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A Baseline Assessment of Furbearers on the Upper Coastal Plain of Virginia

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ABSTRACT

We assessed the status of furbearing mammals on Fort A.P. Hill, Caroline County, Virginia during the 1998-1999 trapping season with the cooperation of local licensed trappers. Our analyses were based on 345 captures representing of 10 mammal species, ranging from one bobcat (*Lynx rufus*) to 157 beavers (*Castor canadensis*). Mean number of captures per 100 trap nights was 17.0. Captures varied from 11.9 to 17.9 per 100 trap nights for conibear traps and 9.7 to 18.3 per 100 trap nights for leg-hold traps. External measurements of six species were similar to those reported for other populations in the region. We suggest that valuable insights into the ecology and trends of furbearer populations can be obtained from studies conducted on government installations such as Fort A. P. Hill. Management plans that include evaluations of infectious disease reservoirs and transmission and impacts of furbearers on wetlands, other wildlife, and human activities would aid in long-term evaluation of these mammals from ecosystem and health perspectives.

Keywords: beaver, *Castor canadensis*, Coastal Plain, furbearer, mammals, morphometrics, raccoon, *Procyon lotor*, trapping, Virginia

INTRODUCTION

Activities of many mammal species are often erroneously considered detrimental to human progress wherever their habits affects human livelihoods. However, most nuisance mammal species are important components of regional ecosystem maintenance, and when properly managed benefit many facets of human activity. For example, beavers (*Castor canadensis* Kuhl) are directly responsible for creation and maintenance of wetland habitats that support a wide diversity of plants and animals (Naiman *et al.*, 1988, 1994). *Castor canadensis* ponds are used extensively by waterfowl species such as Wood Ducks (*Aix sponsa* L.), American Black Ducks (*Anas rubripes* Brewster), and Mallards (*Anas platyrhynchos* L.) because of suitable microhabitats provided by these wetlands (Merendino *et al.*, 1995). Similarly, many amphibian and reptile species benefit from beaver activity (Mitchell, 1994, 2000). The majority of mammal species addressed in this survey are members of the order Carnivora and many are instrumental in the control of insect pests, rodents, and non-game fish species

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(Godin, 1982; Samuel and Nelson, 1982; Toweill and Tabor, 1982). In addition, many of these species are economically important as furbearers.

The furbearers of the upper Coastal Plain of Virginia have not been studied ecologically (R. Farrar, Virginia Department of Game and Inland Fisheries [VDGIF], pers. comm.). The rich diversity of habitat types found in this region, especially wetlands, should provide suitable habitat for a healthy mammal fauna—including the furbearers (Bellows *et al.*, 2001). The primary objective of our research was to provide a baseline assessment of the mid-sized mammals of a region in Virginia's upper Coastal Plain through analysis of trapping success, demographics, and morphometrics of individuals.

METHODS

Our research was conducted on Fort A. P. Hill (APH), Caroline County Virginia, located within the Coastal Plain Physiographic Region (centered approximately at 77° 15′ N and 38° 05′ W). APH is a 30,329 ha field-training military installation in which the majority of the landscape is managed forests and grasslands. Mitchell and Roble (1998) and Bellows *et al.* (1999, 2001) described environmental conditions and habitats on the installation. Bellows *et al.* (2001) provide accounts for all mammal species examined in this paper. Our methods were designed with the cooperation of eight local trappers and the Environmental and Natural Resources Division of APH. Data were collected during the 1998-1999 Virginia trapping season. During this period, trappers provided reports of daily capture success, which included number of each species caught, number of each trap type set, and captures for each trap type. Trap types used fall into two categories, body-gripping (conibear #120, 220, 330) and leg-hold traps (#2 and 3). We recorded species identification, external measurements (total length, tail length, hind foot length, ear length, distance between canines tip-to-tip), demographic data, and body mass for each mammal we processed. Measurements were taken to the nearest mm and mass to the nearest gram.

We calculated total effort, captures per unit effort for each trap type used, and the success of each trap type for each species. Unit of effort = 100 trapnights (TN), and one TN = one trap open for a 24-hr period. We calculated ranges and means (± 1 standard deviation) of external measurements and body mass for each sex of each species. For species with $n \geq 16$, we used two-sample *t*-tests to compare body mass and body length between males and females ($\alpha = 0.05$; Zar 1996).

We qualitatively assessed habitat characteristics of 13 trapping areas used by four trappers. We recorded dominant tree species, overstory and understory, and shrubs. We also described plant species present at the wetland-upland interface (edge). The presence or absence of four types of evidence of beaver activity (lodge, runways, dams, tree cuttings) also was recorded.

RESULTS

Captures

Total reported captures was 345 individuals representing 10 mammal species (Table 1). Number of captures for each species ranged from 157 for *C. canadensis*, representing 46% of reported captures, to one for bobcat (*Lynx rufus* Rafinesque) (Table 1). Raccoons, *Procyon lotor* L., (n=65, 12%) and muskrats, *Ondatra zibethicus* L., (n = 42, 19%) were commonly captured. Captures per 100TNs were based on 288 (1,691TNs) of the 345 captures where trap type was specified. Captures per 100TNs by trap type ranged from 18.3 for #2 leg-hold to 9.7 for #3 leg-hold, and mean captures/100TNs for all trap types was 17.0 (Table 1).

TABLE 1. Total captures[1], total captures where trap type was specified[2], total trapnights (TNs), and captures/100TNs by trap type for all species.

Order Species	Conibear Traps #330	#220	#120	Leg-hold Traps #2	#3	Totals[2]	Totals[1]
Marsupialia							
Didelphis virginiana	0	0	4	25	0	29	30
Rodentia							
Castor canadensis	110	10	0	0	3	123	157
Ondatra zibethicus	21	9	0	2	0	32	42
Carnivora							
Vulpes vulpes	0	0	0	5	0	5	5
Urocyon cinereoargenteus	0	0	1	17	0	18	19
Procyon lotor	0	0	23	33	0	56	65
Mustela vison	1	2	0	1	0	4	4
Mephitis mephitis	0	0	0	11	0	11	11
Lontra canadensis	7	2	0	0	0	9	11
Lynx rufus	0	0	0	1	0	1	1
Captures	139	23	28	95	3	288	345
Trapnights	718	194	230	518	31	1,691	
Captures/100TNs	17.8	11.9	13.0	18.3	9.7	17.0	

Habitats

The 13 trapping sites sampled were all riparian habitats surrounded by uplands; deciduous hardwoods dominated most sites. River birch (*Betula nigra* L.) was the only dominant tree species observed that is obligatorily riparian (Reed, 1988). Oaks (*Quercus* L. spp.) were the dominant overstory tree species in 10 of the 13 sites, with white oak (*Q. alba* L.) being the most common. Other common overstory tree species were northern red oak (*Q. rubra* L.), southern red oak (*Q. falcata* Michaux), tulip-tree (*Liriodendron tulipifera* L.), American beech (*Fagus grandifolia* Ehrhart), and red maple (*Acer rubrum* L.). Hickories (*Carya* spp. Nuttall), chestnut oak (*Q. prinus* L.), and river birch were less frequent, but occurred in substantial numbers at one site each. Pines, Virginia pine (*Pinus virginiana* Miller) and loblolly pine (*Pinus taeda* L.), dominated two sites. Common understory tree species, exclusive of sapling overstory trees, were American holly (*Ilex opaca* Aiton), mountain laurel (*Kalmia latifolia* L.), and flowering dogwood (*Cornus florida* L.). Other understory trees frequently observed were sassafras (*Sassafras albidum* Nuttall), ironwood (*Carpinus caroliniana* Walter), and devil's walking stick (*Aralia spinosa* L.). Two shrubs, blueberries (*Vaccinium* L. spp.) and sweet pepperbush (*Clethra alnifolia* L.), were commonly observed at the edge of most sites. Also present were blackberry (*Rubus* L.), mountain laurel, wax myrtle (*Myrica cerifera* L.), common greenbrier (*Smilax rotundifolia* L.), and deciduous tree saplings. The edges of two sites were relatively open with mature deciduous trees. Downed woody debris (DWD) at most sites were of deciduous trees. Evidence of *C. canadensis* activity varied among the 13 sites, with cuttings of deciduous trees being the most obvious.

Morphometrics

Results of external measurements, demographic information, and body mass were derived from data collected from 111 captures representing six furbearer species (Table 2). The sex of four *C. canadensis*, and two *O. zibethicus* was not recorded, and body mass for an additional 14 *C. canadensis*, 8 females and six males, was not recorded; these 20 individuals are not included in morphometric analyses (Table 2). Analyses were thus based on 91 individuals representing six species. No female mink (*Mustela vison* Schreber) or red fox (*Vulpes vulpes* L.) were captured.

There were no significant differences (t=-0.972, P=0.832) in body mass or mean total length (t=-0.582, P=0.718) between male and female *C. canadensis*. There were no significant differences (t=-0.803, P=0.218) in body mass or mean total length (t=1.291, P=0.109) between male and female *P. lotor*.

DISCUSSION

All 10 species represented in this survey are known to occur in this region (Hall 1981; Webster *et al.*, 1985; Whitaker and Hamilton, 1998); however, between 1977 and 1986 fewer than one *L. rufus* per year was reported taken by trappers in Caroline County (Handley, 1991). Four other mid-sized mammal species that should be common in the region, eastern cottontail (*Sylvilagus floridanus* Allen), woodchuck (*Marmota monax* L.), gray squirrel (*Sciurus carolinensis* Gmelin), and long-tailed weasel (*Mustela frenata* Lichtenstein), were not captured and are not addressed here. These species are not usually captured with the types of traps used in this study. However, *S. floridanus*, *M. monax*, and *S. carolinensis* are prevalent on the installation and all have been observed in many habitat types (Bellows *et al.*, 2001). No captures of domestic dogs (*Canis familiaris* L.) or cats (*Felis catus* L.) were reported.

The use of both conibear and leg-hold traps in a variety of sizes ensured that the widest range of mid-sized mammals was represented. The high mean of captures per 100TNs for all trap types demonstrates their collective effectiveness. Carcasses of two species captured, Virginia opossum (*Didelphis virginiana* Kerr) and striped skunk (*Mephitis mephitis* Schreber), were not made available to us by the trappers. Both species appeared frequently in daily capture reports, and the loss of the information associated with these incidental captures represents a loss of valuable data.

Capture location was not available for all captures, making it difficult to compare capture success among trapping areas (habitat types). Comparison of captures/unit effort is a powerful tool for revealing population and habitat preference trends (Chilelli *et al.*, 1996). With such information, fine-scale patterns of habitat use could be established. Without such data, habitat assessments only demonstrate the habitat types most preferred by trappers.

Four species known to live in close association with aquatic habitats (*C. canadensis*, *O. zibethicus*, *L. canadensis, M. vison*) were taken primarily with conibears, which are usually set in or under water. Captures of species with more upland affinities (*D. virginiana*, *M. mephitis*, *L. rufus*, *V. vulpes*, *Urocyon cinereoargenteus* Schreber [gray fox]) dominated samples taken by leg-hold traps that are generally set in more upland situations (Darrell Schwartz [trapper], pers. comm.). *Castor canadensis* was the most frequently captured and measured species. This is not surprising for two reasons. First, #330 conibears are the preferred trap for *C. canadensis* (Bateman, 1973) and were the most frequently used trap type. Second, all 13 trapping sites we assessed showed evidence of recent *C. canadensis* activity.

The large number of *C. canadensis* captured during the 1998-1999 trapping period is a reflection of the large population size that exists on APH. *Castor canadensis*

TABLE 2. Summary of means for total length (TL), tail length (TV), hind foot length (HF), ear length, body mass, and canines tip-to-tip of six furbearer species captured on Fort A. P. Hill, Caroline County, Virginia. Range and mean ± one standard deviation are provided. No female V. vulpes or M. vison were captured. External measurements are in millimeters, mass was measured in grams.

Species	Sex	n	TL	TV	HF	Ear	Body mass	Canine
C. canadensis	M	36	653-1151	155-320	130-207	25-36	5,000-25,000	n/a
			903 ± 124	238 ± 37	159 ± 16	31 ± 3	11,322 ± 4,264	n/a
	F	22	620-1101	178-295	117-187	24-36	4,400-20,100	n/a
			924 ± 155	245 ± 37	160 ± 21	31 ± 3	12,545 ± 5,235	n/a
	M/F	58	911 ± 136	241 ± 37	160 ± 18	31 ± 3	11,786 ± 4,650	n/a
O. zibethicus	M	5	552-611	238-257	81-86	8-17	1,100-1,500	n/a
			576 ± 26	246 ± 9	82 ± 3	13± 4	1,263 ± 180	
	F	4	528-638	227-253	75-85	13-21	1,250-1,600	n/a
			579 ± 45	244 ± 11	82 ± 4	18± 3	1,470 ± 130	
	M/F	9	578 ± 36	245 ± 10	82 ± 3	15± 4	1,378 ± 181	n/a
*V. vulpes**	M	1	970	360	149	79	4,900	18
P. lotor	M	10	754-890	199-284	104-114	29-64	3,400-6,000	20-25
			819 ± 38	232 ± 29	110 ± 4	50 ± 11	4,815 ± 811	23 ± 2
	F	6	580-938	200-290	98-116	35-58	3,400-6,000	21-24
			758 ± 144	241 ± 35	108 ± 7	48 ± 9	4,475 ± 1,015	23 ± 1
	M/F	16	796 ± 93	236 ± 30	109 ± 5	49 ± 10	4,688 ± 811	23 ± 1
*M. vison**	M	1	641	225	68	19	1,800	12
L. canadensis	M	3	999-1,120	335-423	111-126	12-25	5,750-7,700	18-23
			1,080 ± 67	397 ± 54	120 ± 7	20 ± 7	6,833 ± 993	21 ± 3
	F	3	963-1,170	339-425	113-121	14-24	4,600-9,500	21-23
			1,071 ± 104	376 ± 44	116 ± 4	19 ± 5	6,933 ± 2,458	22 ± 1
	M/F	6	1,075 ± 79	387 ± 46	118 ± 6	19.5 ± 6	6,883 ± 1,678	21 ± 2

* Single individual measured

presence on APH is evidenced by the high density of active *C. canadensis* ponds on the post (ASB and JCM, pers. obs.). High density of these ponds is likely a direct result of a lack of development on APH. The primary function of APH is to provide the military with a relatively remote and diverse landscape sufficient for conducting a wide variety troop field-training activities. Thus, beaver activity is generally only kept in check when roadways or training facilities are impacted. Collectively, our observations on APH (1991-2001) indicate that in many respects, *Castor canadensis* functions as a keystone species. This is evidenced by the qualitative and obvious impacts of its activities, *e.g.*, tree cutting and damming, on the hydrological and structural attributes of the wetlands and adjacent habitats. Impacted habitats have undergone shifts in habitat suitability for local flora and fauna that have resulted in changes of community composition. Beaver-maintained wetlands often support large populations of amphibians, reptiles, birds (including waterfowl), fish, and aquatic invertebrates. Many plant species rely almost exclusively on conditions generated by beaver activity. Our capture records based on trap type indicate that most of the furbearer species addressed in this study rely, at least in part, on the habitat created and maintained by *C. canadensis.*

All 13 trapping sites where we qualitatively assessed plant species composition and *C. canadensis* activity were wetland habitats. Deciduous trees, especially *Quercus* spp., dominated the canopies and subcanopies at most sites; however, subcanopy tree species composition was more heterogeneous among sites than canopy or shrub species composition. With the exception of impoundments (n = 6), sites were *C. canadensis*-maintained habitats (n = 7). Two sites had active *C. canadensis* lodges; some had remnants of old lodges. All sites had recent evidence of *C. canadensis* activity—especially deciduous tree cuttings. Cutting activity and low abundance of pines collectively explain why DWD was mostly deciduous at many sites. There was no obvious correlation between plant species composition at the aquatic and terrestrial interfaces (edges) and frequency of *C. canadensis* cuttings or DWD. We expected to see a positive, qualitative, relationship here, as frequency of DWD or tree cuttings increase (*i.e.*, more sunlight), density of shrubs at the edge should also increase—our observations indicated no patterns among these factors. The most plausible explanation for these results is that most sites (8) are maintained, or manicured, as recreational or troop-training areas. Six of the eight sites are impoundments with trails, picnicking and troop-debriefing areas, and boat landings. All 13 sites were suitable habitat for the species trapped therein (Whitaker and Hamilton, 1998; Bellows *et al.*, 2001).

External measurements for five of the six species measured were generally comparable to those in the literature (Handley and Patton, 1947; Paradiso, 1969; Webster *et al.*, 1985; Cothran *et al.*, 1991; Ernst *et al.*, 1997). Measurements for total body length and tail length for the *O. zibethicus* were slightly higher than specified in Willner *et al.* (1980) but comparable to measurements for regional individuals (*e.g.*, Webster *et al.*, 1985). We found no evidence of sexual dimorphism for body mass or for total body length in *C. canadensis* and *P. lotor*.

All of these mammals can be vectors of disease such as rabies, canine distemper, tularemia, and other parasite-borne diseases. Several of these species are well known to become rapidly over-populated with consequences of infectious diseases, parasites, alteration of local biodiversity, and local extinctions (Garrott *et al.*, 1993). These issues occur at broader scales than at local areas (*e.g.*, military base). Several of the species captured frequently occupy edge habitats. These species, including *P. lotor*, *V.vulpes*, *M. mephitis*, and *D. virginiana*, are responsible for much of the mortality of neotropical migrant bird eggs and nestlings that breed in this region (Wilcove *et al.*, 1986; Meffe and Carroll, 1997). The first three are major predators of freshwater turtles and their

eggs (Ernst *et al.*, 1994; Mitchell, 1994) and also consume a wide variety of human-generated products. The term "subsidized predators" is now commonly used for these species, especially *P. lotor* (Mitchell and Klemens, 2000). These predators are also implicated in the decline of the Bobwhite Quail (*Colinus virginianus* L.); however; habitat fragmentation is the primary reason for low population densities for *C. virginianus* in Virginia (M. Fies, VDGIF, pers. comm.).

The geographic area encompassed by APH provides an excellent arena for examining long-term population trends and habitat availability and use over a large breeding area. Population densities of many animal species fluctuate from year-to-year (Gotelli, 2001) and often track prey species density or mast crops. Therefore, the need for long-term data collection to evaluate such trends is evident. Long-term data collection would also provide additional records for less frequently captured species. Also, the limitation of data collection to the trapping season will reveal only winter patterns of the furbearers.

The furbearer fauna of APH is representative of the upper Coastal Plain of the mid-Atlantic region. Military installations like APH are becoming more ecologically valuable because relatively intact landscapes are quickly disappearing from the region. Such public lands or "refuge-like islands" should be assessed for all taxa. Results of these assessments could be used as yardsticks for determining the effects of landscape-level anthropogenic changes such as deforestation for agriculture and urban and suburban sprawl on regional biota.

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