Research Article

Contribution of Dogs to White-Tailed Deer Hunting Success

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ABSTRACT Dogs (Canis familiaris) are used in hunting white-tailed deer (Odocoileus virginianus) in 10 North American jurisdictions. Although the practice is longstanding and controversial, the effects of dogs on the outcome of the hunt have rarely been studied. We evaluated the influence of dogs on recreational hunting of white-tailed deer based on long-term data from southeastern Ontario, Canada. Over 25 years, annual surveys of hunters were used to collect data on hunting effort and deer harvest from approximately 85 camps, roughly half of which had dogs. We investigated the relationship between harvest and 3 treatments (i.e., 0 dogs, 1 dog, and ≥2 dogs in camp), interactions with weather and deer density, and effects of neighboring camps. Dogs enhanced hunter success. We found no difference in deer encounter rates but, per unit effort, camps with ≥2 dogs harvested 0.013 (26%) more deer per hunter-day, missed 0.010 (23%) more deer per hunter-day, and wounded 0.002 (40%) more deer per hunter-day than camps without dogs. Conversely, camps without dogs saw, without shooting at, 0.033 (23%) more deer per hunter-day than camps with ≥2 dogs. These results are consistent with the idea that hunters with dogs are less selective. Hunters with dogs harvested more fawns per unit effort, but we found no difference in the harvest rate of older female deer. More precipitation, greater wind speed, lower temperatures and greater deer density improved harvest success but had no differential effect among dog treatments. Hunter success at camps with ≥2 dogs was less when neighboring camps also had ≥2 dogs. Because antlerless deer quotas are the principal means to control populations, increasing use of hunting dogs is unlikely to have substantial effects in managing overabundant deer. © 2012 The Wildlife Society.

KEY WORDS dogs, harvest, hunting, neighborhood effects, Odocoileus virginianus, weather, white-tailed deer, wounding loss.

Overabundant populations of white-tailed deer (Odocoileus virginianus) have major ecological and economic effects. In North America, the annual cost of vehicle collisions and damage to crops and forests is in the billions of dollars (Conover 1997). At high density, deer can limit plant regeneration and alter forest ecosystems (Campbell et al. 2004, Côté et al. 2004). In many cases, sport hunting represents the most effective and cost-efficient tool for controlling deer abundance (Giles and Findlay 2004).

Dogs (Canis familiaris) are permitted in white-tailed deer hunting in 10 jurisdictions in North America, including Ontario. The practice is longstanding but increasingly an issue with the public and has generated continual debate on the ethics of dog use, treatment of dogs, and trespass on private lands (Lawrence 1993, Rabb 2010, Hansen 2011). Although the subject of many popular articles, relationships among dogs, hunter success, and deer biology have been the focus of few studies. Some suggest little or no physiological or demographic effects on deer (Progulske and Baskett 1957, Marchinton et al. 1970, Gavitt et al. 1974, Gipson and Sealander 1977); others have noted deer injuries and mortality (Corbett et al. 1971, Nichols and Whitehead 1978) and elevated stress hormones in deer populations hunted with dogs (Bateson and Bradshaw 1997). Novak et al. (1991) reported hunters with dogs were less selective and more successful than still hunters. Hunting success, however, may be influenced by many factors such as weather (Fobes 1945, Hansen et al. 1986), tactics of hunters in neighboring areas (Milner-Gulland et al. 2004), and their interactions (Perry and Giles 1971).

We used long-term observations from southeastern Ontario to investigate the effects of hunting dogs on white-tailed deer hunter success. Over 25 years, annual data were collected on hunter effort and deer harvest from.
approximately 85 camps, roughly half of which had dogs. We tested whether dogs affected the likelihood of harvesting, wounding, missing and encountering deer, as well as age–sex composition of the harvest. We also explored the interactions of dogs with weather and deer density. Finally, because dogs may influence the outcome of other hunters, we investigated the potential spill-over effect of neighboring camps.

STUDY AREA
The Canonto Study Area (CSA; Fig. 1) covered 230 km² in southeastern Ontario (45°08’N, 76°50’W) along the Canadian Shield; 88% of the CSA was Crown land. Elevation ranged from 195 m to 396 m above sea level. The landcover consisted mainly of hardwood forest with some coniferous patches, interspersed with numerous water bodies (Fryxell et al. 1991, Godwin 2010). Vehicle access was primarily via a main road running through the center of the CSA, a hydroelectric transmission line, and secondary roads in the northern and southern limits (Fig. 1). The roads were used by the public and provided access to permanent hunting camps.

The firearms season for white-tailed deer was in November. Before 1985, the season duration was 1-week and 2 weeks thereafter. Party hunting—where hunters were allowed to share game seals—was not allowed for antlerless deer in 1981–1991, although it likely remained common practice in years when not permitted. The traditional method of hunting deer with dogs was to place hunters on watch, usually along roads or trails, while dogs and their handlers moved to the opposite end of the area. The dogs were then either released or kept on leash while handlers progressed through the forest. Once dogs and handlers reached the line of hunters on watch, dogs were collected. Most dogs let off-leash carried collars with return addresses, some with radio transmitters, to prevent them from being lost.

The majority of hunting in our study area was from permanent hunting camps (annual average = 76 camps; range: 62–80). The permanent camps were relatively uniform in their distribution, typically 1 km from the nearest neighbor (Fig. 1). Each had a traditional hunting area with little overlap among camps. In addition, on average 16 tent and casual hunt camps (range: 12–19) occurred in the area in 1980–1986, which declined to an average of 7 such camps in 1988–2004 (range: 3–13). Not all camps hunted every year.

METHODS

Data Collection
Each year, 1980–2004, harvest information was collected from an average of 85 hunting camps (range: 71–99). Of those camps, approximately 40% had 0 dogs, 12% had 1 dog, and 48% had ≥2 dogs (max. 9 dogs). Data were gathered, 1980–1986, from check station interviews and thereafter from questionnaires mailed to the lead member of each camp. Hunters were also individually canvassed by Ministry of Natural Resources personnel each year. The interviews and questionnaires requested information on hunting activities for each day of the hunt: numbers of hunters, dogs, antlerless permits, full-day (>4 hr) hunters, half-day (<4 hr) hunters, bucks killed, does killed, and deer seen, missed, and wounded. In 1987, no information on the number of dogs in camp was collected; we therefore excluded 1987 from analysis. We calculated annual hunter effort per camp by summing full hunter-days (1.0) and half hunter-days (0.5) across the season. We based effort for antlerless deer on the number of permit-days per season, which we estimated as the number of permits multiplied by the number of days a camp operated. Despite the possibility of overestimation of effort bias due to early filling of permits, and underestimation due to party hunting, we believe that this represented a better indication of effort than hunter–days for the antlerless deer harvest. Hunters were asked to fill out the forms daily during the hunt. The overall return rate of the mailed surveys was 83.8%, an excellent response rate for mail survey, indicating minimal non-response bias (Filion 1978).

Data Analysis
During 1980–1986, hunters were asked at check stations to indicate their daily dog usage (as full day, half-day, or not used). From this, we computed dog use over the hunting season each year. On average, camps with 1 dog used it 58% of the time spent hunting each season; camps with ≥2 dogs used them 87–100% of hunting time (Godwin 2010). Therefore, we identified 3 treatments: 0 dogs, 1 dog, and ≥2 dogs per camp. The clear relationship between number of dogs in camp and dog use enabled us to use mail survey results (1988–2004), which reported only the number of dogs in camp during the hunt.

We identified 5 response variables, each computed annually based on the total number of deer divided by total hunter...
effort: kill per unit effort, number of deer harvested; seen per unit effort, number of deer seen (but not shot at); missed per unit effort, number of deer shot at and missed; wounded per unit effort, number of deer wounded but not recovered; and encountered per unit effort, the sum of kill, seen, missed, and wounded per unit effort. All treatments followed a normal distribution with no obvious outliers after visual inspection and they passed Levene's test for homogeneity of variances ($P > 0.05$) unless otherwise noted. We used Statistica version 7 (Statsoft Inc., Tulsa, OK) in our analyses.

Kill per unit effort is a common metric for assessing harvest success, but can be confounded if harvest success varies systematically with effort (Lancia et al. 1996, Van Deelen and Etter 2003, Giles and Findlay 2004). Indeed, we found an accelerating relationship between total harvest ($K$) and effort ($E$) where $K = 0.014 \times E^{1.182}$ (95% CI of the exponent: 1.005, 1.359). Moreover, effort varied among treatments (Fig. 2), a discrepancy driven more by the number of hunters per camp ($r = 0.689$) than the number of days hunted ($r = 0.279$). Any differences in hunter success among treatments, therefore, may have been confounded by the number of hunters per camp (Fig. 2). To test for this possibility, we controlled for camp size. We matched camps into equal numbers of hunters (2–18 hunters per camp) and calculated the mean difference in kill per unit effort (and 95% CI) between treatments each year for each matched group, under the null hypothesis of 0 difference. Each year, on average, we were able to include 54, 30, and 29 camps in contrasts between 1 contrast. We repeated this matching procedure among treatments, therefore, may have been confounded by the number of hunters per camp (Fig. 2). To test for this possibility, we controlled for camp size. We matched camps into equal numbers of hunters (2–18 hunters per camp) and calculated the mean difference in kill per unit effort (and 95% CI) between treatments each year for each matched group, under the null hypothesis of 0 difference. Each year, on average, we were able to include 54, 30, and 29 camps in contrasts between $\geq 2$ dogs and 0 dogs, $\geq 2$ dogs and 1 dog, and 0 dogs and 1 dog, respectively. Some camps were used in $\geq 1$ contrast. We repeated this matching procedure for the other response variables (seen, missed, wounded, and encountered per unit effort) to investigate further the potentially confounding influence of effort on harvest success.

We used a mixed model analysis of variance (ANOVA) to investigate the effect of dog use on dependent variables (kill, missed, and encountered per unit effort) that satisfied the assumptions for a parametric test. Treatment served as the fixed variable and year as a random variable. We applied Tukey’s Honestly Significant Difference (HSD) for post hoc comparisons. Seen per unit effort and wounded per unit effort failed Levene’s test, so we performed a non-parametric Friedman 2-way ANOVA. We used the Mann–Whitney $U$-test with a Bonferroni-corrected $\alpha$ of 0.017 (i.e., 0.05/3 tests) as post hoc tests.

We investigated hunter success on the basis of 4 age–sex classes of deer: adult bucks (>1-yr-old males), adult does (>1-yr-old females), antlerless deer (female deer and male fawns), and fawns. We computed each metric as the total number killed per hunter- (or permit-) day each hunting season. For these 4 response variables, we used the same approach—a mixed-model ANOVA (for adultbucks and adultdoes) and a Friedman 2-way ANOVA test (for antlerless deer, which failed the Levene’s test).

We obtained observations from the closest meteorological station with complete data in 1980–2004, Ottawa International Airport approximately 100 km northeast of the CSA (Environment Canada, unpublished data). We used daily meteorological variables as predictors: maximum temperature, minimum temperature, mean temperature, total snowfall, total rainfall, total precipitation, snow on the ground, and speed of maximum wind gust. Although winds appear to have little effect on deer activity (Webb et al. 2010), given the potential impact of strong winds on the ability of hunters to detect deer, we predicted that the number of days with strong winds (i.e., >31 km/hr) would be negatively correlated with hunting success. We summed the numbers of days per hunting season with wind gusts (>31 km/hr), snowfall, rainfall, snow on the ground, and total precipitation per season. We calculated the average maximum, minimum, and mean temperatures during each season for each year.

We used principal component analysis (PCA) to collapse 8 weather variables, which exhibited substantial correlations, into fewer synthetic variables. Based on the proportion of variance explained (86%), we retained the first 3 PCA axes (Table 1). The first component (PC1) consisted mainly of average maximum, minimum, and mean temperature at the positive end, and total precipitation and days with rainfall at the negative end. The second component (PC2) consisted mainly of days with gusts >31 km/hr and days with snowfall with a strong negative loading. The third component was reflective of the number of days with snow on the ground. Since days with snow on the ground was the only heavily

![Figure 2. Annual harvest of white-tailed deer in relation to annual hunting effort, classified by number of dogs in camp, Canonto Study Area, Ontario, 1980–2004.](image)

Table 1. Eigenvectors and percent variance explained for 8 weather variables on the first 3 axes (PC1, PC2, and PC3) from principal component analysis. Data from Ottawa International Airport, 1980–2004.

<table>
<thead>
<tr>
<th>Variable</th>
<th>PC1</th>
<th>PC2</th>
<th>PC3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percent variance explained</td>
<td>51.58</td>
<td>22.29</td>
<td>12.07</td>
</tr>
<tr>
<td>Days with snow on the ground</td>
<td>0.320</td>
<td>0.084</td>
<td>0.689</td>
</tr>
<tr>
<td>Days with snowfall</td>
<td>0.176</td>
<td>−0.624</td>
<td>−0.331</td>
</tr>
<tr>
<td>Days of rainfall</td>
<td>0.412</td>
<td>−0.037</td>
<td>0.385</td>
</tr>
<tr>
<td>Total precipitation</td>
<td>0.353</td>
<td>−0.438</td>
<td>0.121</td>
</tr>
<tr>
<td>Average max. temperature</td>
<td>−0.428</td>
<td>−0.204</td>
<td>0.280</td>
</tr>
<tr>
<td>Average min. temperature</td>
<td>−0.410</td>
<td>−0.259</td>
<td>0.289</td>
</tr>
<tr>
<td>Average mean temperature</td>
<td>−0.441</td>
<td>−0.245</td>
<td>0.299</td>
</tr>
<tr>
<td>Days with wind gusts &gt;31 km/hr</td>
<td>0.162</td>
<td>−0.491</td>
<td>0.042</td>
</tr>
</tbody>
</table>
weighted parameter, it was used in place of the third principal component. We performed an analysis of covariance (ANCOVA) with PC1, PC2, and days with snow on the ground as covariates, kill per unit effort as the dependent variable, and 3 dog treatments as predictor variables. To test for interactions, we tested for heterogeneity of slopes among treatments for the 3 covariates (Quinn and Keough 2002).

We followed Giles and Findlay (2004) by computing an index of deer density from the residuals of the log–log plot of number of deer encountered and hunter effort. We conducted an ANCOVA with deer density as a covariate, kill per unit effort as the dependent variable, and 3 dog treatments as predictor variables. We tested for heterogeneity of slopes among treatments as indicative of an interaction between deer density and dog use.

We investigated the potential effect of neighboring camps by assessing harvest success in relation to the number and type of camps in the vicinity. Because we expected hunters to exert a greater effect in close proximity, for each camp we weighted linearly and negatively each adjacent camp by its distance, ≤ 2 km, to the focal camp (Fig. 1). For each year, we fitted a regression between kill per unit effort and summed, weighted number of neighboring camps, and then calculated the mean slope and 95% confidence intervals across years. We completed this separately for each treatment. We tested for deviation from the null hypothesis of 0 slope. Because the treatment effect was most pronounced between 0 dogs and ≥ 2 dogs, we focused on these 2 groups.

**RESULTS**

When we controlled for the number of hunters per camp, we found results consistent with other analyses. The mean difference in kill per unit effort and wounded per unit effort between 0 dogs and ≥ 2 dogs was significantly greater than 0, indicating greater harvest success and wounding rate of the ≥ 2 dog treatment (Table 2). In contrast, the mean differences in seen per unit effort, missed per unit effort, and encountered per unit effort between treatments were not significantly different than 0 (Table 2). These results largely corroborated those from the ANOVA where camp size was not controlled for; of 15 contrasts, 11 were consistent with the results from the ANOVA. Moreover, in no instance did a monotonic relationship appear to exist between the magnitude of the contrast and camp size (Godwin 2010). These outcomes discount the potential confounding effect of camp size on our results.

Based on the mixed model ANOVA, dogs had a substantial effect on the outcome of the hunt. Encounter rates with deer (encountered per unit effort) did not differ with respect to dogs, but kill per unit effort varied significantly between treatments (Table 3); hunters in camps with ≥ 2 dogs killed 0.013 (26%) more deer per hunter-day compared to those with 0 dogs. Camps with ≥ 2 dogs also missed 0.010 (23%) more deer per hunter-day and wounded 0.002 (40%) more deer per hunter-day than camps without dogs. In contrast, camps without dogs saw, without shooting, 0.033 (23%) more deer per hunter-day than camps with ≥ 2 dogs (Table 3).

The number of adult bucks killed per hunter-day differed among treatments (Table 4). Hunters using ≥ 2 dogs killed 17% more adult bucks and 54% more fawns per hunter-day compared to the 0 dog treatment, but we found no significant treatment effect on the harvest success of adult does or antlerless deer (Table 4).

Weather influenced hunting outcomes. We found a positive relationship between kill per unit effort and PC1, indicating greater success with less than average maximum, mean April temperature, with the Pearson correlation coefficient of 0.32 and P < 0.001.

**Table 2.** Mean differences in white-tailed deer hunting success between dog treatments, Canonto Study Area, Ontario, 1980–2004, after controlling for number of hunters per camp. Numbers in parentheses represent 95% confidence limits; n represents number of camp sizes.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>≥2 dogs minus 0 dogs</th>
<th>≥2 dogs minus 1 dog</th>
<th>0 dogs minus 1 dog</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deer killed per unit effort</td>
<td>0.030 (0.017, 0.042); n = 17</td>
<td>0.032 (−0.030, 0.093); n = 13</td>
<td>−0.008 (−0.029, 0.012); n = 13</td>
</tr>
<tr>
<td>Deer seen per unit effort</td>
<td>0.108 (−0.146, 0.362); n = 18</td>
<td>0.085 (−0.133, 0.303); n = 12</td>
<td>−0.022 (−0.068, 0.023); n = 12</td>
</tr>
<tr>
<td>Deer missed per unit effort</td>
<td>0.003 (−0.011, 0.017); n = 18</td>
<td>0.010 (−0.002, 0.022); n = 12</td>
<td>0.005 (−0.009, 0.020); n = 12</td>
</tr>
<tr>
<td>Deer wounded per unit effort</td>
<td>0.003 (0.001, 0.005); n = 18</td>
<td>−0.001 (−0.005, 0.004); n = 12</td>
<td>−0.002 (−0.006, 0.002); n = 12</td>
</tr>
<tr>
<td>Deer encountered per unit effort</td>
<td>0.131 (−0.110, 0.373); n = 18</td>
<td>0.126 (−0.150, 0.403); n = 12</td>
<td>−0.027 (−0.095, 0.041); n = 12</td>
</tr>
</tbody>
</table>

* P < 0.05.

**Table 3.** Effects of hunting dogs on hunting success for white-tailed deer, Canonto Study Area, Ontario, 1980–2004. Superscripts (A, B) indicate no significant difference between treatment means in post hoc tests.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Statistic*</th>
<th>df</th>
<th>P</th>
<th>0 dogs</th>
<th>1 dog</th>
<th>≥2 dogs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deer killed per unit effort</td>
<td>F = 11.86</td>
<td>2, 23</td>
<td>&lt;0.001</td>
<td>0.051\textsuperscript{A}</td>
<td>0.052\textsuperscript{A}</td>
<td>0.064</td>
</tr>
<tr>
<td>Deer seen per unit effort</td>
<td>(\chi^2 = 8.083)</td>
<td>2</td>
<td>0.018</td>
<td>0.176</td>
<td>0.164\textsuperscript{AB}</td>
<td>0.143\textsuperscript{B}</td>
</tr>
<tr>
<td>Deer missed per unit effort</td>
<td>F = 5.34</td>
<td>2, 23</td>
<td>0.012</td>
<td>0.044\textsuperscript{A}</td>
<td>0.046\textsuperscript{A}</td>
<td>0.054</td>
</tr>
<tr>
<td>Deer wounded per unit effort</td>
<td>(\chi^2 = 7.00)</td>
<td>2</td>
<td>0.030</td>
<td>0.005\textsuperscript{A}</td>
<td>0.006\textsuperscript{AB}</td>
<td>0.007\textsuperscript{B}</td>
</tr>
<tr>
<td>Deer encountered per unit effort</td>
<td>F = 0.28</td>
<td>2, 23</td>
<td>0.758</td>
<td>0.275</td>
<td>0.267</td>
<td>0.267</td>
</tr>
</tbody>
</table>

* F from mixed model analysis of variance (ANOVA); \(\chi^2\) from Friedman 2-way ANOVA.
Canonto Study Area, Ontario, 1980–2004. Focal camps and neighboring camps indicate no significant difference between treatment means in post hoc tests.

Table 5. Mean slope of number of white-tailed deer killed per unit effort.

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Statistic*</th>
<th>df</th>
<th>P</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adult bucks killed per hunter-day</td>
<td>$F = 5.80$</td>
<td>2, 23</td>
<td>0.009</td>
<td>0 dogs</td>
</tr>
<tr>
<td>Adult does killed per permit-day</td>
<td>$F = 0.784$</td>
<td>2, 23</td>
<td>0.468</td>
<td>1 dog</td>
</tr>
<tr>
<td>Antlerless deer killed per permit-day</td>
<td>$\chi^2 = 0.067$</td>
<td>2</td>
<td>0.967</td>
<td>0.024A</td>
</tr>
<tr>
<td>Fawns killed per permit-day</td>
<td>$F = 9.44$</td>
<td>2, 23</td>
<td>0.001</td>
<td>0.022A</td>
</tr>
</tbody>
</table>

* $F$ computed from mixed model analysis of variance (ANOVA); $\chi^2$ from Friedman 2-way ANOVA.

DISCUSSION

Dogs enhanced hunting success. In our study, with ≥2 dogs in camp, hunters harvested more deer per unit effort, irrespective of the number of hunters in camp, weather, deer abundance, and number of neighboring camps, unless they too used dogs. Improved hunting success from dogs has been a popular notion, albeit the topic of few studies. In South Carolina, deer were 2.4 times more likely to be killed in a dog-hunted area compared to a non-dog hunted area (Novak et al. 1991). Similarly, Scribner et al. (1985) found hunters with dogs harvested more deer per unit effort compared to non-dog, stand hunters. When camps switched from stand hunting to using dogs, their success increased to the same level as camps traditionally using dogs. These results are consistent with the 26% increase in harvest rate (0.013 more deer per hunter-day) for camps with ≥2 dogs in the CSA (Table 3).

Compared to dog hunters, stand hunters often have greater opportunities to watch undisturbed deer until within range; they can generally take their time to shoot (Novak et al. 1991, Martinez et al. 2005). Indeed, CSA hunters with ≥2 dogs fired at and missed significantly more deer, although encounter rates with deer did not differ. This situation may also account for the increase in wounding rates by dog hunters—a surprising result given that dogs are often justified by their utility in finding wounded deer (Jenneney 1977). In our study, any potential improvement in the recovery of wounded deer with dogs apparently was insufficient in reducing wounding rates. To the contrary, we estimate that hunting with dogs (≥2 dogs per camp) resulted in approximately 4 more deer wounded per season compared to a complete absence of dogs in the CSA. Overall, these findings suggest that hunters with dogs are less selective than those without dogs. Indeed, stand hunters tend to display selectively for older or heavier deer (Novak et al. 1991, Martinez et al. 2005). Dogs also affected the composition of the harvest. Hunters with ≥2 dogs harvested significantly more adult bucks and more fawns per hunter-day, but not antlerless deer, compared to camps without dogs (Table 4).

Our study is not the first to question whether catch per unit effort can serve as a reliable index of harvest success (Lancia et al. 1996, Schmidt et al. 2005). In the CSA, because greater effort was associated with dogs in camp as well as disproportionately greater harvest (Fig. 2), our results were potentially confounded. Camp size, the major contributor to effort, varied systematically with dog treatments. Nevertheless, after controlling for the number of hunters per camp, we found broadly similar findings to those from the ANOVA; i.e., significant treatment effects (especially ≥2 dogs) for deer killed, wounded, and encountered. These are, arguably, the most biologically relevant parameters in deer management (Jenneney 1977, Giles and Findlay 2004). We found a discrepancy, nevertheless, in the magnitude of difference in kill per unit effort between ≥2 dogs and 0 dogs, 0.030 deer per hunter-day when camp size was controlled for (Table 2) versus 0.013 deer per hunter-day from the ANOVA (Table 3). This is likely attributable to differences in the experimental unit when computing these averages. We
suggest the value based on the whole dataset (0.013) is more accurate. Overall, these results imply that effort alone does not account for the apparent differences among treatments. We anticipated dogs would impart greater hunting success when weather was unfavorable and deer were less abundant. Lowry and McArthur (1978), for instance, suggested dogs were more effective in pursuing deer when the ground was covered with snow, as deep snow may impede deer. Fobes (1945) also noted that white-tailed deer harvest was weather-dependent (i.e., increased total harvest in warm, wet conditions). Our results differed somewhat from expectation. Although we uncovered a positive effect of cold and wet conditions on hunter success, we also found no interaction with dog treatments, even though scenting by dogs can increase in warm and wet conditions (Styrotuck 1972). Hansen et al. (1986) noted snowfall and high wind speeds created unfavorable hunting conditions, and were correlated negatively with harvest in Illinois. In contrast, snowfall and wind had a positive relationship with kill per unit effort in the CSA.

Not surprisingly, harvest success tended to increase with deer density (Hansen et al. 1986). Although some have suggested the effectiveness of dogs may be inversely density dependent (Perry and Giles 1971), we found no interaction of the impact of dogs with deer abundance. Hunter-deer encounters are also the basis for tracking population trends (Giles and Findlay 2004). In our study, dogs appeared to have no differential effect in deer encounter rates (Table 3), which lends confidence in this population index. Camps with dogs diminished the hunting success of their neighbors. Where hunting camps had ≥2 dogs, kill per unit effort of camps within 2 km was reduced if they too used dogs (Table 5). Foster et al. (1997) suggested deer hunting was dependent on hunter densities. At low hunter densities, hunters are too scattered to encourage deer movement, whereas at high densities, hunter interference reduces the per capita harvest. Spillover effects have been documented in Scotland, too, where un hunted estates can act as sources, allowing for migration of deer into heavily hunted estates (Milner-Gulland et al. 2004). At a broader scale, however, Giles and Findlay (2004) found little evidence of hunter interference between wildlife management units in central Ontario.

**MANAGEMENT IMPLICATIONS**

Hunting remains the principal tool for controlling white-tailed deer populations and their adverse ecological and economic effects. Our study shows that dogs affect the outcome of the recreational hunt; 0.013 (26%) more deer were harvested per hunter-day in camps with ≥2 dogs, although dogs did not enhance the harvest rates of antlerless deer nor adult does. Because antlerless deer quotas represent the primary means to controlling populations, increasing the use of hunting dogs is likely to have marginal effects in managing overabundant deer. Camps with dogs in close proximity (<2 km) may negatively influence one another’s success. Increasing the dispersion of hunters with dogs, therefore, is likely to enhance hunter success and satisfaction.

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