Kanuti National Wildlife Refuge
2006 Wolf Survey Results
March 14 - 18

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Date: September 2006

A wolf survey was conducted on and adjacent to Kanuti National Wildlife Refuge (Kanuti NWR) March 14 – 18, 2006, replicating a survey conducted the previous year (Fig. 1). As in 2005, contract pilot Harley McMahan conducted the survey using the Stephenson survey method (Stephenson 1978). The planned survey area was 3,949 mi^2, but McMahan estimated that 30% of this was windswept and considered unworkable. The windswept area was excluded from the analysis, reducing the total survey area to 2,764 mi^2. This represents a slight reduction from the area surveyed in 2005, when tracking conditions were good to excellent on 2,848 mi^2 within the survey area. The survey took 30.24 hours in 2006, not including travel time to and from Bettles, which is similar to the 30 hours flown in 2005. Results from this type of survey are considered a minimum count that represents a "snapshot in time" for when the survey was conducted.

Seventy-two wolves in 16 packs (range 1 – 10 wolves per pack) were counted within and near the survey area (Fig. 1). Three of these, in two packs, were found outside of the survey area, although their tracks originated within it. Based on previous radio telemetry data, we know that some wolves found on the refuge have territories that are largely outside of the refuge boundary. Including wolves that only spend a fraction of their time within the survey area may overestimate wolf density. Cases of wolves found outside of designated survey areas are treated different ways in the literature. In some cases they are excluded based on known movement patterns, and in others they are only included if half of their fresh tracks are within the survey area. For the 2005 survey density estimates, we handled this situation by dividing the number of wolves in half if the pack was outside the survey area rather than excluding them entirely (Saperstein 2005). If we apply this approach to the 2006 count of 3 wolves located outside the survey area, the total is reduced to 71 wolves (70.5 wolves rounded up to 71).

Three additional track networks, containing an estimated total of 7 wolves that were never seen, were specifically noted by the pilot as being distinct from actual wolf observations. The total wolf observations were therefore increased to 78 wolves.

Wolf densities are usually reported as the number of wolves/1,000 mi^2. The 2006 survey resulted in a density estimate of just under 28 wolves/1,000 mi^2. This exceeds the 2005 density estimate of 17 wolves/1,000 mi^2 and is also higher than the estimated density of 14 wolves/1,000 mi^2 derived from a similar survey in mid-March 2001 (Figs. 2 and 3). Figure 2 also shows wolf locations relative to wolf territories mapped as part of a radio telemetry study from 1998 – 2001.

Part of the increase between 2005 and 2006 may be explained by the number of wolves found outside of the survey area boundaries. In 2005, 19 wolves were located outside the boundary, and these were reduced to 10 wolves for the density estimate. If these had all been found in the survey area, the 2005 density estimate would have increased to 20 wolves/1,000 mi^2. Variation in wolf locations among years (inside versus outside the survey area), combined with changing survey area due to snow tracking conditions, will result in fluctuations in wolf density that may or may not indicate actual changes in the wolf population (Fig. 2). Unlike moose surveys, this technique does not provide a

statistical measure of the error associated with the count. Such survey techniques have been developed for wolves, but the survey protocol requires excellent tracking conditions. We have attempted these surveys in the past, but have been unable to meet the requirements. The current method will provide trend information on wolf numbers over time, but sources of variability should be kept in mind when comparing results among years.

The intensity of potential predation on moose can be assessed by looking at moose/wolf ratios. The fall 2005 moose survey on Kanuti Refuge resulted in an estimated 1,026 moose, or 378 moose/1,000 mi^2. This moose density is appropriate to use for areas just outside of the refuge boundary that were included in the wolf survey. The spring 2006 moose/wolf ratio is therefore just over 13 moose/wolf (Table 1). This is lower than the ratio in spring 2005 (18 moose/wolf), when there was a lower fall moose density but a lower March wolf density.

The Alaska Department of Fish and Game management goal for GMU 24 is a fall density, prior to over-winter mortality, of 13 – 23 wolves/1,000 mi^2 (Stout 2003). This management goal does not take into account the recent subdivision of GMU 24; the survey area is now in GMU 24B. Wolf density during the 2006 survey exceeded this management goal. A rough rule of thumb is that ratios over 30 moose/wolf could result in stable to increasing moose populations *if* the habitat can support this number of moose and if other sources of mortality from factors such as hunting or severe weather were not excessively high (Gasaway et al. 1983). According to Mark McNay (ADFG, personal communication, April 2005), the density of wolves seen during the Kanuti survey is typical for areas of interior Alaska without predator control. The observed moose/wolf ratio is low, but consistent with other low density areas such as GMU 19D (McGrath area), 20C (south of Tanana River and west of Nenana River), and the Yukon Flats.

Determining wolf densities and moose/wolf ratios is not an exact science, and a number of general factors should be kept in mind when looking at these relationships.

- Wolf density will be highly dependent on the size and shape of the survey area. This was demonstrated in the Kanuti surveys in that a variable number of wolves were found just outside of the survey area in 2005 and 2006.
- Wolf density is highly variable and is affected by factors such as prey, season, and harvest. Studies in North America show that 64% of the variation in wolf density could be explained by variation in prey availability (Fuller et al. 2003).
- Tracking conditions during wolf surveys and the ability of trackers will affect results. For this survey, we had good conditions in most of the survey area and an excellent tracker who was successful in finding lone wolves and pairs. Maintaining the same observer in 2005 and 2006 helped reduce potential variability in results.
- Moose populations are variable and are affected by factors such as age structure of the population, predation and human harvest, environmental conditions such as snow depth, and habitat quality. Caribou are also prey for wolves in winter; caribou were scarce in the survey area for the past two winters.
- Although our moose survey methods provide statistics that enable us to assess how accurate the survey was, we know that we are not seeing all the moose in our survey units. Recent research suggests that 20 - 25% of the moose may be missed in forest-shrub habitat (Boertje 2005). If a similar number of moose are missed on Kanuti, moose/wolf ratios may be higher than calculated here.

In summary, we estimated there were about 28 wolves/1,000 mi^2 in the survey area during the March 2006 survey. This density is consistent with other areas of interior Alaska with natural predator levels, but exceeds the State management goal for a fall wolf density of 13 – 23 wolves/1,000 mi^2 in GMU 24. Management goals will need to be revised due to the recent subdivision of GMU 24. Moose density in the survey area is low, and the resulting moose/wolf ratio of 13 moose/wolf is also low but similar to other low-density moose areas in Alaska. Moose and wolf populations both can be highly variable and will change according to a number of factors. Estimating moose and wolf populations is not an exact science and factors that affect the estimates should be kept in mind. These efforts represent the best that we can do given current budgets.

Table 1. Summary of data used to calculate moose/wolf ratios.

	2004	2005
Estimated moose on Kanuti NWR (fall surveys)	842 (range = 602 – 1,083)	1,025 (range = 581 – 1,470)
Estimated moose density (moose/1,000mi^2)	310	378
Estimated wolf density (wolves/1,000 mi^2)	17	28
Estimated number of moose per wolf	18	13

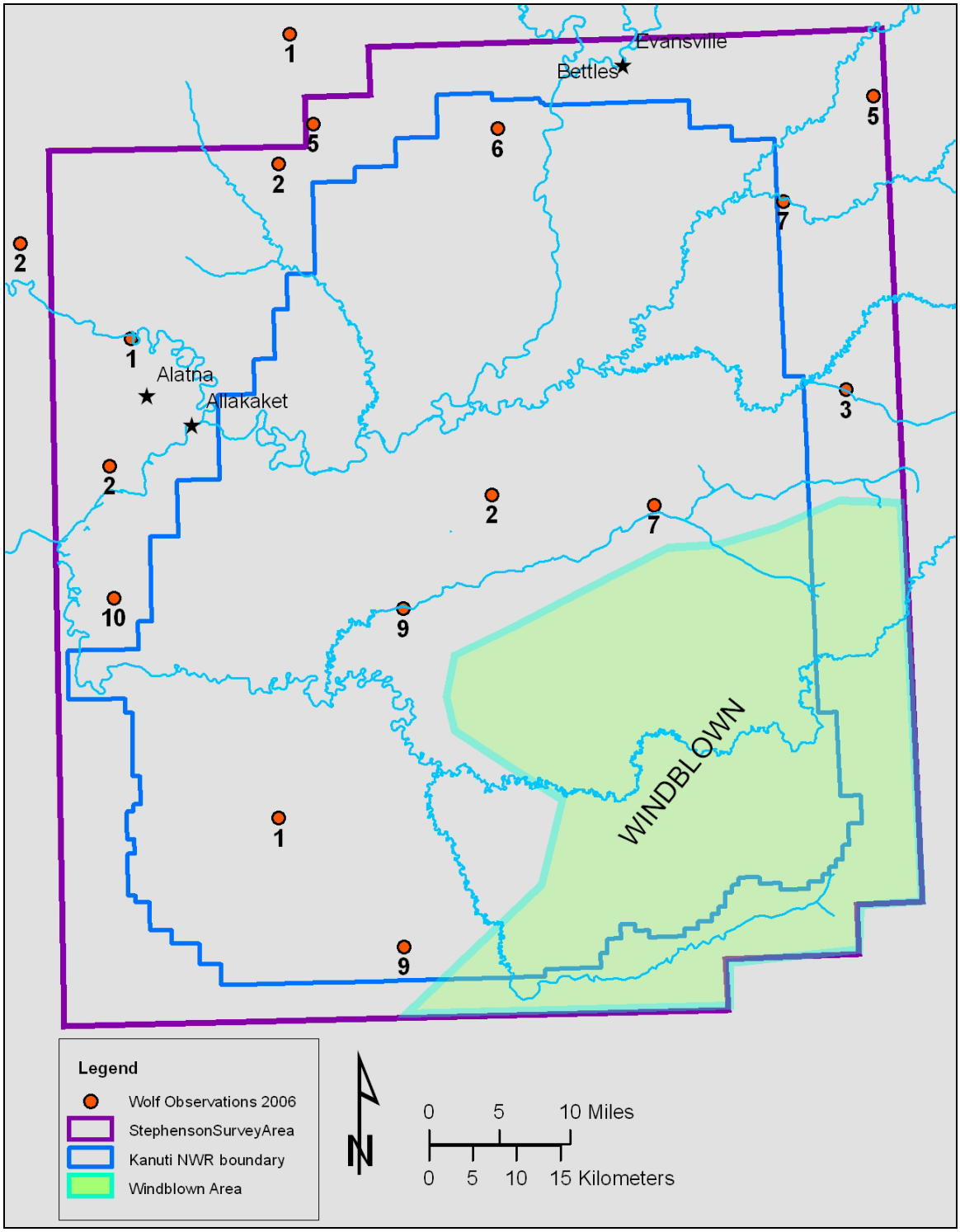

Figure 1. Wolf survey area and location of wolf observations, Kanuti National Wildlife Refuge, March 2006.

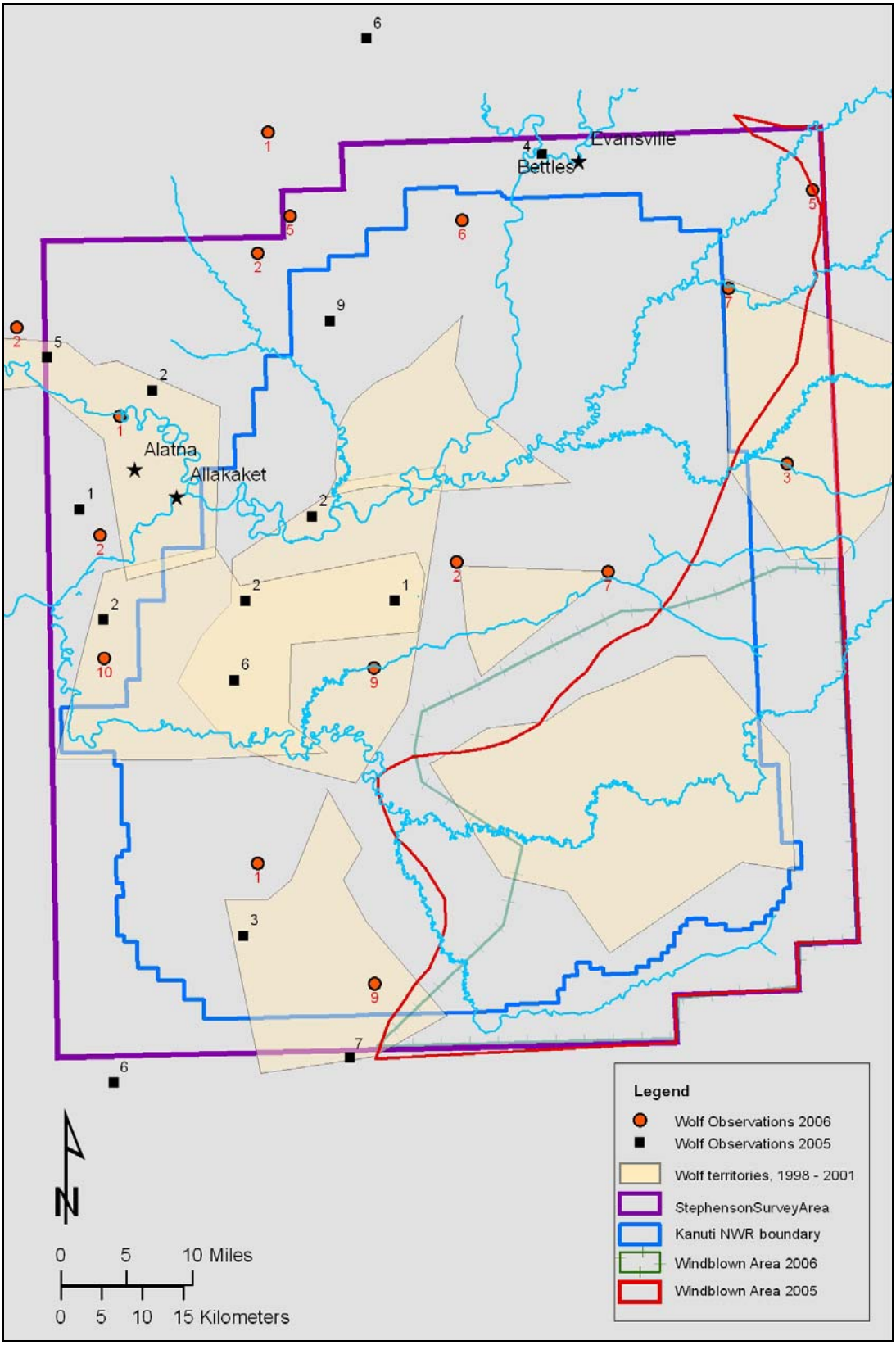

Figure 2. Wolf observations during late winter aerial surveys on Kanuti NWR in 2005 and 2006, overlain on pack territories derived from radio telemetry data 1998 – 2001.

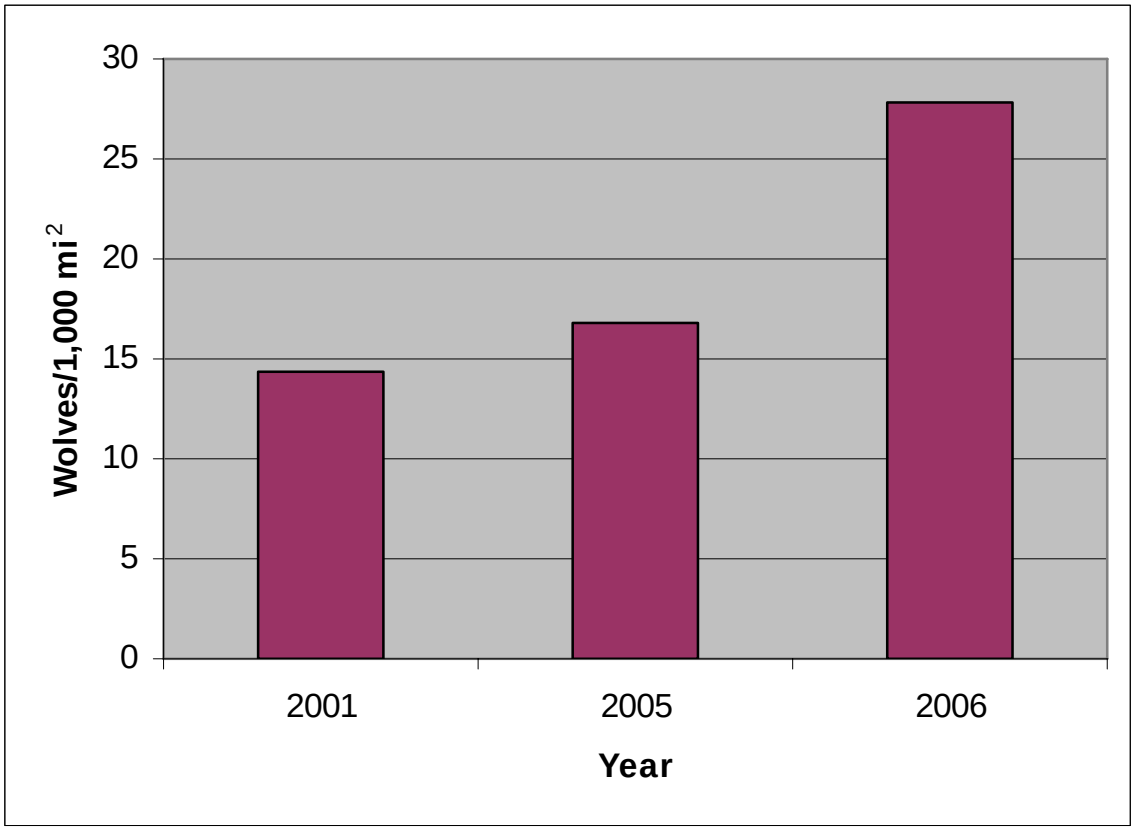

Figure 3. Late winter estimates of wolf density in the Kanuti National Wildlife Refuge area, 2001 – 2006.

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