

The Raven

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2. Other forays or field trips lasting a day or more and scheduled throughout the year so as to include all seasons and to cover the major physiographic regions of the state.
3. A journal, *The Raven*, published twice yearly, containing articles relevant to Virginia ornithology as well as news of the activities of the Society and its chapters.
4. A newsletter, the VSO Newsletter, published quarterly, containing current news items of interest to members and information about upcoming events and pertinent conservation issues.
5. Study projects (nesting studies, winter bird population surveys, etc.) aimed at making genuine contributions to ornithological knowledge.

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Editor
Wesley M. Brown



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The Eastern Screech-Owl (*Megascops asio*) in Highland County, Virginia A Study of its Prevalence and Distribution

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New Hampden and Staunton, Virginia

ABSTRACT

The Eastern Screech-Owl is widespread in Virginia, and probably our most common owl. However, few published studies have specifically targeted distribution of this species in this state. This study examined the prevalence and distribution of this owl in the western Mountains and Valleys physiographic region of Virginia, specifically in Highland County. The Eastern Screech-Owl is common and widespread in Highland County with distinct habitat and elevation preferences.

INTRODUCTION

The Eastern Screech-Owl (EASO), *Megascops asio*, ranges throughout most of the continental United States east of the Rocky Mountains, with extension into parts of southern Canada and northeastern Mexico (Gelbach 1995, Dunn and Aldefer 2011). It is the most common owl within its range (Gelbach 1995) and is a permanent resident in a variety of landscapes, provided that at least some mature trees are available for shelter, nesting, and hunting. A nocturnal predator, it has a highly varied diet that includes invertebrates, especially insects, as well as vertebrates like reptiles, frogs, fish, birds and small mammals (Allen 1924, Ritchison et al 1988, VanCamp and 1975, Gelbach 1995). They form permanent pair bonds and defend single territories throughout the year (VanCamp and Henny 1975, Lawless et al 1997). They use tree cavities to nest in the early spring, rearing the young through late spring, into early fall (Gelbach 1995).

As nocturnal owls, their prevalence and distribution cannot be monitored by commonly employed survey methods. Christmas Bird Counts are conducted when this species is less vocal and most Virginia counts include limited or no nocturnal efforts (National Audubon Society 2010). Breeding Bird Survey protocols are diurnal (Sauer 2014), focusing on early to mid-morning, a time when most owls are less active and relatively silent. Nonetheless, population studies of EASO have been conducted in other states, including Connecticut (Lynch and Smith 1984), Ohio (VanCamp and Henny 1975), Iowa (Degeus and Bowles 1991), Kansas (Cink 1975) Michigan (Nowicki 1974), Kentucky (Allaire and Landrum 1975, Sparks et al 1994),

Texas (1994) and Wyoming (Fitton 1993). Although this species is considered common and widely distributed in Virginia, especially in the western mountains and valleys (Rottenborn and Brinkley 2007, Trollinger and Reay 2001), no systematic studies that have specifically evaluated populations in Virginia have been published. This study used nocturnal surveys to explore the prevalence and distribution of the EASO in the western mountains and valleys region of Virginia, specifically in Highland County. Highland County (HC), Virginia, was selected because it is exclusively rural with varied habitat types. The county's population in 2010 census was 2,321, making it the least populous county in Virginia with 2.16 people per square kilometer (km) and a total area of 3,665 square km (US Census Bureau 2010). The sparse human population with very low vehicular traffic affords ideal conditions for nocturnal roadside surveys. Topographically, six northeast-to-southwest oriented mountain ranges alternate with five roughly parallel valleys. Elevations range from 495 to 1385 meter (m), with a mean of 863 m (US Geological Survey).

METHODS

Because the EASO is nocturnally active, meaningful surveys must be conducted at night. Owl survey protocols can be passive where one listens for owl vocalizations, or active, where recorded conspecific owl calls are broadcast to provoke a vocal response or visual appearance. An active broadcast survey was selected for this study because a single species was targeted. EASOs respond to conspecific playback, typically replying with calls and/or flying towards the playback site (Nowicki 1974, Lynch and Smith 1984). These owls spontaneously vocalize at night to communicate with each other, define territories, and warn predators (Sprout and Richison 1994, Gelbach 1995). The two most common vocalizations are the "whinny" and "tremolo" calls. The whinny, a quavering descending trill reminiscent of a horse whinny, is considered the primary song that is uttered mostly for territorial defense (Richison et al 1988, Gelbach 1995). The tremolo, also called the bounce, warble or secondary song, can be described as a monotonic trill that may increase or decrease in amplitude before terminating abruptly. It is primarily a contact song

used for pair and family bonding, courting and nest-site advertising (Gelbach 1995).

Broadcast equipment included an mp3 device (Apple iPod) preloaded with EASO vocalizations. Both the whinny and tremolo vocalizations were used, as they are the essential song repertoire of the EASO. This was played and amplified through a lightweight, hand-held, 3-watt, speaker capable of broadcasting in all directions (AYL).

The broadcast protocol was conducted according to published guidelines (Takats et al 2001) and consisted of defined survey routes along public roads in HC. Each route was approximately 14.5 km long with 10 survey stops spaced approximately 1.6 km apart. Each route was assigned a unique name and number. Surveys were conducted at night between March 11, 2014 and January 24, 2015. Data recorded on the data sheet included date, start and finish time, weather conditions and lunar phase. Additional data recorded at each survey stop included the GPS coordinates, elevation (in meters) and habitat type.

Habitats were categorized into four types based on the presence and distribution of trees and open space:

- 1) Rural Residential (RR) – Includes the town of Monterey, the largest community, as well as smaller villages with at least six houses spaced less than 20 m apart, with adjacent open meadows, fields, or pastures. Lawns and cemetery plots were commonly present as well.
- 2) Woodlots (WD) -- Small clusters of mature trees (usually hardwoods) in a mostly open habitat of meadows, fields or pastures.
- 3) Forest Edge (FE) -- The interface of large tracts of hardwood or mixed forest and open habitat of meadows, fields, or pastures.
- 4) Forest (FO) -- Uninterrupted mature hardwood or mixed forest with no visible open habitat other than the transecting road.

Note that open meadows, fields or pastures are common to RR, WD, FE and absent in FO.

The habitat types varied by elevation (Table 1)*. The middle elevations had the greatest diversity of habitat types, especially the 610-914 m stratum. Above 1,219 m there were no WD or RR habitats.

Habitat Types	< 610	610-914	914-1219	> 1219
Rural Residential (RR)	0	12	3	0
Woodlots (WD)	10	58	15	0
Forest Edge (FE)	13	114	23	10
Forest (FO)	0	10	4	8

Table 1: Habitat Types by Elevation (m)

The protocol at each survey stop started with a 2-minute silent listening period followed by 6 broadcast/listening periods and a final 2-minute silent listening period. Each broadcast/listening period consisted of a 30 second (sec) track of EASO vocalization followed by a 30 sec silent period. The vocalization track represented 20 sec of the descending whinny followed by 10 sec of the single-pitch tremolo. If an owl was heard or seen, including during the initial silent period, no further broadcasting was done. The immediate area was spotlighted at least once during the survey stop to search for any owls that may have come in silently or to visualize any owl that approached closely.

All EASO encountered were recorded on the data sheet, along with the type of vocal response (whinny, tremolo, other). Also recorded was the estimated distance using a numerical code (1 < 5 m., 2 = 5-30 m, 3 > 30 m) and compass direction of the owl from the survey spot, excessive noise and number of cars that passed during the survey period. If owls were illuminated well enough with an LED flashlight, the color morph was noted parenthetically; some were photographed. (Figure 1)



Figure 1: Gray morph EASO, Blue Grass Route, stop # 4. Photo courtesy of Stephen Rannels.

Between March 2014 and January 2015 a total of 28 routes were surveyed, covering 425 road km, or 90.1% of the total road km in HC. Seven of the 28 routes were surveyed multiple times during this 11-month period, resulting in 43 total surveys. The 28 routes amounted to 278 survey stops

where weather conditions were adequate to proceed with data collection. Surveys were not conducted if wind caused branches or trees to sway (5 or above on the Beaufort Wind Scale) or if precipitation was more than drizzle or light snow flurries.

Data analysis: Differences between population means were analyzed using Student’s t-tests (Microsoft Excel). P-values less than or equal to 0.05 were considered statistically significant.

RESULTS

Geographic Distribution -- Eastern Screech Owls were recorded in 27 of the 28 routes. Only the high elevation Allegheny Ridge route on April 6, 2014 had no owl responses. The highest yield was 16 owls in 10 survey stops on the mid-elevation New Hampden route on August 30, 2014. At least one owl was recorded in 190 of the 278 survey stops (68.3%). (Fig 2)

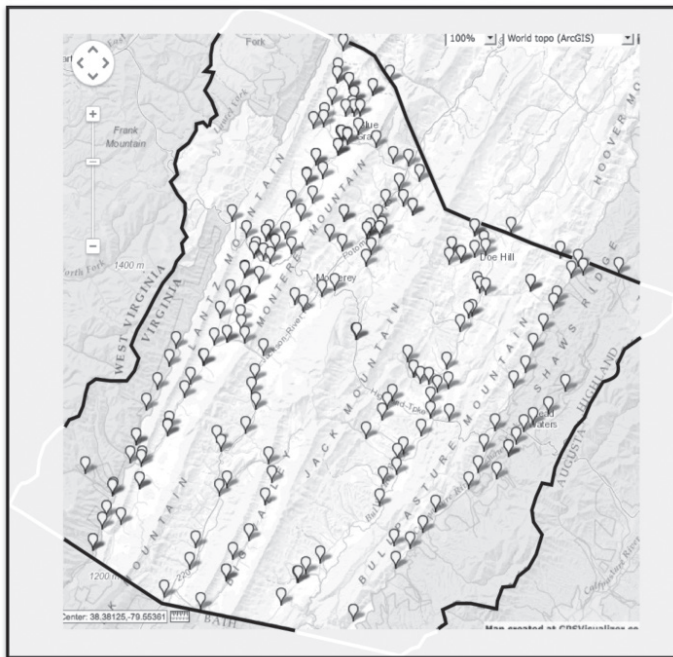


Figure 2: Map of Highland County marked with EASO detection locations.

Prevalence by Habitats --The prevalence of EASOs varied by habitats (Chart 1). The highest prevalence was in the WD habitats with slightly, but significantly, lower values in FE and RR types. Uninterrupted forest habitats (FO) had the lowest prevalence.

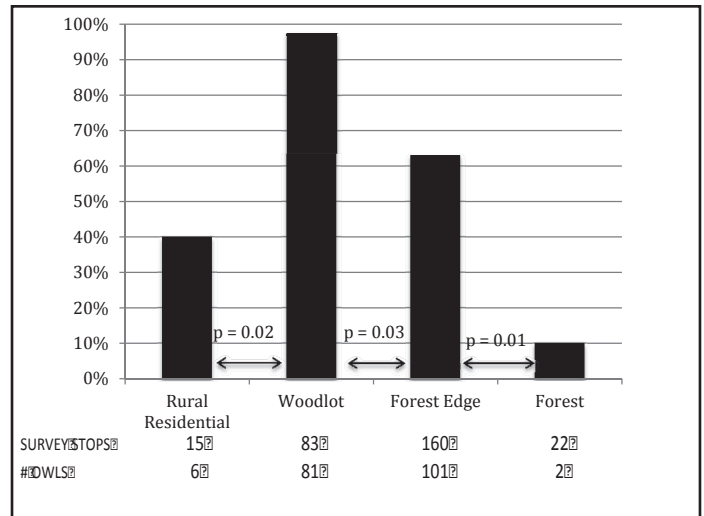


Figure 3: EASO Prevalence by Habitat Type

Prevalence by Elevation – The habitat types, in turn, varied by elevation (Table 1). The middle elevations had the greatest diversity, especially the 610-914 m stratum. Above 1219 m there were no WD or RR habitats.

The only habitat that was present throughout all elevations was FE. Therefore, this was the habitat type studied in evaluating prevalence by elevation. The highest prevalence was in the 610-914 m stratum, with significant decreases ($p < .05$) in the adjacent lower (< 610 m) and higher (915-1219 m) strata. No EASOs were recorded above 1219 (Chart 3).

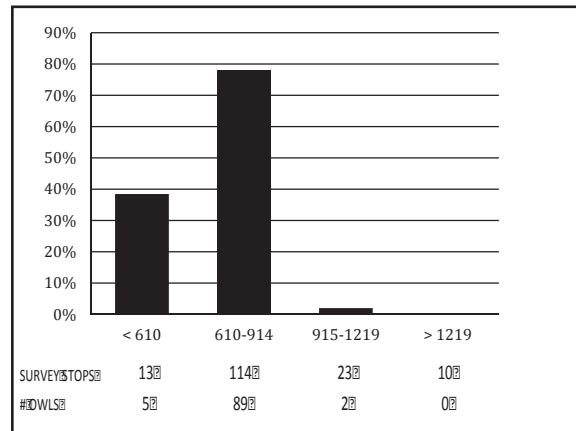


Figure 4: EASO Prevalence by Elevation (m)

DISCUSSION

This study shows that the Eastern Screech-Owl is common and widespread in Highland County, Virginia. The prevalence, however, is neither random nor uniform across the survey region. Rather, prevalence varies by habitat types and elevation.

Prevalence was highest (98%) in the WD habitats, followed by slightly lower levels in the FE (63%) and moderately lower levels in the RR (40%) types. Together these three habitats held 188 of the 190 total owls encountered (99%).

Common to all three habitats is the presence of mature trees with adjacent open meadows, fields or pasture. Mature trees offer roosting and nesting sites as well as hunting perches. Open areas offer habitats where suitable prey species are present in adequate quantity and attainability. Small mammals, especially voles (*Microtus sp.*), deer mice (*Peromyscus sp.*), and shrews (*Blarina sp.*) can comprise up to 66% of the prey biomass of EASO (Richison and Cavanagh 1988). Voles inhabit open non-forested areas almost exclusively (Conley et al 1976) while deer mice and shrews have a broader habitat tolerance that includes open meadows and grasslands (George et al 1986). Furthermore, according to Richison and Cavanaugh (1988) birds are the second most common source of biomass consumed by EASO, up to 20%, with the most commonly taken species being Blue Jay (*Cyanocitta cristata*), Eastern Bluebird (*Sialia sialis*), Northern Cardinal (*Cardinalis cardinalis*) and Eastern Towhee (*Pipilo erythrophthalmus*). These species are common in open and edge habitats in HC (Webb 2005).

Conversely, only 2 of the 190 total owls recorded (1%) were located in the FO habitat, which has scant open areas other than the transecting road. Although FO contains ample mature trees, the scarcity of open habitat may be expected to reduce prey diversity and quantity, especially of ground dwelling species. In Gelbach's studies (2008) two-thirds of the EASO prey was captured on the ground. Furthermore, the FO habitats in this study typically included a cluttered understory of saplings, shrubs, ferns and other plants, often with limited exposed open forest floor. Gelbach (2008) further suggests that dense ground vegetation and high shrub density make hunting more difficult for these small owls. Another possibility for relatively low numbers of EASO in uninterrupted FO is the presence of Barred Owls (*Strix varia*). These large owls prefer mature forests and are highly opportunistic nocturnal predator known to prey on EASO (Johnsgard 2002).

These habitat-specific distributions I observed are consistent with those of other studies which all suggest that ample open areas yield a higher prevalence of resident EASOs (Marshall 1967, Ellison 1980, Lynch and Smith 1984, Sparks et al 1994, Gelbach 2008, Nagy et al 2012).

This study also showed a stratification of prevalence by elevation. The peak prevalence of 82% was in the 610-914 m range. Prevalence decreased moderately (38%) at the

next lower and markedly (13%) at the next higher elevation stratum (Fig. 4). Multiple references state that the EASO's vertical range is typically below 1500 m (Willis 1999, Duncan 2003, Koenig and Weick 2008). However, I found no studies that directly explored potential hypotheses for this distribution pattern. To my knowledge, the present study is the first to evaluate and quantify a relationship between elevation and prevalence of EASO in a defined geographic region and latitude. My observations are consistent with assertion that EASO are usually found below 1524 m, but I could not document EASO presence above 1219 m. This may be due, in part, to limited sampling size as only 10 survey stops were above 1219 m (Figure 4). At least one historic daytime record of an EASO at 1250 m on the Allegheny ridge in HC exists (personal observation, May 27, 2006). Furthermore, an EASO was detected at 1463 m in the Virginia Appalachian Mountains at Mount Rogers (Rottenborn and Brinkley 2007), which is two degrees latitude south of HC. These anecdotal records, together with this study's findings, suggest a very low prevalence of EASO above 1219 m in the mountains of western Virginia.

Habitat type and diversity may explain why this mid-elevation stratum (610-914 m) contained such a high EASO abundance. Of the four habitat types described herein, all were well represented at this elevation and were present in greater quantity than at any other range (Table 1). Furthermore, the two habitats (FE and WD) with the highest prevalence were the dominant types at this stratum. Within these two habitat types in HC there are many large wind-damaged trees, primarily Black Locust (*Robisonia pseudoacacia*) and Sugar Maple (*Acer saccharum*), with numerous broken snags and natural cavities suitable for nesting and roosting (personal observation). These same trees, as well as other associated species, usually had low exposed branches and ample surrounding open, sparsely vegetated habitat. The EASO is a sit-and-wait ("perch and pounce") hunter, launching from a low perch with short foraging flights for line-of-sight prey that is usually on the ground with a reduced shrub density (Sparks et al 1994, Gelbach 2008).

In addition, most human habitation and activity in HC is within this 610-914 m elevation range (personal observation). EASO's do not shy away from human activity, and several studies have shown an increased presence of this species in close proximity to human habitation (Gelbach 2008, Artuso 2009). These elevations are also where most barns, farm buildings, and abandoned houses are located. Such structures have been used by EASOs for winter

roosting (personal observation), and possibly for nesting. The many active sheep and cattle farms concentrated at these elevations potentially afford a higher availability of small mammals (rodents and shrews), a major food source of EASOs, especially in winter (Ritchison and Cavanagh 1992). Furthermore, livestock trample down snow in the pastures and fields, thereby exposing grassy surfaces and bare ground that should make small mammals more visible and accessible to owls. EASOs have symmetric external ear openings (Marshall 1967) and rely extensively on vision for prey location.

Personal observations indicate that there are more riparian habitats such as open streams, ponds and marshes at the middle and lower elevations. As a result, a higher quantity of aquatic biota, a known element of prey of this highly opportunistic owl, especially during the breeding season (Ritchison and Cavanagh 1992), is expected. Conceivably, more avian prey can be expected in winter at the middle and lower elevations as well, especially of small passerines like Black-capped Chickadees (*Poecile atricapillus*), Dark-eyed Juncos (*Junco hyemalis*), Golden-crowned Kinglets (*Regulus satrapa*), nuthatches (*Sitta sp.*), and Purple Finches (*Haemorphous purpureus*) that migrate vertically from the high elevation forests to the more open lower valleys. Other birds that tend to aggregate into flocks or loose groups in the winter like Common Starling (*Sturnus vulgaris*), blackbirds (Icteridae), finches, (Fringillidae) doves (Columbidae), and sparrows (Emberizidae) are noted mostly below 3000 ft and away from forest habitats.

The scarcity of EASO above 914 m (13%) and near absence above 1219 m may be explained by the same factors. In HC, as elevation increases above 914 m habitat diversity, human habitation, man-made structures, and livestock farming all decrease (personal observation). In addition, there is less riparian habitat and more large tracts of forest are present. More snow accumulates at higher elevations, and remains for longer periods of time, obscuring potential hunting surfaces. EASOs are non-migratory (Johnsgard 2002) and would presumably remain year-round within the same elevation strata where they breed. Survival for these owls presumably becomes increasingly challenging the higher the elevation extends above 914 m.

In summary, both habitat and elevation influence EASO prevalence in HC. Habitats that combine mature trees with adjoining open fields, pastures or meadows seem to be preferentially selected, while uninterrupted forest with little or no open areas are used far less commonly. Elevation above 914 m have a markedly reduced EASO prevalence

compared to lower strata, and above 1219 m this species is nearly absent. Presumably shelter for roosting and nesting are important in these prevalence distinctions. Adequate prey and suitable hunting locations may be an even greater driving force in habitat and elevation selection.

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*The units initially used for the elevation were feet, in 1000 ft increments. That is <2000, 2000-2999, 3000-4000, >4000. Conversion to metric resulted in the irregular breakpoints for the elevation strata.

Caspian Terns Staging on the Lower James River

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Caspian Terns (*Hydroprogne caspia*) are the largest of the terns and are cosmopolitan, nesting on five continents. They are fish-eaters, though not birds of the open ocean, preferring instead a variety of freshwater and saltwater habitats (Kaufman 1996). In North America, Caspian Terns nest to the north around the Great Lakes, though less so around Lake Superior, and also in the western United States and Canada (Wires and Cuthbert 2000). Shuford and Craig (2002) describe aspects of Caspian Tern migration and ecology and regarding their general continental migration movements, state that "Very little appears to be known about the migration pathways of populations breeding in central Canada, the Atlantic coast and the Gulf coast... on geographic grounds, it seems likely that Atlantic coast birds follow the coastline south to winter in areas similar to those occupied by Great lakes birds...most Caspian Terns congregate for migration at traditional foraging locations along marine coasts and major rivers or freshwater lakes about a month after young have fledged...migrate singly or...rare flocks of thousands." Research recommendations from the Shuford and Craig (2002) assessment include to "catalogue key migration staging areas."

During August and September, from 2010 through 2015, Caspian Terns were observed in two possible post-breeding staging areas, which are pre-migration (or early migration) gathering points, one along the lower James River at Hog Island Wildlife Management Area in Surry County and the other at Craney Island Dredged Material Management Area in Portsmouth. The Caspian Terns recorded at Hog Island (Table 1) by the author on 23 August 2010 were a new state high count (eBird), more than double the previous high count that had been recorded at Craney Island on 1 September 2004 (Rottenborn and Brinkley 2007). The 23 August 2010 high count prompted more regular surveys by the author and other observers, resulting in another new state high by the author at Hog Island on 9 September 2011 (eBird). Other observers conducted Hog Island surveys in 2012, but my surveys in 2013, 2014 and 2015 there resulted in the highs shown in Table 1. The Hog Island surveys, simple counts on a given day by the author and by other

small groups of birders, indicated that Caspian Terns arrived in significant numbers from about mid-August to mid-September.

Craney Island surveys have been conducted for many years, mainly through the efforts of Professor Emeritus Ruth Beck, of the College of William and Mary, in Williamsburg, Virginia and her team. The author has assisted with weekly Craney Island surveys as part of Professor Beck's team from 2009-2016. Birds were often packed tightly while sitting and flying, making age determination difficult. Two surveys with good visibility indicated that about 10% were juveniles. Caspian Terns were regularly seen carrying small fish, suggesting that adequate food resources were present, though no assessment of that was made.

Caspian Terns are described in the Williamsburg area, which is just across the James River from Hog Island, as "a common spring...and...fall transient and uncommon summer transient" (Williams 2012). They are described on the State coastal plain as a "fairly rare summer resident on coast...although sizeable flocks occur along tidal rivers at some inland locations in spring and fall" (Rottenborn and Brinkley 2007). Neither publication mentioned observations of staging.

Though not previously reported, Caspian Terns were likely using Hog Island for staging and to a lesser extent, Craney Island. As Craney Island is only approximately 40 kilometers downstream on the James River from Hog Island, it would seem likely that migrant Caspian Terns would frequent both sites in comparable numbers during the same time period. However, Hog Island seems preferred, as more birds were generally seen there, and they stayed at Hog Island for longer periods of time, as determined by surveys at both sites. Dramatic examples of this likely preference can be seen in Table 1: 811 for Hog Island, compared to 110 for Craney during the same week in 2010; 832 for Hog Island, compared to 118 for Craney during the same week in 2011. Surveys in 2013 and 2014 revealed that about 300 Caspian Terns stayed at Hog Island for more than two weeks, while during that same

time period, there was only one day with a similar total at Craney Island. In 2015, surveys showed that more than 100 were at Hog Island for three weeks, while during that time period, the Craney Island counts averaged only 29.

Hog Island differs from Craney Island in that it is subject to much less disturbance by visitors or machinery (pers. obs.). Although various crops are planted in the fields at Hog Island, the several impoundments remain present from year-to-year and generally seem unchanged, though with fluctuating water levels and amounts of shoreline mudflats and vegetation caused by varying weather conditions. Perhaps these features account for reliably larger numbers there. Corn crops there may have obscured some terns from view, which may have led to undercounting despite my efforts to observe from locations with greatest visibility. Craney Island, by contrast, is a busy site, often with dredge spoil pumping, heavy truck traffic and digging by various machines of the U.S. Army Corps of Engineers. Caspian Terns are not attracted to dredge spoil pumping at Craney Island as are the scavenging gulls. In addition, Craney Island water levels fluctuate greatly with pumping operations.

Although this assessment is preliminary, my observations suggest that staging may actually only occur at Hog Island, while shorter-term resting occurs at Craney Island. I am not aware of other such staging sites for Caspian Terns in Virginia. Additional surveys will help provide answers about Caspian Tern movements on the lower James River. Reports of survey results to U.S. Army Corps of Engineers and Virginia Department of Game and Inland Fisheries may lead to management strategies at Craney Island and Hog Island, respectively, for Caspian Terns.

Table 1 Caspian Tern peak counts at Hog Island and Craney Island (from surveys, personal communications and eBird)

Year	Site	Peak Count/date
2010	Hog	811 on 23 Aug
2010	Craney	110 on 19 Aug
2011	Hog	832 on 9 Sep
2011	Craney	118 on 15 Sep
2012	Hog	62 on 18 Aug
2012	Craney	108 on 4 Oct
2013	Hog	340 on 21 Aug
2013	Craney	363 on 5 Sep
2014	Hog	400 on 23 Aug
2014	Craney	425 on 5 Sep
2015	Hog	157 on 19 Sep
2015	Craney	42 on 2 Sep

Acknowledgments

Thanks for Craney Island survey data from College of William and Mary Biology Professor Emeritus Ruth Beck and her team of George and Virginia Boyles, Alex Minarik, Lee Schuster, Bill Williams and Dave Youker; also to Andrew Baldelli and Tracy Tate and for Hog Island survey data from Jeffery Blalock, Adam D'Onofrio, Frank Fogarty, Steven Living and Bill Williams. Finally, thank you to an anonymous reviewer who improved this manuscript.

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BELL'S VIREO CAPTURED ON LOWER DELMARVA PENINSULA

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The Bell's Vireo (*Vireo bellii*) is a small, migratory vireo that breeds in North America and overwinters primarily along the Pacific Coast from Baja California to Honduras. The species has been subdivided into four recognized subspecies including *V. b. belli* that breeds from eastern Colorado, South Dakota and Iowa south to Arkansas, Louisiana and central Texas, *V. b. medius* breeds from southwest Texas south to Durango and Coahuila, Mexico, *V. b. arizonae* breeds from Nevada and southwest Utah and central Arizona to California and Sonora and *V. b. pusillus* breeds in southwest California and Baja (Brown 1993). Subspecies vary somewhat in plumage color with the westernmost Least (*V. b. pusillus*) appearing mostly gray above and pale below and the easternmost *V. b. belli* appearing greenish above and yellow below (Pyle 1997). Southwestern birds including *V. b. medius* and *V. b. arizonae* are intermediate in color.

The Bell's Vireo is a nearly complete migrant with very little overlap between breeding and winter ranges. Individuals leave the northernmost breeding grounds by August or September and most have left the U.S. by early October (Barlow 1962, Brown 1993). Birds begin to arrive on portions of the winter grounds by early September (Monroe 1968, Binford 1989). Migratory routes remain poorly documented.

On 19 September 2010 while operating a fall banding station on the Eastern Shore of Virginia National Wildlife Refuge in Northampton County, we captured a Bell's Vireo in a mist net (Figure 1). The bird was captured within scrub vegetation between the visitor's center and the monarch trail. Upon extraction, the bird was immediately identified as a vireo by its thick grayish bill and thick legs and feet that were bluish-gray in color. Overall, the bird was washed greenish-gray on the dorsum with a slightly grayer, contrasting head and a yellowish wash on the

breast, sides, and belly. This bird was differentiated from other vireo species by small size compared to Philadelphia Vireo (which was compared side-by-side to the Bell's at the time of capture), Gray Vireo, White-eyed Vireo, and Hutton's Vireo. The bird had a noticeable whitish spectacle and two pale indistinct yellowish wing bars, ruling out either Philadelphia or Warbling Vireo, and the wing chord was too short for a typical Warbling Vireo. The head shape, body proportion, and overall coloration were inconsistent with either Hutton's Vireo or Gray Vireo.

The bird was taken to the banding station and processed. It was aged as a hatch-year based on the extent of skull pneumatization (less than one third ossified). Sex could not be determined. Linear morphometric measurements included wing chord – 56 mm, tail length – 51 mm, exposed culmen – 8.9 mm and the difference in length between the tenth primary and the outermost primary covert – 4.8 mm. Mass was 9.8 g. Fat score was graded 3 on a scale of 5 (furcular hollow filled with fat but still concave) and keel score was graded 3 on a scale of 3 (pectoralis muscle even with sternum to slightly bulging). No body molt was observed.

The Bell's Vireo reported here represents the second accepted record for Virginia (Ealding, 2012). The first individual was observed on 12 August, 1962 within Pocahontas State Park in Chesterfield County (Rottenborn and Brinkley 2007). Based on the amount of green in the dorsum, the bird reported here appears to have been from the eastern portion of the breeding range (*V. b. bellii*).

Several characteristics of the Bell's Vireo captured in 2010 are consistent with a growing list of fall records for this species along the outer Atlantic Coast. Although accepted fall records for this species prior to 1990 are rare (e.g. Jehl 1960, Bull 1975, Post 1986), we located more than 30 accepted records since 2000 (e.g. Garvey and Iliff 2011,

Hanson et al. 2015, Mirick 2015, Persons et al. 2015) with records reported from virtually every coastal state from Nova Scotia through Georgia (winter records are now annual in Florida). More than 90% of first detections have occurred during September and October. All birds (N = 10 since 1897) that were either captured as part of banding operations and/or collected were determined to be hatching-year birds. All available descriptions are suggestive of the more colorful eastern subspecies (*V. b. bellii*). All descriptions of habitat have indicated birds were using shrub or coastal scrub vegetation.

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Figure Legends



Figure 1. Profile photo of a Bell's Vireo captured on 19 September, 2010 on the Eastern Shore of Virginia National Wildlife Refuge. Photo by Todd Jones.

Habitat relations of birds at the Manassas National Battlefield Park, Virginia.

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Abstract

We conducted a study on the diversity and abundance of birds in different habitats of the Manassas National Battlefield Park to determine the habitat relations of bird species in the park. The unmowed meadows and mixed deciduous coniferous forests in the park had the highest diversity. The recently clear-cut area also harbored a diverse bird fauna. The mowed areas of the park had the lowest diversity. Most bird species occupied five or more habitats. Species distributions may be due to the smaller area and the early succession stages of vegetation in the park.

Introduction

Manassas National Battlefield Park is located adjacent to the city of Manassas in Prince William and Fairfax Counties, Virginia. It harbors a rich and abundant bird fauna. A few previous studies have been conducted on the bird species in the park (Sinclair et.al 2003, Peterjohn 2006, Garabedian et.al 2010). The long term study conducted by Zacharias and Gorsira (2014) showed a decline in the populations of several species, following the trend seen in the results of the North American Breeding Bird Survey (Saur et al. 2012). The National Park Service has implemented conservation programs such as the restoration of grasslands and management of forests, aimed at improving the quality of habitats for wildlife in the park, including such declining birds. In the present study, we used data from breeding bird surveys conducted in 2008 and 2009 to analyze the habitat relations of birds in the Manassas National Battlefield Park to understand the habitat utilization of different species in view of the restoration programs conducted in the park. The results of this analysis may help to evaluate the impact of habitat improvement for bird population.

Study Area and Methods

The data for this study were collected through point counts on the Manassas National Battlefield Park during 2008 and 2009. The points were selected at random and the protocol described by Ralph et al. (1995) was followed. The counts were conducted using a standardized 250 m grid. There were ten points on each grid in the ten habitats, and five minutes were spent at each point once per year. Counts took place in

the month of June between dawn and 08.30. Surveys were conducted by teams of volunteers, and each team consisted of a master birder, able to identify bird species in Northern Virginia by sight or sound and one assistant. The same master birder counted birds in both these years. The park has an area of 1779 ha and contains a diverse set of habitats. Vegetation of the park has been described by Fleming and Weber (2003) and Peterjohn (2006). The long history of agricultural practices is reflected in the current vegetation of the park. Habitat types were classified as (1) Pastures (Hayfields) (2) Unmowed meadows (Old-field grasslands), (3) Unmowed pasture with cedars (4) Recently clear-cut area, (5) Deciduous forest (Old-hickory and Bottomland forests) and (6) Mixed deciduous and Coniferous forest (7) Coniferous forests (8) Small ponds (9) Mowed fields and (10) Roads, which include the verges and roadside areas (Appendix 1). Roads were treated as a separate habitat for examining the tolerance of various species to disturbances. Bottomland forests, the only remaining patches of the old growth forests are included in the deciduous forests. They are not treated separately because of their smaller size.

Data Analysis

Abundance plots were used to visualize species abundance and distribution. In this study, the plots were derived for a total of 2000 minutes, and 'Biodiversity Professional Version2' was used to calculate several diversity indices to examine patterns of bird communities in different habitats (McAleece, et al.1997): K-Dominance, Shannon Diversity Index and Margalef's Richness Index. K-Dominance measures intrinsic diversity (Lambhead et.al 1983). Shannon Diversity Index (Shannon & Weiner, 1949) is used to characterize species diversity in a community. Shannon Index $H' = -\sum_{i=1}^S (p_i \times \log p_i) = -\sum_{i=1}^S (\frac{n_i}{N} \times \log \frac{n_i}{N})$ where S is the total number of species in the population, n_i is the number of individuals of species in the sample and N the total number of individuals of all the species in the sample. Higher H' values indicate higher diversity, which is maximum when each individual in the sample belongs to a separate species and minimum when all individuals belong to the same species. Shannon index reflects both

the richness and evenness of the community. In this study, the index was derived for comparing species diversity in different habitats. Margalef's Richness Index (Margalef 1958) is a simple measure of species richness of a community where evenness is not taken into consideration. Margalef's Richness Index $M = (S-1) / \log N$ where S is the total number.

Results

Of the 81 species whose habitats were recorded, the largest number of species was recorded in the Unmowed meadows (69) followed by roads (68) mixed deciduous and coniferous forests (51) and deciduous forests (39) (Appendix 2). The lowest number of species was recorded in the mowed area of the park. The recently clear-cut experimental area had 36 species including American Robin, Common Yellowthroat, Field Sparrow and Eastern Bluebird. Twenty-seven species were found in five or more habitats. American Crow and Eastern Towhee were found in all habitats, while Red-winged Blackbird, Field Sparrow, Northern Mockingbird Carolina Chickadee and Carolina Wren were found in nine habitats. While Pileated Woodpecker was found only in the deciduous forests, Downy Woodpecker and Red-bellied Woodpecker were found in seven habitats each. Northern Flicker was found only in unmowed meadows and mixed deciduous and coniferous forests. Eastern Meadowlark, a species of concern, was recorded in four habitats, the largest number being recorded in the unmowed meadows. Abundance plots are used to visualize species abundance and distribution. In K-dominance curves, cumulative ranked abundance is plotted against a log species rank. It indicates the lowest diversity with elevated steep curves. The data are summarized and plotted in a way that the abundance of each species in a community is ranked from the most to the least abundant and species rank plotted against species abundance. Abundance plots generated for different habitats. (Fig. 1&2)

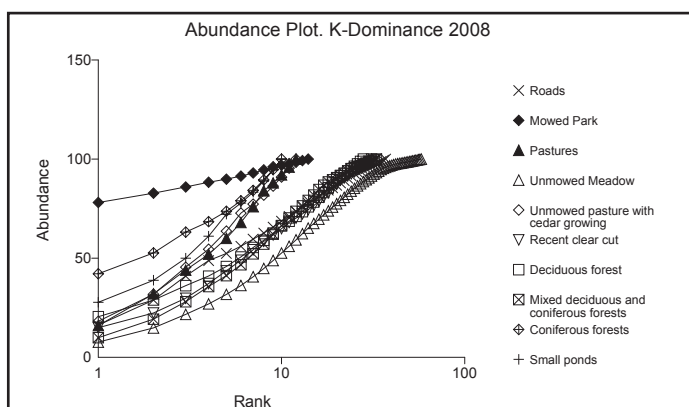


Fig. 1 Abundance plot for bird communities in different habitats during 2008.

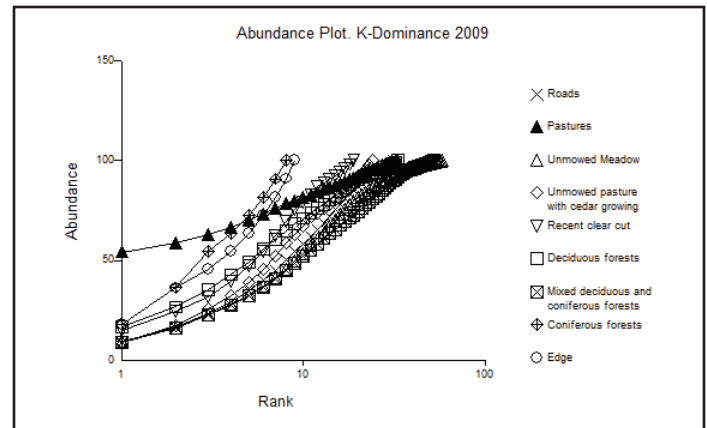


Fig. 2 Abundance plot for bird communities in different habitats during 2009.

K-Dominance curves for 2008 (Fig.1) showed that bird communities in unmowed meadows, mixed deciduous coniferous forests and recent clear-cut areas were more diverse than in the other habitats. Mowed park areas with trees/grass showed the lowest abundance and diversity followed by coniferous forest and small ponds/farms. Similarly, curves for 2009 data (Fig.2) showed high levels of abundance in mixed deciduous/coniferous forest followed by mowed meadow. Pastures exhibited the lowest abundance followed by coniferous forests. Mixed deciduous /coniferous forests and unmowed meadows showed high abundance levels in both 2008 and 2009 whereas low abundance was shown by coniferous forests.

Patterns across habitats

In 2008, unmowed meadows were the most diverse and mowed area the least diverse, based on the Shannon index. Highest value for Margalef's Richness Index was shown by the pond. (Table.1) Mowed area and pond were not represented in 2009 data. Mixed deciduous coniferous forest showed the highest Shannon value and coniferous forest the lowest Shannon value in 2009. The coniferous forests yielded the highest value for Margalef's Richness Index, while unmowed meadows produced the lowest in 2009. On the roads, 68 species of birds were counted, with American Crow and European Starling being the most abundant species.

Table: 1. Shannon Diversity Index and Margalef’s Richness Index for various habitats in 2008 and 2009 (Habitat codes are given as appendix)

Year		2008		2009	
Index		Shannon H' Log Base 10.	Margalef M Base 10.	Shannon H' Log Base 10.	Margalef M Base 10.
Mowed Park		0.455	31.796	-	-
Pastures		1.028	47.928	0.931	30.144
Unmowed meadows		1.53	23.859	1.51	25.464
Unmowed pasture with cedar growing		1.021	49.91	1.311	42.099
Recent clear-cut		1.354	33.956	1.188	40.597
Deciduous forests		1.299	34.913	1.307	32.524
Mixed deciduous and coniferous forests		1.352	29.645	1.538	28.177
Coniferous forests		0.835	52.395	0.877	67.218
Small ponds		0.927	53.375	-	-

Habitat 412 (Unmowed meadows) and 670 (mixed deciduous /coniferous forest) showed higher Shannon diversity indices in both 2008 and 2009, whereas habitats 135 (mowed park), 770 (coniferous forests) and 814 (small ponds) showed lower values. Contradictory to this, Margalef’s richness index derived higher values for habitat 814 (small ponds), 770 (coniferous forest) and 415 (Unmowed hayfields) and lower values for 412 (Unmowed meadows) and 670 (mixed deciduous and coniferous forests). This may be due to the common species such as American Crow, Carolina Chickadee, Carolina Wren, European Starling, Eastern Towhee, Field Sparrow and Northern Cardinal.

Habitats other than mowed areas showed similar diversity trends, at lower levels of abundance in 2008. Unmowed areas represented the most abundant community in both 2008 and 2009. Data were not available for mowed areas in 2009. Curves for 2009 showed the lowest diversity in pastures and the highest in unmowed meadows.

Discussion

The bird community composition within and between forest habitats is largely dependent on the physical structure of the vegetation, the kind of distribution of foraging substrates, and the availability of food resources (Holmes et.al.1979). Manassas Park provides diverse habitat for different species of birds. Several species were found using different habitats. The number of different vegetation types occupied by a species can be treated as a measure of the degree to which the species is specialized in that dimension of its ecological niche (Gaston 1978). At Manassas, the highest diversity and abundance of species were found in

unmowed meadows and mixed deciduous and coniferous forests, while the lowest, in the mowed areas of the park. We did not see higher diversity or abundance in recently the clear-cut areas. In the clear-cut areas, we found all the shrubland species mentioned by Zacharias and Gorsira (2014) except the Yellow-breasted Chat, but we did not find any obligatory grassland species. Yahner (1988) and Derleth et al. (1989) believed that clear-cut areas in forests increase edge effect, which may be beneficial to some species but detrimental to others. Yahner (1988) suggested long term studies to arrive at any conclusion on the impact of clear-cut. Since this study covered only two years, we could not arrive at any conclusion on the aspect. The Red-headed Woodpecker, a widespread species but of concern in many parts of North America, was not seen in the park, though patches of the mature, hardwood bottomland forests, the favorite habitat of the species, is found in the park. There are historic records of sighting of breeding pairs of the species in May/June 1914 and June 1915 at Wellington, close to the park and specimens collected in 1887 (USNM 111498, 176127,192360) from Gainesville, also nearby. The park may not have enough area of mature hardwood bottomland forests, which could be a reason for the absence of the Red-headed Woodpecker. Vickery et al. (1994) and Hinsley et al. (1996) believed that the size of area is important for a bird species to survive in a habitat and area requirements vary among species. Reduction in habitat size can cause a species, especially the hardy ones, to encroach into habitats/ niches of other more sensitive species. Most birds are found in several habitats. This may also be attributable to the park’s relatively smaller area and to the early successional stages of vegetation in the park.

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Appendix 1. Habitat codes used

Habitats	Code
Pastures	311
Unmowed meadows	412
Unmowed hayfields with cedar	415
Recent clear-cut	416
Deciduous forests	570
Mixed deciduous coniferous forests	670
Coniferous forests	770
Small ponds	814
Mowed park	135

Appendix 2. Habitats of Birds at Manassas National Battlefield Park: 2008-09

Common Name	135	311	412	415	416	570	670	770	814	Total
Canada Goose			12					8		3
Mallard		2								1
Northern Bobwhite			1				1			2
Great Blue Heron	1	1	9			1				4
Green Heron			2							1
Black Vulture			1							1
Turkey Vulture		1	7		1		4			4
Red-shouldered Hawk			7			1	3			3
Red-tailed Hawk		1	3							2
American Kestrel			3		2		1			3
Killdeer					1					1
Mourning Dove		3	17	3	10	2	4			6
Yellow-billed Cuckoo			5		2	2	7			4
Whip-Poor-will			1							1
Chimney Swift			9				1			2
Ruby-throated Hummingbird						1	1			2
woodpecker sp.			2				1			2
Red-bellied Woodpecker		1	12	1	4	7	7			6
Downy Woodpecker	1		9	1	1	4	10	1		7
Hairy Woodpecker		2	1			1				3
Northern Flicker			2				2			2
Pileated Woodpecker						1				1
Eastern Wood-Pewee			7	3	7	15				4
Acadian Flycatcher						2	8			2

flycatcher sp.			1							1
Eastern Phoebe			6				2			2
Great-Crested Flycatcher			12		1	4	4	3		5
Eastern Kingbird		3	3		1	1				4
White-eyed Vireo							1			1
Red-eyed Vireo		1	9	1		13	7			5
Blue Jay			20		5	10	19	3		5
American Crow	2	9	50	4	16	13	26	1	2	9
Fish Crow			1	1		3	1			4
Common Raven			2							1
crow sp.			5			2	5			3
Purple Martin			1							1
Tree Swallow		5	9				4			3
N. Rough-winged Swallow			1				1			2
swallow sp.			1							1
Barn Swallow	1	6	64		2	2	3			6
Carolina Chickadee	2	3	30	1	7	11	27	4		8
Tufted Titmouse		1	39	4	3	18	39			6
White-breasted Nuthatch			2		1	3	10			4
Carolina Wren		2	56	2	5	11	44	1	1	8
House Wren			1				3			2
Blue-gray Gnatcatcher		5	35		2	8	16			5
Eastern Bluebird		1	20		2	2				4
Wood Thrush			9			1	9	2		4
American Robin		41	3	6	24	11	2			6
Gray Catbird		3	9	2			3	1	1	6
Northern Mockingbird	6	8	40	1	6	1	6		2	8
Brown Thrasher			1							1
European Starling	100	114	65	3		3	14			6
Cedar Waxwing			29							1
Northern Parula			1		1		1			3

Yellow-throated Warbler				2						1
Pine Warbler			4		1		5			3
Prairie Warbler	2	6	55	4	1		15	1	1	8
Oven bird							1			1
Common Yellowthroat		2	27		3		14			4
Yellow-breasted Chat				2						1
Scarlet Tanager		2	1		3	6				4
Eastern Towhee	2	4	35	4	9	2	20	2	1	9
Chipping Sparrow		2	27	1	1	4	2			6
Field Sparrow	3	14	83	5	7	2	18		5	8
Grasshopper Sparrow			3							1
Song Sparrow		2	2	3	1				2	5
sparrow sp.										
Northern Cardinal	1	4	88	4	7	16	34			7
Blue Grosbeak			1							1
Indigo Bunting	1	4	52	7	10	4	9			7
Red-winged Blackbird	4	8	42	3	11	1	8		2	9
Eastern Meadowlark		2	34	1			5			4
Common Grackle		6	19		4	24	14	1		6
Brown-headed Cowbird	2		7	1	4	5	3		1	7
Orchard Oriole		3	4							2
Baltimore Oriole		2	3							2
House Finch		1	1				1			3
American Goldfinch		5	44	3	5	5	11			6
House Sparrow				1						1
Total	14	35	69	27	36	39	51	13	10	81

Minutes of the 2015 VSO Annual Meeting

May 8 – 10, 2015; Wintergreen Resort & Conference Center
Rosewood, VA

Judith Wiegand, Secretary

Friday, May 8, 2015

The 2015 Annual Meeting of the Virginia Society of Ornithology (VSO) was held at Wintergreen. A number of field trips were held throughout the area on Friday, May 8; Saturday, May 9; and Sunday, May 10, 2015.

Friday Evening Meeting

Joe Coleman, president, called the meeting to order at 7:05 pm and introduced himself. He thanked all those who are participating in the VSO Annual Meeting. The Monticello (Charlottesville) and Augusta bird clubs, who are hosts for this annual meeting, were recognized and thanked. Wintergreen is a beautiful location. The minutes of the 2014 Annual Meeting were read and a change was made. Susan Brown moved to approve the 2014 minutes as amended, Allen Hale seconded, and the minutes were approved.

Treasurer's Report. Terri Cuthriell, treasurer, reported that the beginning balance on January 1, 2014 was \$188,704.72 and the ending balance on December 31, 2014 was \$187,273.38.

Nominating Committee Report.

Joe Coleman noted that one of the most important duties of the Immediate Past President is to chair the nominating committee and determine a slate of officers and committee members for the next year. He introduced Andrew Dolby, immediate past president, who began by thanking those whose terms on the board were coming to an end this year: Joelle Buffa, Judith Wiegand, and Andrew Dolby. He then presented the slate of officers and board members for the coming year, asking them to stand as their names were read:

President: Jeff Trollinger
Past President: Joe Coleman
Vice President: Lenny Bankester
Secretary: Laura Mae
Treasurer: Terri Cuthriell
Membership Secretary: Shirley Devan
Newsletter Editor: Len Alfredson
Raven Editor: Wes Brown

Board of Directors, Class of 2018: Patti Reum; Russell Taylor; and David Youker, Yorktown, VA.

Board of Directors, Class of 2016, one-year replacement: Leslie Bulluck, Richmond, VA.

Andrew Dolby moved approval of the officers and directors, Bruce Johnson seconded, and the motion was approved. Joe Coleman noted that these individual's terms will begin on July 1, 2015.

President's Report. Joe Coleman began by describing the VSO as a statewide organization whose officers are volunteers and whose board meets quarterly. The VSO conducts several field trips each year (besides those that are part of the annual meeting) and publishes a number of publications, some digitally and others in print form. The VSO's digital publications are also now available in color. The organization needs additional volunteers, please contact him or another board member with questions or to volunteer. The VSO could not function without the board; Joe thanked Andrew Dolby for his service over the last several years, including the organization of two annual meetings and the move into the digital era. The VSO has been very fortunate to have Andrew's leadership during his time as president and immediate past president. Joe also thanked Joelle Buffa and Judith Wiegand for their service on the board and said they would be missed. He noted that Joelle has assembled the Speaker's Directory, which is a useful tool for the bird clubs in the VSO.

Joe then turned to the next item on the agenda, an amendment to the VSO bylaws. As a result of the communications survey conducted earlier in the year, the board would like to add a "student" membership category to attract more young people. He stated that, at its February 28, 2015 meeting, the board had approved including a student category. Bruce Johnson moved to include a "student" category, Jeff Trollinger seconded, and the motion was approved by a unanimous vote.

Joe explained that, at this time during the annual meeting, the president usually announces the location of the next annual meeting. However, no club has yet agreed to serve

as host, so no location has been chosen. The VSO needs a volunteer or a pair of clubs to volunteer to host the 2016 annual meeting. He and John Spahr are available to help and advise any club on how to organize the meeting. He asked any volunteers to contact him.

Andrew Dolby was recognized. He explained that the coffee for sale at the VSO table in the exhibit area comes directly from Guatemala and 100 percent of the proceeds from the sale of the coffee goes back to the community to assist with cloud forest preservation. These funds help reduce the need for deforestation and increase education about coffee-growing in a sustainable manner. Nothing is taken out of the proceeds for overhead expenses.

At 7:20 pm, Virgil Frizzell moved to adjourn the meeting and the motion was approved unanimously.

Program. Marshall Faintich gave a presentation: "A Photographic Introduction to the Birds of Wintergreen and Nelson County."

Saturday, May 9, 2015

A variety of field trips throughout the area were held for Saturday morning participants.

On Saturday afternoon, Jeff Trollinger moderated the Technical Papers Session, which included the following topics:

"Assessing Migratory Bird Use of Forested Stopover Sites along the Atlantic Flyway"

- Andrew Arnold, Tim Schreckengost, Jeff Buler, Eric L. Walters

"Working to Reduce Bird-Window Collisions at a Suburban Office Park"

- Rebecca Murray Schneider

"The Prevalence and Distribution of Eastern Screech owls in Highland County, Virginia"

- John Spahr

"Evaluating Factors That Influence Native Bird Window Strikes at the Virginia Zoo"

- Annie M. Sabo

During the banquet on Saturday evening, Joe Coleman presented the Eike Award to Andrew Dolby for his many years of service to the VSO, including organizing a number of Forays; serving as vice president, president, and immediate past president; organizing two annual meetings in Fredericksburg (2009) and Chesapeake (2014); and organizing five annual paper sessions at annual

meetings. He has also overseen the VSO's transition from all-print publications to the new digital world. He has also been the driving force behind the selection of recipients of the Mitchell Byrd award.

Joe then presented Murray Awards to Virginia Green and Sarah Wolf. The Murray Award has been given to students by the VSO since 1980 to encourage research that results in a meaningful contribution to our understanding of birds. For many years, the Northern Neck Audubon Society has funded a second award.

Patti Reum then presented the Jackson Abbott Award to Larry Smith from the Virginia Department of Conservation and Recreation. Patti described Larry's extensive work toward the conservation of Virginia birds and natural areas, noting that 55,352 acres were preserved in 2014.

Speaker. Jenny Gaden from the Monticello Bird Club then introduced Scott Weidensaul, who gave the keynote address, "Project SnowStorm," based on research on Snowy Owls during the 2013-14 irruption of the owls.

Sunday, May 10, 2015

Several field trips were offered on Sunday morning.

INFORMATION FOR CONTRIBUTORS

The Raven, the official journal of the Virginia Society of Ornithology (VSO), functions to publish original contributions and original review articles in ornithology relating to Virginia Birdlife. Electronic files are the required form for manuscript submission. Text files, prepared using a Mac OS-compatible word processing program or Microsoft® Word, should contain minimal formatting. Graphics (photos, maps, graphs, charts) should be sent as high quality EPS or JPEG files. An accompanying “cover letter” file should be emailed to the editor stating (1) article title, (2) author(s) full name(s) and email and home or institutional address(es) and, for multi-authored manuscripts, (3) the name of one author designated to carry out correspondence with the editor. If the manuscript or report is technical, a list of persons who would be appropriate reviewers should also be included in the “cover letter” file. Authors are encouraged to consult with the editor on additional matters of content, format, or style.

Most Manuscripts published in *The Raven* concern the distribution, abundance and migration of birds in Virginia. However, if there is evidence of summer residency in Virginia provided, manuscripts describing the distribution, abundance, life history, ecology and behavior of Virginia’s migrant birds on their wintering grounds are also welcome. Manuscripts on other ornithological topics, including Virginia-based historical reviews, bibliographical reviews, life histories, and behavioral observations, are also welcomed. In addition, the journal serves to publish the official proceedings of the VSO and other formal items pertaining to all aspects of the Society’s activities. *The Raven* may also publish articles pertaining to the activities of various public and private organizations engaged in biological and conservation work in Virginia. *The Raven* is a peer-reviewed journal; all feature articles and short communications are reviewed before a decision about acceptance for publication is made.

Format of *The Raven* generally follows guidelines set by the Council for Biology editors as outlined in the *CBE style manual, 6th edition, 1994* (Council of Biology Editors, Inc., 11250 Roger Bacon Dr., Reston, VA 20190). Recent volumes of *The Raven* should be inspected for style. Vernacular and scientific names of birds should be those in the most recent edition (and supplement) of the A.O.U.’s Check-list of North American Birds (www.aou.org/checklist/north). Scientific names should be italicized. All size, temperature and other measurements should be in metric units.

