Summary Report for 2001 Grassland Bird Projects at the Eastern Virginia Rivers National Wildlife Refuge Complex

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Overview

In 2001, the Conservation Management Institute (CMI) and the US Fish and Wildlife Service (FWS) at the Rappahannock River Valley National Wildlife Refuge (NWR) completed a pilot study on grassland breeding birds on the refuge. This study was designed in conjunction with a region-wide grassland breeding bird study conducted cooperatively by the USFWS and the USGS Biological Research Division.

The goal of this pilot study was to assess the productivity of grassland breeding birds in several naturally regenerating fields on the NWR. We also attempted to determine the effectiveness of observing bird breeding behavior as a surrogate for actual measurements of productivity through nest observation and monitoring. Finally, we completed insect sampling on the sites to determine and identify any differences in prey abundance in each field.

The results of each of these studies are presented separately. The purpose of this report is not to explore all of the data that was collected, but to provide an overview to the dataset and highlight several points of interest that may warrant further investigation.

Study Area

The grassland bird productivity study was conducted on 3 units of the Rappahannock River Valley National Wildlife Refuge. A total of 7 fields were used; 4 on the Wilna Unit, 2 on the Mothershead Unit, and 1 on the Tayloe Unit.

These fields were characterized by regenerating herbaceous plants in various stages of succession after row crop agriculture. The fields at the Wilna Unit were nearly identical in size at about 30 acres each. The Wilna Northwest (WNW) field was fallow for one year preceding the study (Figure 1a), with the Wilna Northeast, Southeast (Figures 1b and c) and Southwest (WNE, WSE, and WSW respectively) fields having been cultivated in the previous growing season. The WSW was disked in the spring immediately preceding the study (Figure 1d). The field at the Tayloe Unit (TAY) was treated similarly to the WNE and WSE fields with the exception of a warm-season grass planting on approximately two-thirds of the 52-acre field (Figure 1e). The fields with the most advanced succession were found on the Mothershead Unit. The Mothershead North (MHN) and South (MHS) fields have remained largely unmanaged for approximately 5 years prior to the onset of this study (Figure 1 f and g).

Figure 1a. Wilna Northwest (WNW) on May 2, 2001

Figure 1b. Wilna Northeast (WNE) field on May 2, 2001

Figure 1c. Wilna SE field on May 2, 2001

Figure 1d. Wilna Southeast (WSE) field on May 2, 2001

Figure 1e. Tayloe (TAY) field on May 16, 2001

Figure 1f. Mothershead North (MHN) field on May 15, 2001

Figure 1g. Mothershead South (MHS) field on May 15, 2001

Nest Location and Monitoring

Introduction

Many studies of grassland birds focus on breeding and do not actively pursue measures of productivity. Typically, bird surveys are conducted during the early breeding season when males are very vocal and vegetation is not yet dense enough to obscure birds. Although this is an effective way to document the presence of bird species in the area, it does not provide reliable information regarding the success rate of the observed species.

In order to ascertain the breeding activities and success of birds in a particular area, a specific effort to document breeding actions (e.g., courtship, nest building, brood rearing) must be undertaken. Information on breeding success and productivity must be obtained through nest location and monitoring.

This information is important for management of grasslands because it is possible these actions will attract adult birds in the nesting season to habitats that will ultimately produce few or no offspring. This is effectively a breeding sink and is nearly undetectable without incorporating specific measures of productivity.

The most complete and accurate method for assessing productivity is to locate and monitor nests in the field. This is extremely difficult and resource-consumptive. Many nests for several species need to be located and monitored to obtain useful information. Further compounding the problem is the belief that frequent disturbance of nests or incubating parents decreases nest success and increases predation risk.

For this portion of the study, we attempted to locate and monitor as many nests as possible in and around the study fields. This information will provide us with information on nest success, density, and productivity.

Methods

Field researchers attempted to locate nests for all grassland birds within a field regardless of species. Nests were located through direct observation of breeding males and females. Individuals observed carrying nesting materials, fecal sacks, or food were followed as closely and unobtrusively as possible to locate nests and record data. We made no direct attempt to flush nesting birds from cover with ropes, poles, or other equipment.

When a nest was located, data on the type of nest, the condition of nest, number of eggs/hatchlings, and behavior of the adults was noted. We marked the location of the nest both with flagging (off set from the actual nest location by approximately 10 m) and with a geographic coordinate location taken with a global positioning unit (GPS). Nests were revisited every 2-3 days to record nest condition and/or fate.

Results

A total of 8 nests were located (Figure 2.). Species of nesters included grasshopper sparrow (*Ammodramus savannarum*)(4), song sparrow (*Melospiza melodia*)(2), wild turkey (*Meleagris galapavo*)(1), and common yellowthroat (*Geothlypis trichas*)(1). The number of nests located was extremely low and precluded any quantitative analysis. Of these 8 nests, only 1 was determined to have remained undisturbed through the fledging period. One other nest appeared to fledge birds while 4 of the other nests were predated or disturbed after laying/fledging. At least 2 of the nests had been depredated or destroyed when they were first discovered.

Figure 2. Nests were located whenever possible.

Discussion

Many researchers have reported difficulty in locating and monitoring grassland bird species and their nests. Much time and effort was spent observing birds and attempting to track them to their nests, yet the lack of a substantial number of nests located here is still considered to be a failure. This is likely due to the inexperience of the field researchers in nest searching and the load of other tasks required of them during a field day. Still, we expected more success with this method and are optimistic that, with better qualified field personnel, similar attempts would be more successful. Perhaps other techniques like capturing females and fitting them temporarily with a radio-transmitter would improve our ability to locate nests, but this would require significantly more time, effort, and cost.

Nest Productivity

Introduction

As demonstrated in the nest location and monitoring portion of this study, locating and monitoring the success of nests in the field can be difficult. Other researchers have attempted to develop indirect methods of measuring productivity of birds by recording parenting behavior in the field (Vickery et al. 1992[1]). By simply observing behavior, one can determine the state of a nest without ever actually locating it. Parenting behaviors like nest building and feeding can be easily observed and recorded in the field, and repeated over time to quantify the process of attempting to reproduce.

We attempted to indirectly monitor all grassland species on the study site through the breeding season. We recorded, using the scale provided by Vickery (1992), the parental behaviors of grassland birds in each study field. By maintaining records of approximate locations of birds in the field, we were able to follow breeding pairs through the cycle and capture information indicating how successful these birds were at reproducing.

Methods

Observations of birds and their parenting behavior began early in the breeding season (around May 15th). Behavior was classified using these categories:

1. Male singing
2. Male and female observed
3. Nest building or distraction display
4. Carrying food
5. Evidence of fledgling success (1 brood)
6. Evidence of fledgling success (multiple broods)

Birds were observed from a distance with the aid of binoculars and, occasionally, portable tripod stands approximately 8 feet in height. The use of the tripods permitted observers a better vantage point to observe birds over a larger field area. Two observers visited one field each day for approximately 4 hours.

Fields were visited throughout the breeding season, and specific individuals or territories were monitored for breeding behavior. We could not utilize a preset grid or an indicator flagging to assist in orienting for specific pairs because this would violate the protocols of the region-wide study. Instead, observers attempted to utilize existing landmarks or vegetation and survey points marked and used in the region-wide study.

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[1] Vickery, P. D., M. L. Hunter, Jr., and J. V. Wells. 1992. Use of a new reproductive index to evaluate relationships between habitat quality and breeding success. Auk 109:697-705.

Results

The observers recorded 131 behavioral observations on 11 species of birds. The average time spent observing each individual was about 11.5 minutes. The maximum breeding category observed for any species or field was 4 (Carrying food). Specific species and fields are provided in Table 1.

Table 1. Maximum breeding categories by species and field. Numbers in bold are considered to have successfully nested. Numbers in italics indicate nesting attempts.

	BLGR	BOBW	COYE	DICK	FISP	GRSP	INBU	RWBL	SAVS	SOSP
MHN			3	1	1	2	2			
MHS	2	2			1	4	2			
TAY			4			3		2	4	
WNE	2					3	1			2
WNW	1	2			3	2	2	2		1
WSE	1					1				2
WSW						2				
Grand Total	2	2	**4**	1	*3*	**4**	2	2	**4**	2

Several observations of food carrying were noted, but not in all fields. The most common species, the grasshopper sparrow, was only seen carrying food in one field even though it was observed frequently in all fields and is likely breeding (Klopfer, personal observation).

Discussion

These data represent a preliminary effort in determining productivity in the study fields. Without actual nest monitoring data to compliment assumptions, we cannot draw any conclusions regarding the effectiveness of this method at estimating production within each of these fields.

Although the number of observations for each species in each field is too low for meaningful quantitative analysis, we can make some observations that may serve future management and research activities on these sites.

Perhaps the most obvious difference between these sites at the onset of this investigation was the status of existing vegetation. When we consider the breeding observations for these same fields, we can see some likely relationships. Perhaps this difference is most illustrative at the Wilna Unit. The WSW had only one species observation (GRSP). This field was the last field disturbed before this study was undertaken, and consequently contained the youngest vegetation community. It remained in very sparse vegetation for May and early June. This would logically preclude nesting for the species studied here. It would not preclude feeding, however, and therefore an observation of “2” (both male and female) is reasonable. The WNW field was fallow in 2000 and was the only Wilna field with appreciable vegetation at the onset of this study in 2001. Compared to the other 3 Wilna fields, the WNW field had greater vertical structure and ground cover, as well as higher plant diversity. The WNE and WSE field appeared to have about the same vegetation structure and composition, but lower plant diversity, height, and cover than WNW. The WSW field was plowed earlier that spring, and coupled with a lower than average rainfall period, was nearly devoid of vegetation at the start of the season. In comparison, the bird diversity was 7 species for WNW, 4 for WNE, 3 for WSE, and 1 for WSW. Of these, only field sparrows were confirmed nesting in WNW, but it is likely that grasshopper sparrows also attempted to nest. A grasshopper sparrow was observed carrying nest material early in the season on WNE.

The 2 fields on the Mothershead property have been in regenerating old-field longer than the other 5. These fields share a common border (without roads or other “hard” edge) and are often difficult for observers to discern from one another. The total number of species in these fields was 7, and of these only the common yellowthroat and the grasshopper sparrow exhibited nesting behavior.

Without behavior data matched to a monitored nest, we can only speculate as to the eventual nesting success of birds in these fields. It does appear, however, that this observation technique will at least document reproductive attempts and may provide useful information when compared to the grassland breeding bird surveys conducted in 2001.

Insect Sampling

Introduction

In an effort to supplement vegetation data, we also sampled insects within these fields concurrent to observation activities. Insects make up a significant portion of a grassland bird's diet, and the abundance, size, and availability of these insects may affect the success of breeding and feeding activities in these fields.

Methods

In order to measure the abundance and diversity of insect prey in the field, we collected insects through 3 separate methods: pitfall traps, sweep netting, and glue trapping. We selected 2 vegetation points in each field at random to also serve as insect trapping stations. These stations were sampled each time the field crew was in the field observing birds. The sampling array (Figure 3 and 4) consisted of 10 pitfall traps (made from plastic party cups) containing a small amount ethylene glycol, and in some cases 5 glue traps. Pitfalls were opened at sunrise and remained opened for 5 hours to collect insects. Glue traps were also placed at this time. A series of 3 sweeps through the surrounding vegetation was conducted within 1 m of each pitfall when the traps were checked. All insects were categorized by Order and size (1, 2, or 3) (Figure 5).

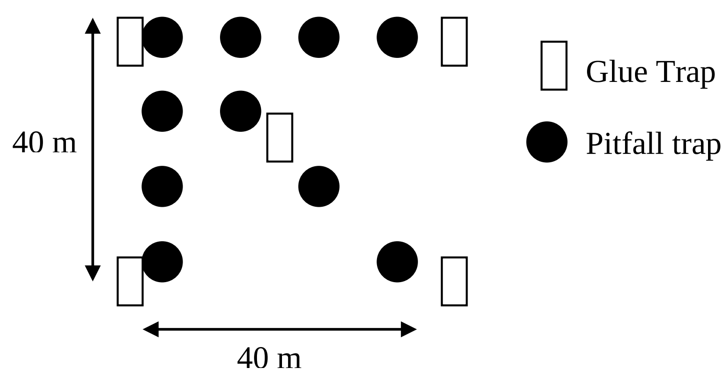

Figure 3. Array of traps used for insect sampling

Figure 4. Pifall traps were buried even with the surrounding soil and loaded with approximately 0.5 in. of ethylene glycol to preserve specimens.

Figure 5. Insect sampling arrays were checked after approximately 5 hours. We recorded trap type, insect order, size class, for each insect captured.

The size classes assigned by deciding if the individual is smaller than 0.25 in., between 0.25 and 0.5 in., or larger than 0.5 in. We attempted to control for observer variability by maintaining the same netter for the sweep nets for all locations.

Results

The overall insect diversity and abundance differed among fields (Table 2). We analyzed all data collected for both pitfall traps and sweep netting. Glue traps were used incorrectly for part of the study and were excluded from the analyses.

In general, more individuals were captured in the pitfall traps than the sweep nets (Table 3). However, there are obviously some differences in the sampling susceptibility for each insect order. Orders of Dermaptera and Orthoptera have considerably higher catch rates in sweep nets as opposed to pitfalls.

Table 2. Total number of insects trapped by field and sample method.

Field	Total Captured	Total Effort	Mean per trap	No. of Orders
MHN	619	160	3.87	11
MHS	616	140	4.40	11
TAY	678	160	4.23	12
WNE	835	160	5.22	12
WNW	746	160	4.66	13
WSE	791	140	5.65	11
WSW	273	160	1.71	8
Grand total	4,558	1,080	4.22	16

Table 3. Total number of individuals capturing during insect sampling by Order with rates of capture (No. of individuals per eventbased on 540 trap-events).

	Pitfall	Sweep	Grand Total	Rate (pitfall)	Rate (sweep)
Arthropod	359	64	423	0.66	0.12
Blatteria	16	8	24	0.03	0.01
Coleoptera	2220	292	2512	4.11	0.54
Dermaptera		22	22	0.00	0.04
Diptera	285	610	895	0.53	1.13
Ephemeroptera	3	2	5	0.01	0.00
Hemiptera	34	0	34	0.06	0.00
Homoptera	17	7	24	0.03	0.01
Hymenoptera	265	57	322	0.49	0.11
Lepidoptera	1	1	2	0.00	0.00
Mantodea	0	4	4	0.00	0.01
Neuroptera	24	18	42	0.04	0.03
Odonota	1	8	9	0.00	0.01
Orthoptera	89	141	230	0.16	0.26
Other	6	2	8	0.01	0.00
Phasmida	2	0	2	0.00	0.00
Grand Total	3322	1236	4558	6.15	2.29

In addition to insect Order, each individual was classified by size and summarized by sampling technique (Table 4). It is apparent that the type of sampling can greatly affect the size of prey captured. Although both pitfalls and sweep netting caught similar numbers of sized 2 and 3 insects, the pitfall was far more effective at capturing smaller individuals. If we assume that the total catch is representative of the actual distribution of size classes in the field, the pitfall trap appears to do a better job of catching all the prey sizes available to grassland birds.

Table 4. Summary of the number of individuals of each size class with statistics for size and sampling technique. (1 = size <0.25 in., 2 = 0.25 in. < size <0.5 in., 3 = size > 0.5 in.)

	N				% of size		% of trap	
Size	Pitfall	Sweep	Grand Total	% Total Catch	Pitfall	Sweep	Pitfall	Sweep
1	2876	891	3767	82.6%	76.3%	23.7%	86.6%	72.1%
2	347	274	621	13.6%	55.9%	44.1%	10.4%	22.2%
3	99	71	170	3.7%	58.2%	41.8%	3.0%	5.7%
Total	3322	1236	4558		72.9%	27.1%		

We analyzed these data by field in an attempt to identify which fields had the highest abundance of insects (Table 6.). This analysis was completed separately for pitfall traps, sweep nets, and both combined. The resulting catch rates were ranked and an overall rank was calculated (Table 5).

Table 5. Summary of ranks for each trap type with an overall rank.

Highest Value	Pitfall	Sweep	Both	Overall Rank
1	WNW	WSE	WSE	WSE
2	WNE	WNW	WNW	WNW
3	WSE	WNE	WNE	WNE
4	MHS	TAY	TAY	TAY
5	TAY	MHS	MHS	MHS
6	MHN	MHN	MHN	MHN
7	WSW	WSW	WSW	WSW

This analysis suggests that the Wilna SE field had the highest overall abundance of insects, with the Wilna NW and NE fields closely behind. All analysis shows that the Wilna SW field (which was devoid of vegetation early in the season) and the 2 fields at Mothershead were consistently lower in insect abundance.

Discussion

Much more information could be extracted from this dataset. We have only provided summary statistics here to guide thought and interpretation for further analysis.

It is apparent that, although most Orders are represented in each field, there are differences in insect abundance and size. It may be assumed that certain sized insects are preferred as prey by grassland birds. Although this size preference would likely vary by species, it would likely be skewed towards the larger sizes of prey. If we look at a similar rank analysis as to what was done above, but incorporate each size class (rank each separately and equally) we see some slight difference in the overall result (Table 7). We considered each size class separately for ranking, then summed the ranks for all 3-size classes and ranked by the total sum. Not unlike the previous analysis, the newer fields (although not too new) seem to have the higher insect abundance and, presumably, offer the better foraging habitat for grassland birds.

Table 7. Summary of ranks for each field when size is considered.

Highest Value	Pitfall	Sweep	Both	Overall Rank
1	WNE	WSE	WNE	WNE
2	WSE	WNE	WSE	WSE
3	TAY	WNW	TAY	TAY
4	MHS	TAY	WNW	WNW
5	WSW	MHN	MHS	MHS
6	WNW	MHS	MHN	MHN
7	MHN	WSW	WSW	WSW

When vegetation data is available from the region-wide grassland study, it can be used along with these data to explore possible relationships between insect prey, vegetation, and nesting grassland birds. Future studies should incorporate all of these factors to determine whether insect abundance is directly selected for by nesting grassland birds, or if insect abundance and diversity is more closely related to vegetation.

There are also differences in results depending on the sampling method used. It is probably worthwhile to research and incorporate information on size preference of specific target grassland species to ensure that the chosen sampling methodology is able to capture that size efficiently. For overall investigations such as this one, it is important to incorporate several different types of sampling methods.

Table 6. Relative abundance of insect orders by field for pitfall, sweep, and both techniques combined.

	MHN			**MHS**			**TAY**			**WNE**			**WNW**			**WSE**			**WSW**			**Total**		
	Pitfall	Sweep	Both	Pitfall	Sweep	Both	Pitfall	Sweep	Both	Pitfall	Sweep	Both	Pitfall	Sweep	Both	Pitfall	Sweep	Both	Pitfall	Sweep	Both	Pitfall	Sweep	Both
Arthropod	0.26	0.28	0.54	0.43	0.14	0.57	0.60	0.06	0.66	0.54	0.09	0.63	0.36	0.08	0.44	0.60	0.11	0.71	0.46	0.04	0.50	0.46	0.11	0.58
Blatteria	0.03	0.01	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.01	0.06	0.01	0.01	0.03	0.00	0.03	0.03	0.00	0.00	0.00	0.01	0.01	0.02
Coleptera	0.96	0.21	1.18	0.86	0.33	1.19	1.00	0.18	1.18	1.24	0.43	1.66	0.70	0.58	1.28	1.37	0.70	2.07	0.70	0.11	0.81	0.97	0.36	1.33
Dermaptera	0.00	0.04	0.04	0.00	0.04	0.04	0.00	0.05	0.05	0.00	0.00	0.00	0.00	0.04	0.04	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.03	0.03
Diptera	0.33	0.48	0.80	0.21	0.44	0.66	0.41	0.58	0.99	0.29	0.68	0.96	0.34	0.61	0.95	0.37	0.89	1.26	0.34	0.48	0.81	0.33	0.59	0.92
Ephemeroptera	0.01	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01
Hemiptera	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.04	0.00	0.04	0.03	0.00	0.03	0.09	0.00	0.09	0.00	0.00	0.00	0.02	0.00	0.02
Homoptera	0.00	0.03	0.03	0.06	0.01	0.07	0.00	0.00	0.00	0.03	0.01	0.04	0.01	0.00	0.01	0.00	0.00	0.00	0.06	0.00	0.06	0.02	0.01	0.03
Hymenoptera	0.28	0.08	0.35	0.40	0.09	0.49	0.29	0.01	0.30	0.19	0.04	0.23	0.35	0.11	0.46	0.26	0.00	0.26	0.13	0.01	0.14	0.27	0.05	0.31
Lepidoptera	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mantodea	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.01
Neuroptera	0.01	0.01	0.03	0.00	0.03	0.03	0.11	0.03	0.14	0.06	0.06	0.13	0.03	0.03	0.05	0.09	0.04	0.13	0.00	0.01	0.01	0.04	0.03	0.07
Odonota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.03	0.00	0.04	0.04	0.00	0.00	0.00	0.01	0.01	0.03	0.00	0.00	0.00	0.00	0.01	0.01
Orthoptera	0.24	0.26	0.50	0.07	0.11	0.19	0.18	0.54	0.71	0.19	0.13	0.31	0.10	0.14	0.24	0.14	0.10	0.24	0.05	0.08	0.13	0.14	0.20	0.34
Other*	0.03	0.00	0.03	0.01	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	0.00	0.00	0.01	0.01	0.00	0.01	0.01	0.00	0.01
Phasmida	0.00	0.00	0.00	0.00	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.14	1.39	3.53	2.06	1.23	3.29	2.64	1.49	4.13	2.61	1.50	4.11	1.95	1.59	3.54	2.93	1.94	4.87	1.75	0.73	2.48	2.29	1.40	3.69

* Other includes spiders, ticks, and other arachnids.