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CHARACTERISTICS OF GRAY SQUIRREL RELEASE SITES SELECTED BY KENTUCKY NUISANCE WILDLIFE CONTROL OPERATORS

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Abstract: A telephone survey of Kentucky nuisance wildlife control operators (NWCOs) (*n*=66) was conducted in April of 1997 to assess their knowledge and practices regarding nuisance gray squirrel (*Sciurus carolinensis*) release-site habitat. Thirty-three percent of NWCOs (*n*=22) trapped and relocated ≥1 nuisance gray squirrel in the previous year and these individuals/companies were selected for the survey. NWCOs trap and release >1,700 squirrels annually in Kentucky. Sampled release sites varied in size from 18 to 5,200 acres, and >70% were classified as poor to marginal habitat. Three of the release sites sampled provided adequate to optimum gray squirrel habitat. Actual release site habitat quality was in direct contrast to the opinions of NWCOs regarding suitable gray squirrel habitat. NWCOs' responses to questions concerning winter food, cover, and reproductive requirements indicated that they understood and were selecting suitable gray squirrel habitat components. Results of this survey indicate that thousands of squirrels are being translocated to both private and public land annually, with unknown consequences on survival and population demographics. Furthermore, although Kentucky NWCOs have an adequate understanding of the biological requirements of gray squirrel habitat, they are selecting unsuitable release sites.

Key Words: gray squirrel, Kentucky, nuisance wildlife, release sites, relocation, *Sciurus carolinensis*, translocation.

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The nuisance wildlife control industry has experienced rapid growth since the mid-1980s (Barnes 1995a, Barnes 1995b, Braband 1995, Curtis et al. 1995). Several factors have contributed to the expansion of this industry. Increased urbanization and growing urban wildlife populations have resulted in greater numbers of human-wildlife conflicts. Concomitant with this increase in human-wildlife conflicts and expansion of the nuisance wildlife control operator (NWCO) industry, biologists and managers have begun asking numerous questions regarding the humaneness and efficacy of moving large numbers of nuisance wildlife around the landscape.

Much variation exists among states' regulations concerning nuisance wildlife control operators. La Vine et al. (1996) found that 45.8% of U.S. states required private NWCOs to obtain a permit or license. Only 25 states required license/permit prerequisites such as training courses, operator exams, education, experience, or agency review. Although 80% of the states have regulations regarding repellents, poisons/pesticides, and trapping (La Vine et al. 1996), translocation of nuisance wildlife largely is unregulated. Craven (1992) observed that 47 states allowed off-site release of nuisance wildlife. A more recent survey of state wildlife agencies showed that 90% of states allowed some translocation of nuisance wildlife (T.G. Barnes, unpublished data). In addition, no state guidelines exist that outline species-specific habitat requirements of release

sites.

The lack of regulation and/or guidelines regarding nuisance wildlife translocations has important biological and policy implications. In a review of translocation studies, Griffith et al. (1989) found that translocation success was associated directly with release site location and habitat quality. In the absence of guidelines and/or regulations, release sites may be selected by NWCOs with limited wildlife management training (Barnes 1995a,b). Based on release site location, results of NWCOs' translocations could have positive, neutral, or negative effects on translocated animals and/or resident populations. Important questions regarding survival, movements, disease transmission, and impacts of translocated wildlife on population demographics of resident wildlife remain unanswered. The first step to resolve these issues is to quantify the numbers of wildlife being released and release-site habitat.

The objectives of this study were to characterize nuisance gray squirrel release sites, to assess knowledge of NWCOs in Kentucky on habitat requirements of gray squirrels, and to determine the suitability of those release sites for gray squirrels.

METHODS

We conducted a telephone survey in April 1997 of all NWCOs (*n*=66) permitted by the Kentucky Department of Fish and Wildlife Resources (KDFWR). Only NWCOs who trap and release nuisance gray squirrels were included for study. The survey instrument included 25 questions regarding NWCO company profiles, education, and gray squirrel habitat characteristics. At the termination of the questions, NWCOs were asked to provide specific locations of gray squirrel release sites.

After completion of the telephone survey, we visited every NWCO-provided release site (*n*=11) and measured habitat quality using Habitat Suitability Indices (HSI) (Allen 1987). At each release site, a transect was established on a randomly chosen compass bearing. At randomly selected distances from the starting point, 10 20-x20-m plots were sampled. The ocular tube method (James and Shugart 1970) was used to estimate total tree canopy and percent hard mast species in the canopy. Mean diameter breast height (dbh) of trees was calculated for all trees ≥80% of the height of the tallest tree in the plot (Allen 1987). HSI values were calculated using formulas presented by Allen (1987).

Education of NWCOs participating in the survey was classified as 1=<high school, 2=high school, 3=high school +, 4=associate's degree, 5=bachelor's degree, 6=>bachelor's degree. Release site characteristics were scored for each respondent. Association between perceived suitability of release sites and level of education for NWCOs was tested using the Kruskal-Wallis test and Kendall's measure of association (Ott 1992).

RESULTS AND DISCUSSION

All 66 permittees were contacted (100% response rate) and 33% (*n*=22) had trapped and relocated ≥1 nuisance gray squirrel during the previous year. These companies/individuals then were asked the survey questions and all 22 (100% response rate) responded. The majority (90.9%) of NWCOs individually owned their nuisance wildlife operations; 2 were part of franchises. Most (63.6%) were not listed in the phone book and received the majority (59.1%) of their business through referrals. Typically, respondents (81.8%) employed <5 people, on a part-time basis (57.1%), which was similar to rates found in earlier surveys (Barnes 1995a,b). Eight of the 9 respondents who worked full-time lived in or near large cities, and all respondents who worked part-time lived in or near small towns or in rural areas. These results parallel those in other studies (Barnes 1995b, Curtis 1995), which suggest that metropolitan areas are more likely than rural areas to support full-time NWCOs.

Education of respondents and their employees varied from <high school to a Ph.D.; the majority (76.3%) had no formal education beyond high school. A previous study (Barnes 1995b) reported 52.2% of NWCOs had >high school education. Only 3 respondents had a degree in a wildlife-related field (i.e., zoology, biology, entomology). The majority (63.6%) of respondents had attended ≥1 wildlife damage

short course/workshop, an increase from earlier reports (Barnes 1995a,b). Three respondents had attended a Fur Trappers College.

Kentucky NWCOs trapped and released an average of 1,786 nuisance gray squirrels/year; 34% of these animals were released on public lands. The size of perceived release sites ranged from 10 to 10,000 acres ($\bar{x}$ =674.9, SE=469.8). The majority (86.4%) of NWCOs stated that they chose release sites having large overstory trees and ≥50% canopy cover, and located a substantial distance from major roadways (68.2%) All respondents stated that they chose release sites having snags and/or cavities. In addition, 63.6% of respondents stated that ≥50% of the trees at the release sites produced hard mast. There were no differences (P=0.201) and no correlation (r_k=0.22) between education and perceived suitability of release-site habitat characteristics. Respondents also were asked to assess the importance of specific habitat characteristics to the quality of release sites. With the exception of presence of wildlife, all characteristics were valued as important to very important by respondents (Table 1).

Release sites sampled varied in size from 18 to 5,200 acres and were located in 5 counties on both private and public land, including 3 private farms, 4 city parks, 1 city cemetery, 2 nature/wildlife sanctuaries, and 1 state park. HSI values varied from 0.00 to 0.89 ($\bar{x}$ =0.40, SE=0.08). Life requisite values, winter food index (SIWF), and cover/reproduction index (SICR) were used to calculate a habitat suitability index (HSI) for release sites (Allen 1987). SIWF includes the number of hard mast producing species and the proportion of total canopy cover that is composed of hard mast producing trees ≥25 cm dbh. Percent canopy cover and mean dbh of overstory trees are included in SICR (Allen 1987). Ten sampled sites provided adequate cover/reproductive requirements, whereas only 3 sites provided adequate winter food requirements, as indicated by the SICR and SIWF, respectively (Table 2).

The ecological and management implications of releasing large numbers of squirrels into poor or marginal habitat are unknown. No published studies have documented the effects of translocation on either the nuisance individual or resident wildlife populations. We expect that, because nuisance squirrels will act as artificial dispersers, they will be exposed to the potential disadvantages of dispersal as outlined by Stenseth and Lidicker (1992). These disadvantages include uncertainties of finding food, shelter, and an appropriate social environment, and increased predation hazard. Poor quality habitat release sites are expected to magnify these disadvantages because of limited resources. As a result, we hypothesize that nuisance squirrels translocated to poor quality environments will have low long-term survival rates.

CONCLUSIONS

Our data indicate that, regardless of education, Kentucky NWCOs have a sufficient understanding of suitable gray squirrel habitat characteristics. Many NWCOs with less formal education indicated that they primarily trapped nuisance wildlife as a hobby rather than a reliable source of income. These respondents have an interest in wildlife and wildlife-related issues, thus are expected to have a general to advanced level of knowledge concerning habitat, at least for common species such as the eastern gray squirrel. Respondents indicated that they were choosing mature forested areas with a diversity of mast-producing trees. However, habitat assessments of NWCO-selected release sites showed that NWCOs in Kentucky are translocating nuisance gray squirrels to unsuitable habitats, as defined by the HSI model.

Several factors may explain the contradiction between knowledge and actual practice among Kentucky NWCOs. First, response bias is expected with any survey. Respondents may have provided information based on what they believed was appropriate rather than actual practices. Secondly, NWCOs in Kentucky may not be taking enough time to adequately assess selected release sites. While the majority of sites satisfied the cover/reproductive requirements, only 3 sites provided adequate winter food requirements. In addition, 8 of 11 sites were located on public lands that provided easy access, and all sites were located near the cities/towns in which the NWCO worked. Based on these

results, NWCOs in Kentucky probably are selecting release sites based on 3 factors: forest stand maturity, accessibility, and proximity to the job site.

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Table 1. Importance of habitat characteristics to a sample of Kentucky nuisance wildlife control operators (*n* = 21) when selecting gray squirrel release sites (1 = not at all important, 2 = slightly important, 3 = important, 4 = very important, 5 = extremely important).

	Importance value	
Characteristic	Mean	SE
Percentage of mast-producing trees	4.57	0.16
Types of trees	4.14	0.19
Size of forested area	4.05	0.20
Size of dominant trees	4.05	0.20
Proximity to capture site	4.05	0.29
Number of tree species	3.90	0.18
Age of trees	3.76	0.23
Amount of shade	3.33	0.20
Presence of wildlife	2.62	0.33

Table 2. Mean vegetative measurements (n = 10) including size in acres (ac), mean percentage of canopy cover, mean diameter breast height (dbh), mean percentage of canopy that is mast-producing, maximum number of mast species, and calculated habitat suitability index (HSI) values, including cover/reproduction index (SICR) and winter food index (SIWF) of release sites selected by a sample (n = 8) of nuisance wildlife control operators in Kentucky.

County	Ownership	Size (ac)	Canopy Cover (%)		Mean dbh (cm)		SICR	Mast Overstory (%)		Mast species (#)	SIWF	HSI
			Mean	SE	Mean	SE		Mean	SE	Maximum		
Hopkins	private	----	10.0	6.8	48.7	17.4	0.00	6.0	6.0	1	0.07	0.00
Fayette	public	216	48.0	5.7	41.1	3.4	1.00	0.0	0.0	0	0.10	0.10
Jefferson	public	333	35.5	10.5	60.6	23.5	0.85	8.0	8.0	1	0.22	0.22
Fayette	public	170	23.0	11.6	53.1	5.3	0.76	15.0	10.7	1	0.22	0.22
Grayson	public	637	55.0	6.2	31.7	1.8	0.87	11.0	9.9	2	0.35	0.35
Grant	private	----	60.5	8.5	27.4	2.0	0.81	8.0	3.7	5	0.39	0.39
Fayette	public	374	56.5	10.2	26.4	1.5	0.74	14.0	7.2	2	0.42	0.42
Fayette	private	18	61.0	9.2	26.7	1.8	0.76	23.0	12.2	2	0.46	0.46
Jefferson	public	31	54.0	10.7	31.9	5.5	0.71	43.0	11.4	3	0.60	0.60
Jefferson	public	5,200	71.0	5.6	44.5	4.8	1.00	37.5	10.2	4	0.74	0.74
Hopkins	public	----	63.0	8.9	54.5	2.0	1.00	90.0	10.0	3	0.89	0.89