EARLY FALL MIGRANT BLACK-AND-WHITE WARBLERS *MNIOTILTA VARIA* IN THE LOWER RIO GRANDE VALLEY DETECTED BY NOCTURNAL FLIGHT CALLS

William R. Evans[1] and Mark H. Conway[2]

[1] Old Bird Inc. 296 Bald Hill Rd. Spencer, NY 14883
[2] 2106 Emerald Lake Drive, Harlingen, TX 78550

ABSTRACT.—What began as a general exploration of the passerine nocturnal flight call (nfc) phenomenon in Cameron Co., TX in 2012, took a more focused turn when we uncovered an early and surprisingly pure flight of the Black-and-white Warbler *Mniotilta varia* (BAWW) that July. The small but intriguing nfc sample led us to collect three more seasons of data to solidify our understanding of the early migration pattern. Our results suggest a wave of night-migrating BAWWs begins passing over Harlingen, TX at least by the first week in July and peaks in a 2-week period from about July 20 to August 4. The flight then falls off by mid-August before a new wave of migrant BAWWs may arrive, we presume from a more northerly breeding population. To ground truth the early BAWW nfc pattern, we correlated eBird frequency data from Cameron County and found a strong linear relationship. We speculate that in some years southbound BAWW migrants are already passing over the lower Rio Grande River into Mexico in late June.

There are no modern-day breeding records of the Black-and-white Warbler *Mniotilta varia* (BAWW) in the Lower Rio Grande Valley (LRGV), and the generally accepted equation is that their spring migration is largely over by the end of the third week in May and fall migration does not begin until mid-July. So, if you find a BAWW warbler in the Valley in June one might say you have entered the twilight zone. The closer the sighting is to late May, the more one might suspect a late spring migrant. The closer the sighting is to early July, the more one might suspect an early fall migrant. But how do we explain June birds? As a vagrant of some sort? Perhaps an injured bird or one that was delayed in northbound migration and then the migration urge shut off?

We present data that sheds light on early July BAWWs in the LRGV and suggests that late June birds are early fall migrants. During May-Dec 2012, we monitored avian nocturnal flight calls (nfcs) in Cameron County, TX from a skyward-facing microphone mounted on the roof of Harlingen High School South (HHSS, 26° 10’ 35.7888” N, 97° 43’ 11.3514” W). The school is on the southwest side of Harlingen, TX and was part of a Dickcissel nfc monitoring project across the LRGV from 2000-2003 (Larkin et al. 2002). With advances in technology, now the audio for a whole night could be digitally recorded while software detected and extracted copies of bird calls; these data potentially put online in near real time via the Internet.

A primary focus of the new project was on warbler & sparrows. Most have similar nfcs that can be extracted together with the same software. We classified software-extracted calls to species categories by visual inspection of spectrographs and made the data available online the next morning. Our intention was to carry out nightly monitoring of the spring and fall migration periods, and our spring monitoring extended through the night of 18-19 June. During the first 18 nights of June, we only logged 2 warbler & sparrow nfcs—a Grasshopper Sparrow *Ammodramus savannarum* on the night of 12-13 June and a call too faint to ID on the night of 17-18 June. Fall migration monitoring began the night of 3-4 July, and on the night of 7 July at 2206 CST we recorded our first warbler nfc of the “fall” migration—a Black-and-white Warbler (Fig. 1).

The nocturnal flight call of the BAWW was determined in 1989 when WRE spectrographically matched diurnal flight calls of visually confirmed BAWWs with a distinctive unidentified night flight call he had recorded. It would then take more than a decade of additional sleuthing in collaboration with Michael O’Brien before flight call examples of all migrant warblers & sparrows in eastern NA

[1] E-mail: ear2sky@oldbird.org

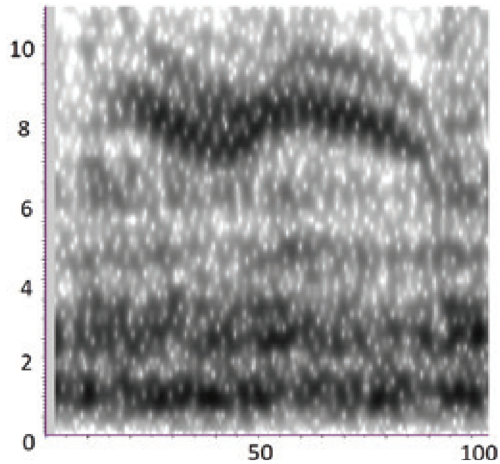

Figure 1. Spectrogram of BAWW nfc recorded 7 July 2012 over Harlingen High School South. Frequency is in kilohertz on the Y-axis and time is in milliseconds on the X-axis. The call is about 80 mS long, a bit less than 1/10 of a second.

were acquired. This was necessary to verify that no other species had a similar flight call to BAWW that needed discrimination. It turned out the nfc of BAWW is one of the more distinctive small passerine nfcs in North America; no other species is remotely similar. The Evans and O'Brien archive of visually confirmed passerine flight call descriptions for eastern NA was published in 2002 and has been an online public resource since 2017 (see link in lit. cited).

By the end of July 2012, our nightly audio recording of the sky over HHSS had resulted in 79 warbler & sparrow nfc detections, 67 identified as BAWW. While we knew BAWW is an early migrant, we did not anticipate it would be the most abundant nfc over HHSS in July. In the BAWW's peak fall migration months (Aug & Sep) in the Upper Midwest and Northeastern U.S., the BAWW nfc is typically no more than 3% of the total composition (WRE, unpubl. data). This is because other species giving nfcs are migrating along with them. In the July 2012 data from HHSS, more than 75% of the total nfcs were BAWW. The 12 non-BAWW calls recorded in July 2012 were identified as 1 Savannah Sparrow *Passerculus sandwichensis*, 3 Grasshopper Sparrows, 1 Yellow Warbler *Setophaga petechia* type, and 7 others too weak in amplitude to classify.

To be clear, the 67 BAWW nfcs do not represent 67 separate birds. Some individuals give more than one call when passing in range of the microphone/ detection system. And artificial light, especially during low cloud ceiling or hazy nights, can cause an increase in the calling rate of an individual bird as well as aggregation behavior that may result in the same individual passing through the microphone's call pick-up zone multiple times. Like most high schools in the U.S., the grounds of HHSS are well lit at night. During the period of this study, these lights were brighter than those in the immediate surrounding land and residential area. While there are many bright light sources associated with the municipality of Harlingen, the school lighting produced a relatively bright island of light on the outskirts of the complex lightscape of the city.

Potential light-effected calling rate increases and aggregation phenomenon seemingly confound use of nocturnal flight calls for producing a reliable index to the numbers of birds passing. Evans and Mellinger (1999) suggested a way to counter these and other such variables by deriving an index aimed toward estimating the minimum number of vocal individuals passing. They termed it the "MIP" method. A major component of this method, which can be used alone or with other algorithms, is to estimate the typical time an individual bird of a particular species would take to pass through a microphone's call pickup region. One then lumps all calls of a species occurring within that interval as 1 detected individual. After evaluating tens of hours of nocturnal flight call recordings with a specific microphone, one gets a sense of the typical passage time for different species.

With a similar microphone design as this BAWW study, Evans and Mellinger (1999) used a 1-minute interval to produce a MIP index for Grasshopper and Savannah Sparrow nfcs. Using the same microphone design as this BAWW study, Evans et al. (2017) used a very conservative 15-minute interval to quantify the occurrence of an unknown flight call in southern Mexico. A longer summation interval leads to more certainty in quantifying different individuals, but more likelihood of undercounting. The optimum summation interval depends on the species involved, study site characteristics, and specific goals of a study.

In our 2012 study at HHSS we chose a 1-minute interval. For example, there were 2 nights (21-22, 22-23 July) where a rapid series of BAWW nfcs occurred, sounding like they were from the same individual. Both these nights had periods where the calling pattern suggested birds were disoriented in the light. The first night had 11 BAWW nfcs within 30 seconds just after midnight and a single BAWW nfc at 0110 CST. Using the 1-minute rule, the first bout of calling was interpreted as 1 individual because all the calls occurred within a minute. Counting the isolated BAWW nfc at 0110 as a separate individual, the MIP count for this night was determined to be 2. Applying this method to the whole month of July 2012, 67 individual BAWW nfcs translated to a MIP total of 38. The MIP total is also not the actual number of individuals passing over. It is an estimate of the minimum number of vocal individuals passing that is likely a more accurate passage rate activity index than a total call count, especially when isolated artificial light sources are involved.

METHODS

To investigate whether the 2012 BAWW nfc phenomenon was regular at HHSS, we set out to record nfcs again in the years that followed. As in 2012, we recorded 9 hours of monaural audio per night from 2000-0500 CST (UTC-6) using an Old Bird 21c microphone (Old Bird, Ithaca, NY) aimed at the night sky (Fig. 2). This microphone has a hypercardioid sensitivity pattern and is designed to have acute directional sensitivity in the 2-10 kHz range—for a rough sense of the pickup pattern, imagine a 60-degree cone expanding well up into the sky along with a zone of omnidirectional sensitivity closer to the microphone. The microphone's maximum detection range for warbler and sparrow nfcs is estimated to be roughly 300 m.

We used about 30 m of cable to transfer the audio signal from the microphone to a Turtle Beach Amigo II sound card, which was connected to a PC running Windows 7 in MHC's biology classroom. Audio was automatically recorded to the PC nightly with Easy HiQ software (now obsolete) at 22050 Hz sampling rate and 16-bit resolution in WAV file format. We aimed to begin recording each year in early July.

To extract BAWW nfcs from the all-night audio, we ran Tseep software (Old Bird, Ithaca, NY) either in real-time (2012) or later on the recorded 9-hr audio files to automatically extract short transient sounds in the 6-10 kHz frequency band. WRE then visually analyzed spectrograms of the short clips using GlassOFire software (Old Bird, Ithaca, NY) to separate avian nfcs from non-calls, and to manually classify nfcs to species categories. The GlassOFire spectrograms were computed with a 128-sample Hamming window, a hop size of 1

Figure 2. Old Bird 21c microphone located on the roof of HHSS in spring 2012.

sample, and a DFT size of 256 samples. Evans and O'Brien (2002) served as the basis for assigning calls to species categories. BAWW nfc occurrence data was converted to an estimate of the minimum number of individuals acoustically detected (MIP total) using the 1-minute rule as in 2012.

To explore the possibility of independent ground-truthing, we followed Gyekis et al. (2019) in comparing eBird observations with our nfc data. We downloaded Cameron County TX eBird frequency data for the BAWW from July & August for 2011-2020 (eBird 2021). These eBird data indicate the proportion of checklists with BAWW reports per "eBird week", where a month is divided into 4 weeks, the first 3 are standard weeks with 7 days and the last week contains whatever number of days to finish the month. In our case, the final eBird week of July and August each contained 10 days. We then carried out Pearson product-moment correlation to determine the strength of the linear relationship between weekly changes among our BAWW nfc MIP data and the weekly percentage of eBird checklists with BAWW reports. To account for the different number of days in an eBird week, nfc MIP totals per eBird week were divided by the number of days in an eBird week to come up with a nightly average per eBird week, which was used as the nfc variable.

RESULTS

To augment our 2012 data, we attempted to obtain additional nfc data from early July through August 2013-2017. Technical problems led to incomplete, unusable datasets in 2013 and 2017. We were successful in obtaining three years of additional data (2014-2016), which gave us four total seasons of data for our analysis. For this report, we evaluated continuous nightly recordings from 2000-0500 CST over the dates noted below:

2012: 3 July—1 September
2014: 3 July—1 September
2015: 7 July—1 September
2016: 11 July—1 September

Figure 3 shows the combined-year nightly average BAWW nfc MIP total per eBird week. Table 1 shows the BAWW nfc MIP totals per standard week per year. For a standard week when all 4 years recorded each of the 7 nights, there were 28 station-nights recorded. All combined-year standard weeks in the study had 28 station-nights recorded except the first 2 weeks. In the week of July 1-7, only 11 of 28 potential station nights were recorded, so the bar for that week in Figure 3 may be underrepresented. For the week of 8-14 July, 25 of 28 potential station-nights were recorded, so the bar for that week in Figure 3 may be a bit underrepresented.

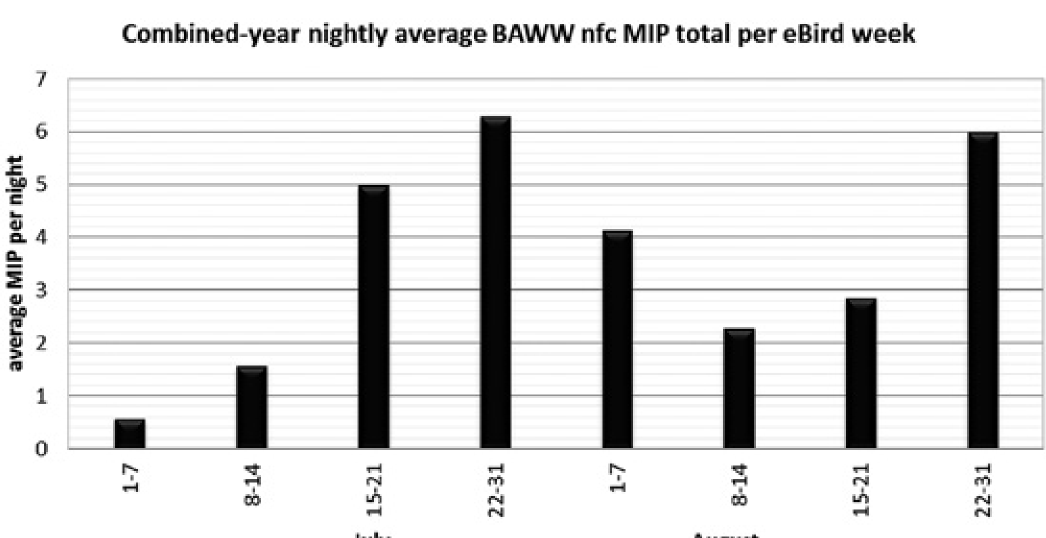

Figure 3. Bars shows the nightly average BAWW nfc MIP total per eBird week for the combined four years of study.

Table 1. BAWW nfc MIP totals per standard week per year (1 July—1 Sep). An asterisk indicates a week with incomplete nightly coverage.

Week dates	2012	2014	2015	2016
1-7*	1	3	0*	nd
8-14*	2	4	5	0*
15-21	17	7	3	8
22-28	14	13	14	7
29-4	3	26	7	10
5-11	4	1	4	6
12-18	4	1	0	5
19-25	5	8	3	42
26-1	1	4	0	12

Over the 4 years of nightly July-August monitoring, 382 BAWW nfcs were detected and a MIP total of 238 was derived, 113 in July and 125 in August. Figure 3 shows a bimodal distribution of the combined-year nightly average nfc MIP total per eBird week over the 2 months, with peaks in the last 10 days of each month and a trough in the middle of August.

The eBird frequency data is based on 169 of 4692 Cameron Co. birding checklists that logged BAWW over 10 years in the July-August period (eBird 2021). Though we did not have nfc data for 6 of these years, 10 years of eBird data was necessary in order to generate a comparable sample size with our nfc data (n= 169 versus n = 238 for nfc) to enable a reasonably robust statistical correlation. Figure 4 shows the percentage of eBird checklists per eBird week reporting BAWWs in July and August of 2011-2020. A bimodal pattern like that shown for BAWW nfc MIP totals in Figure 3 is indicated.

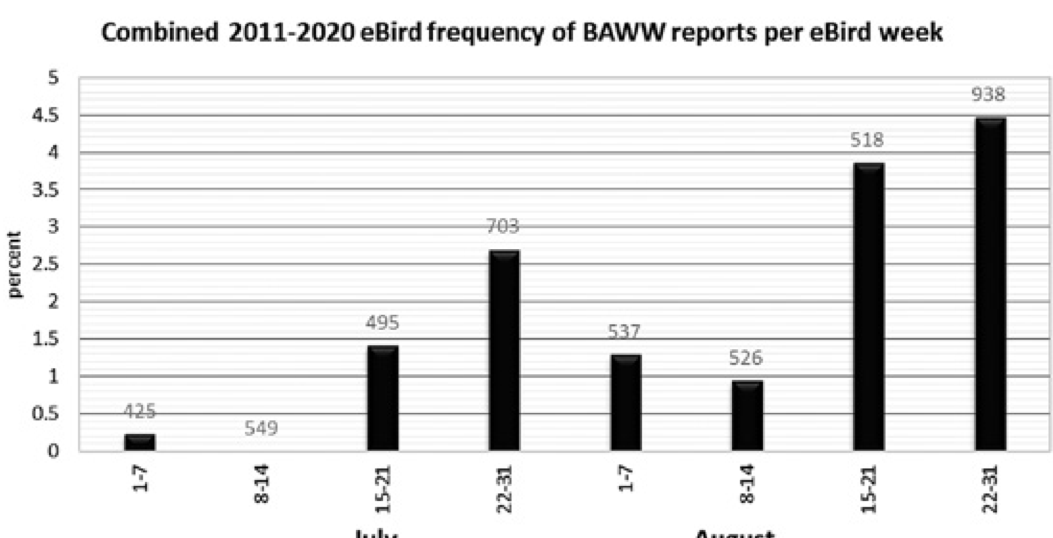

Figure 4. Bars show the percentage of Cameron County, TX eBird checklists from 2011-2020 that reported BAWW in the designated week. The total number of eBird checklists for each week is noted atop the bars.

BAWW nfc MIP data and eBird BAWW frequency data from July & August correlate moderately well (r = 0.66). A much stronger value of r = 0.93 occurs when just the first 6 eBird weeks are correlated.

DISCUSSION

Our BAWW flight call data from birds in active night migration indicates an early wave of migrants passes through Cameron County, TX from July through early August. The nfc data shows the wave begins at least by the first week of July. Inspecting Table 1 reveals that all 4 years show a peak in nfc MIP totals sometime in the week beginning July 15 to the week beginning July 29. The peak varied in being centered in the beginning or end of this period, and in 2016 seems less defined and more protracted. Table 1 indicates that the 2-week dip in nfc MIP totals from 5-18 August that defines the end of the wave is apparent in all 4 years. We show that this pattern of nfc detection from July through mid-August is strongly correlated with BAWW eBird frequency data for Cameron County. The strong positive correlation is benefited somewhat by the fact that both datasets begin in the early portion of fall migration at an accordingly low level.

BAWWs that compose the July through early August flight are likely from an early-breeding population in the southern portion of the species' range. The population breeding in the Texas Hill Country west, north, and east of San Antonio is the closest, beginning about 400 km north-northwest of Cameron County (eBird 2021). The southern portion of the continental BAWW breeding population extends in a broad swath northeastward from relatively dense populations in the Texas Hill Country, across lower populations in Eastern TX, toward denser populations from Southeastern Oklahoma through the Ozarks, and then eastward to denser populations in the Appalachians and vicinity (eBird 2021). To what extent these more eastern populations may migrate westward around the Gulf of Mexico and through the LRGV is unknown to us.

Figure 3 shows a steep increase in nfc MIP totals from 22-31 August. Inspection of the data for that time in Table 1 indicates the big increase is due to the high tally in 2016. None of the other 3 years show this increase. One possibility is that in 2016 a typically later arriving wave may have shown up earlier than in the other years. Perhaps this is a wave arriving from the southcentral portion of the BAWW breeding range (i.e., Ozarks, ~1000 km NNE). Based on WRE's experience monitoring BAWW nfcs across the Upper Midwest and Northeastern U.S., late August seems too early for a wave from the northern breeding population (Northern U.S. and Southern Canada) to be passing through the LRGV—in particular, the concentration of birds that was passing on the nights of 21-22 & 22-23 August 2016, which had the highest 2-night total in the 4 complete years of study (MIP total of 27).

The eBird data from 2011-2020 shows a steep increase in BAWW reports in the whole second half of August (Fig. 4). As noted, this was not the case in 3 out of 4 of our nfc monitoring seasons. We can speculate whether this might be due to early flights of a second BAWW wave that may have occurred in the additional 6 years of eBird data included in the comparison for which we have no nfc data. In any case, it makes sense that BAWWs from further away, either the Ozarks or the northern populations in the upper Midwestern US and Canada would be more variable in their time of passage through the LRGV. The further away a population is originating, the greater the time & space for weather variables to impact migration progress. Furthermore, some of these distant populations may cross the Gulf of Mexico when conditions are right or go around the western Gulf when weather is not conducive for crossing. So, the latter half of August has a lot of unknowns and possibilities at play in the timing of later BAWW flights through the LRGV, especially considering tropical storm activity in the northwestern Gulf of Mexico.

The passage of July migrant BAWWs through the LRGV appears to have relatively consistent timing, suggesting these birds are from a closer breeding population like that in the Texas Hill Country. It seems unlikely that the Hill Country population would wholly bypass the LRGV to the west, though a substantial portion may do so. This is an interesting question for future studies.

Looking at the eBird BAWW histogram for Cameron County (Fig. 5), one gets the impression that fall migration does not begin until the week of 15 July. Our nocturnal flight call data indicate there is BAWW migration over the LRGV in the first 2 weeks in July. While we did not monitor for BAWW nfcs in late June, we note that on 29 June 2012 there were 2 eBird checklists reporting BAWW in the LRGV in or close to Cameron County. One was at Resaca de la Palma State Park and the other at Estero Llano Grande State Park (4 km west of Cameron

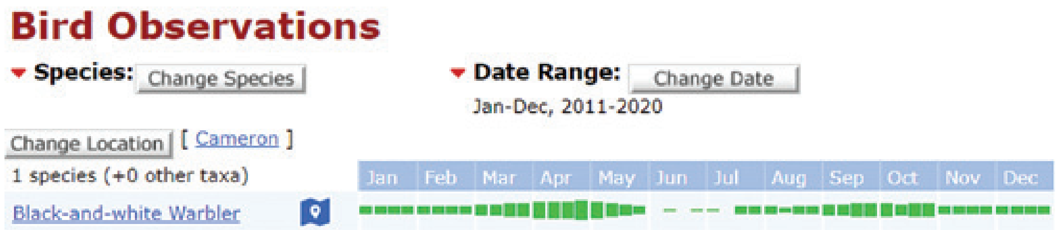

Figure 5. BAWW histogram for Cameron County, TX provided by eBird (www.ebird.org); created 12 Feb 2021.

Co.). We suggest that these birds are likely early fall migrants and that in some years southbound migrant BAWWs are already passing over the lower Rio Grande River into Mexico in late June.

ACKNOWLEDGEMENTS

We thank Harlingen High School South for hosting our night flight call monitoring equipment, Edward Guzman for IT support, and Jesus Mata & Ruth Salazar at HHSS for general assistance with the project.

LITERATURE CITED

eBird. 2021. eBird: An online database of bird distribution and abundance [web application]. eBird, Cornell Lab of Ornithology, Ithaca, New York. Online: http://www.ebird.org. (Accessed: February 12, 2021).

Evans, W. R. and D. K. Mellinger. 1999. Monitoring grassland birds in nocturnal migration. Studies in Avian Biology, No. 19:219-229. https://sora.unm.edu/node/139584

Evans W. R. and M. O'Brien. 2002. Flight calls of migratory birds: Eastern North American landbirds. Old Bird Incorporated [CD-ROM]. Online: http://www.oldbird.org/pubs/EvansOBrien2002.html

Evans, W. R., M. Grosselet, and G. Ruiz Michael. 2017. An unidentified nocturnal flight call from southern Mexico. Huitzal 18:131-140. http://www.scielo.org.mx/scielo.php?script=sci_arttext&pid=S1870-74592017000100131

Gyekis, J., J. Hill, and B. Evans. 2019. Spring migration timing of Grasshopper Sparrows in central Pennsylvania as estimated from eBird records and two nocturnal flight call stations. Pennsylvania Birds 93:89-92.

Larkin, R. P., W. R. Evans, and R. H. Diehl. 2002. Nocturnal flight calls of Dickcissels and Doppler radar echoes over south Texas in spring. Journal of Field Ornithology 73:2-8.