accurate than counts from the air. However, aerial surveys provide indices over a much larger area and may be the most useful for scarce and particularly wide-ranging species (Golden 1994). Winter counts of tracks in the snow have been used as indices of distribution and relative abundance, habitat use, and population density estimators in a variety of areas (Golden 1994, Becker et al. 1998).

SURVEY AREA

The survey area was in east-central Alaska and was bordered to the northeast by the Alaska Highway, and to the west and south by the Mentasta and Nutzotin Mountains of the Alaska Range (Fig. 1). The 1,183 mi^2 (3,065 km^2) survey area encompassed the northern portion of Tetlin Refuge and portions of Tetlin Native Corporation Lands. The survey area comprised about 12% of State Game Management Unit 12.

The landscape within the survey area was characterized by large tracts of boreal forest (taiga) interspersed with wetlands typical of much of interior Alaska. As elevation increased, dense spruce gave way to open spruce woodlands mixed with tall shrubs, then dwarf-shrub communities, and finally alpine tundra. Shrubs were most common along streams and water bodies, within recently burned areas, and along gullies that drain subalpine tundra. The boreal forest consisted primarily of black spruce (*Picea mariana*) in wet and poorly drained areas and white spruce (*P. glauca*) on drier sites. Quaking aspen (*Populus tremuloides*) often occurred in pure stands on recently burned south-facing slopes. Paper birch *(Betula papyrifera*) and balsam poplar (*P. balsamifera*) occasionally occurred in pure stands or were mixed with spruce. The shrub component was primarily willow (*Salix spp*.), alder (*Alnus spp*.), and dwarf birch (*B. spp*.).

METHODS

This survey used the method proposed by Becker et al. (1998) wherein the probability of observing an animals' track in the snow is used to obtain precise population estimates of low-density species whose tracks can be observed and followed from a small, low-flying airplane ("SUPE", Sample Unit Probability Estimator). To obtain the population estimate, the method uses a stratified network sample design (Thompson 1992), which is a form of probability sampling (Horvitz and Thompson 1992).

General Assumptions. – The probability estimator used in the stratified-network sample design requires (1) all animals to move during the course of the study; (2) their tracks are recognizable from small, low-flying aircraft; (3) tracks are continuous; (4) movements are independent of the sampling process; (5) pre- and post snowstorm tracks can be distinguished; (6) post snowstorm tracks in searched sample units are not missed; (7) post snowstorm tracks found in selected sample units can be followed to determine all sample units containing those tracks; and (8) group size is correctly enumerated.

Sample Design. – The 1,183 mi^2 (3,065 km^2) study area was partitioned into sample units (n = 81) approximately 14.6 mi^2 (37.8 km^2) defined by 4 minutes of latitude and 6 minutes of longitude (H. Golden, Alaska Department of Fish and Game, Anchorage, Alaska, Personal Communication). Each sample unit was grouped into one of three strata (low, n = 27; medium, n = 20; high, n = 34) denoting the relative likelihood of observing a fresh track of the target species 24-36 hours after a snowstorm (Fig. 1). The area was stratified based upon previous estimates of wolf pack territory delineation and prey distribution, primarily moose. A random sample, without replacement, was then selected to survey. The percentage of sample units from each stratum randomly selected followed guidelines suggested by Becker (1999) by using the number of observations expected prior to the survey. We expected to observe between 7 and 10 tracks of singles or groups during the survey, therefore we randomly selected 67% of the high strata (*n* = 22), 40% of the medium strata (n = 8), and 20% of the low strata (*n* = 5) (Becker 1999).

Field Methods. – We conducted daily surveys with one pilot / biologist team using a Piper PA-18 SuperCub to search selected sample units for fresh wolf tracks from 8 March to 10 March 2004. The survey was initiated approximately 36 hours following a 2.5 cm snowfall on top of a good base (0.6 – 0.7 meters). Fresh tracks were defined as tracks made since the last snowfall and new enough to follow by aircraft (< 4 days old; Becker et al. 1998). Search intensity depended upon overstory, lighting conditions, and amount of track deposition by non-target species (e.g., caribou and moose). When fresh wolf tracks were found within a selected sample unit, they were backtracked to the point where they were no longer considered fresh, and then tracked forward towards the animals. The number of wolves in the group, the sample units that their fresh tracks intersected, the direction of travel, and distinguishing features were recorded. We inferred pack size from track counts when conditions did not allow for a direct count of the pack (Becker et al. 1998). When tracking in a heavily forested or heavily tracked sample unit, we also searched nearby open areas such as lakes, rivers, and meadows to ensure we correctly identified all sample units containing fresh tracks. All analyses were conducted using the software application, *SUPEPop* (Becker et al. 1998).

RESULTS

This initial survey was planned as a pilot effort to evaluate the feasibility of using this method to monitor wolf populations on and adjacent to Tetlin Refuge. Habitats across the survey area vary from wetlands interspersed with bands of trees, to wide expanses of thick spruce forest. Habitat type can substantially affect the ability to find and follow tracks from the air, and also dictate the amount of time spent in a sample unit to complete an adequate survey. Further, small bands of caribou are known to winter on Tetlin Refuge, which can significantly hinder aerial wolf tracking (Becker and Gardner 1992; Hayes and Harestad 2000). To measure our ability to track wolves through different habitat types and caribou abundance, and given a limited time frame, most of this pilot survey effort was directed towards the high strata to maximize the possibility of encountering fresh wolf tracks; only 18 (51%) of the randomly selected sample units (*n* = 35) were completed.

Approximately 5% (n = 18 sample units) of the total area was surveyed over 16.6 hours, with an average of 55 min/sample unit. This effort included 50% of the high strata (n = 17 sample units) and 4% of the low strata (n = 1 sample unit); no medium strata sample units were surveyed. We correctly stratified 67% of the completed sample units (n = 12).

We followed fresh wolf tracks from 5 groups, but were only able to get a visual on one (Group 1; n = 9) (Table 1, Fig. 1). The number of wolves in packs where a visual was not obtained was inferred from their tracks. Efforts to pursue Groups 2 (n = 2) and 4 (n = 4) were hampered by caribou trailing, which the wolves were following. The tracks for both Groups 3 (n = 4) and 5 (n = 1) were lost when the wolves entered thick spruce forest. Fresh tracks for one other pack (8 – 10 wolves) adjacent to the study area was also recorded, but not followed.

By applying probability equations (Becker et al. 1998), we obtained a population estimate of 24.8 ± 13.4 wolves (90% C.I. = 11.4 – 38.1), or a density of 8.1 ± 4.4 wolves/1,000 km^2 (90% C.I. = 3.7 – 12.4). We also estimated that there were 4.8 ± 2.2 wolf packs (90% C.I. = 2.6 – 7.1). A wolf pack is defined as ≥2 wolves (Ballard et al. 1987, Becker et al. 1998). The average estimated pack size was 4.9 ± 1.5 wolves (90% C.I. = 3.4 – 6.4).

DISCUSSION

The dynamic nature of wolf movements, pack size, and location, including resting on kills, present a worse-case scenario for a population estimator (Becker et al. 1998). Probability sampling is one way to overcome these problems, however, the difficulty in use of probability sampling is finding a way to determine the probability that an observation is contained in the sample design. In addition, the typically large daily range of wolves limits the ability to exactly predict which sample units would contain the pack on a particular survey day. The SUPE can overcome these difficulties by substituting a stratification requirement on the likelihood of a sample unit containing fresh tracks rather than the conventional sampling requirement that the sample unit contain the wolves (Becker et al. 1998). A limitation of the SUPE is it requires good piloting skills to fly small aircraft slow and low to the ground, as well as good tracking skills by both the pilot and observer to find, identify, and follow tracks of target species (Becker et al. 1998).

One of our main challenges in this area was the occasional presence of wintering caribou, which can make aerial wolf tracking difficult. A possible solution would be to locate caribou groups immediately prior to beginning the wolf survey and surveying affected sample units first before they become heavily impacted by caribou trailing.

Although this was a pilot effort in small area, we found the estimated values were close to our expectations. Prior to the survey, we predicted we had the potential to encounter 35 wolves in 6 packs, averaging 6 wolves per pack (Alaska Department of Fish and Game, Unpublished data). Our survey subsequently estimated there were 24.8 (± 13.4) wolves in 4.8 (± 2.2) packs, with an average pack size of 4.9 (± 1.5) wolves. Earlier subjective estimates of wolf density for our area were considered moderate and ranged from 7.2 wolves/1,000 km^2 (Tetlin Refuge, Unpublished data; 1987) to 9 wolves/1,000 km^2 (Gasaway et al. 1992), both comparable with this surveys findings (8.1 ± 4.4 wolves/1,000 km^2). However, the resulting estimates were fairly imprecise and improving our stratification should also improve the estimate's precision. Because we rely in part on our experience from past surveys to stratify, we presume that over time our accuracy will improve.

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Table 1. Observations made during a pilot wolf survey on Tetlin Refuge and surrounding lands, eastern Alaska, 2004.

	n	Date Obs	Pack Name[a]	Notes
Group 1	9	9-Mar-04	Bear Creek	Individuals observed
Group 2	2	10-Mar-04	Cheslina	Tracks only
Group 3	4	10-Mar-04	Cheslina	Tracks only
Group 4	4	10-Mar-04	Central	Tracks only
Group 5	1	10-Mar-04	Central	Tracks only

[a]Possible pack association inferred from proximity to historical pack territory delineations (Alaska Department of Fish and Game, Unpublished data).

Figure 1. Tetlin Refuge wolf survey area and randomly selected sample units, eastern Alaska, 2004.