



Southern Lepidopterists' NEWS

EST. 1978 Official Newsletter of the Southern Lepidopterists' Society (ISSN 2167-0285)

Vol. 46 Supplemental Issue

2024

THE OFFICIAL PUBLICATION OF THE SOUTHERN LEPIDOPTERISTS' SOCIETY
ORGANIZED TO PROMOTE SCIENTIFIC INTEREST AND KNOWLEDGE RELATED
TO UNDERSTANDING THE LEPIDOPTERA FAUNA OF THE SOUTHERN REGION
OF THE UNITED STATES (WEBSITE: www.southernlepsoc.org/)

J. BARRY LOMBARDINI: EDITOR

MIGRANTS, STRAYS, RECENT COLONIZATIONS, AND NEWLY RECORDED
LEPIDOPTERA SPECIES FROM OUTAGAMIE COUNTY, WISCONSIN,
AND ADJACENT AREAS (BY HUGO KONS JR.)



Top Left

Ascalapha odorata (Noctuidae): WI Outagamie County: Mosquito Hill, hill top mesic hardwood forest, bait trail, 24 July 2020.

Top Middle

Utetheisa bella (Noctuidae): WI Outagamie County: Wiouwash Trail just north of Winnebago County border, grassy wetland, 20 October 2017.

Top Right

Callopietria floridensis (Noctuidae): WI Outagamie County: suburban Appleton, West Summer Street, bait trail, 26 July 2018.

Middle

Magusa divaricata (Noctuidae): WI Outagamie County: West Summer Street, bait trail, 15 October 2016.

Bottom Left

Hylephila phyleus (Hesperiidae): WI Outagamie County: Prairie Hill Park, field with prairie planting, 30 September 2022.

Bottom Middle

Hypocala andremona (Noctuidae): WI Shawano County: Navarino Wildlife Area, sandy oak-pine barrens, bait trail, 23 October 2022.

Bottom Right

Anomis illita (Noctuidae): WI Shawano County: Navarino Wildlife Area, bait trail, 24 October 2022.

**The Southern Lepidopterists'
Society****OFFICERS**

David Fine: Chairman
4110 NW 12th Street
Arcadia, FL 34266-5554
E-Mail: davidf@calvaryftl.org

Jeffrey R. Slotten: Treasurer
5421 NW 69th Lane
Gainesville, FL 32653
Tel.: (904) 699-3478
E-Mail: jslotten@bellsouth.net

Laura Gaudette: Secretary
1721 NE 75th Street
Gainesville, FL 32641
E-Mail: gaudettelaura@gmail.com

Marc Minno: Membership
Coordinator
600 NW 34 Terrace
Gainesville, FL 32607
E-Mail: mminno@bellsouth.net

Lance Durden: Member-at-large
Department of Biology
Georgia Southern University
P.O. Box 8042
Statesboro, GA 30458
E-Mail: ldurden@georgiasouthern.edu

John Calhoun: Member-at-Large
977 Wicks Drive
Palm Harbor, FL 34684-4656
Tel.: (727) 501 3536
E-mail: bretcall@verizon.net

Tom Neal: Member-at-Large
1705 NW 23rd Street
Gainesville, FL 32605
Tel.: (352) 375 1916
E-Mail: chouwah@aol.com

Dave Morgan: Website Manager
3162 Johnson Ferry Rd.
Suite 260-446
Marietta, GA 30062
E-Mail: mrdavemorgan@hotmail.com

J. Barry Lombardini: Editor
3507 41st Street
Lubbock, Texas 79413
Tel.: (806) 470 1584
E-Mail: jbarry.lombardini@ttuhsc.edu

Annual membership dues:

Regular	\$30.00
Student	\$15.00
Sustaining	\$35.00
Contributor	\$55.00
Benefactor	\$75.00
Life (40X Reg.)	\$1,200

A newsletter, The News of the
Southern Lepidopterists' Society is
published four times annually.

Website: www.southernlepsoc.org/

**MIGRANTS, STRAYS, RECENT COLONIZATIONS, AND NEWLY
RECORDED LEPIDOPTERA SPECIES FROM OUTAGAMIE COUNTY,
WISCONSIN, AND ADJACENT AREAS**

**BY
HUGO L. KONS JR.¹**



Ascalapha odorata from Wisconsin, Outagamie County: Appleton: bait trail, 22 July 2017.

¹ Lepidoptera Biodiversity LLC, hkonsjr@yahoo.com

TABLE OF CONTENTS

Abstract.....	5
Introduction.....	5
Methods.....	6
Results.....	8
Discussion.....	9
PART I: Strays and Migrants.....	9
Section I.A: Criteria.....	9
Section I.B: Seasonal Species Diversity.....	10
Section I.C: Overall Patterns For Strays And Migrants.....	10
Section I.D: Origin Of Strays And Migrants.....	14
Section I.E: Detection Of Strays And Migrants.....	15
Section I.F: Diversity And Abundance Of Strays And Migrants.....	15
Section I.G: Annual Migrants.....	16
Section I.H: Accidentals.....	17
Section I.I: Species Accounts For Strays And Ephemeral Migrants Recorded From The Outagamie County Area.....	17
Section I.J: Undocumented Strays And Accidentals From the Outagamie County Area.....	45
Section I.K: Species Accounts For Probable/Possible Strays And Ephemeral Migrants Recorded From Elsewhere In Wisconsin During The Study Interval.....	46
PART II: Recent Colonizations And Other Species Newly Recorded From The Outagamie County Area.....	51
Section II.A: Recent Colonizations Of Palearctic Species.....	51
Section II.B: Recent Colonizations Of Nearctic Species.....	54
Section II.C: Newly Recorded Species Of Uncertain Status.....	59
Section II.D: Newly Recorded Species That Were Probably Overlooked By Previous Surveys.....	65
Section II.E: Newly Recorded Species From Previously Unsurveyed Localities.....	67
Section II.F: Species Omitted From Previous Checklists.....	68
PART III: Faunal Comparisons.....	70
Section III.A: Outagamie County Versus The Navarino Wildlife Area.....	70
Section III.B: Faunal Change Gradients in Eastern Wisconsin For Macrolepidoptera And Rhopalocera.....	72
Acknowledgments.....	75
References.....	76
Appendix A: Survey Localities.....	79
Tables	
Table 1: Summarization of Phenological Data For Lepidoptera Strays And Migrants Recorded From Outagamie County And Adjacent Areas.....	83
Table 2: Summarization of Distributional Data For Lepidoptera Strays And Migrants Recorded From Outagamie County And Adjacent Areas.....	90
Table 3: Lepidoptera Strays And Ephemeral Migrants Recorded From Outagamie County, WI, And Adjacent Areas in 2022.....	101
Table 4: Macrolepidoptera Species Of Strays And Ephemeral Migrants Recorded From Different Survey Methods In Suburban Appleton.....	106
Table 5: Macrolepidoptera Species Of Annual Migrants Recorded From Different Survey Methods In Suburban Appleton From 2016-2020.....	109
Table 6: Macrolepidoptera and Rhopalocera Species Newly Recorded From Outagamie County.....	110
Table 7: Eastern Wisconsin Lepidoptera Species Resident In One Or Two Of The Life Zones.....	116
Figures	
Figures 1-3: (Figures related to seasonal diversity of strays and migrants).....	118
Figure 4: Portions Of Lepidoptera Species Of Strays Or Ephemeral Migrants That Originate From South, West, And North Of The Outagamie County, WI Study Area.....	119
Figures 5-40: 2016-2020 Phenology Data From Suburban Appleton For Annual Migrants.....	120
Figures 41-65: 2016-2020 Phenology Data From Suburban Appleton For Ephemeral Migrants.....	128
Figure 66: Wisconsin Maps With Survey Localities, Life Zones, and Biogeographic Areas.....	135
Specimen Plates: Images of Selected Voucher Specimens	
Figures 67-95: Strays and Migrants.....	136
Figures 96-117: Newly Recorded Species and/or Recent Colonizations.....	192
Figures 118-134: Species Complexes.....	238
Addendum (November 2023).....	272
Taxon Index.....	279

Abstract

I have conducted extensive Lepidoptera surveys in Outagamie County, Wisconsin, and adjacent areas, especially from 1989-1996 and 2016-2022. As of April 2023, I have computerized over 110,000 unique records for over 560,000 individuals representing over 2,111 species, including 1061 Macrolepidoptera and 96 Rhopalocera species.

I hypothesize that at least 222 of these species occur as strays or ephemeral migrants outside of their permanent ranges, and that 90.5% are of southern origin, 3.2% of western origin, and 6.3% of northern origin. I further hypothesize that an additional 39 species are southern migrants than do not overwinter in the area, but occur annually as seasonal residents. I present cumulative phenology and distributional data for strays and migrants. Highest species totals for southern strays and ephemeral migrants have been recorded between late August and mid October, with a peak in early September. Seasonal abundance patterns are provided for migrants recorded from suburban Appleton from 2016-2020. Most species of strays and migrants are multivoltine, widespread habitat generalists in their permanent and temporary ranges. Length of species lists of strays and migrants collected at individual localities corresponds with survey intensity rather than habitat quality or diversity. The longest species list of strays and migrants is for suburban Appleton, the most intensively collected locality but with the least natural habitat among study sites in the area. Field observations suggest that southern migrants often appear on nights with a strong south wind, and leave the area on nights with a north wind preceding a cold front and freezing temperatures. The survey period from 2016-2022 has produced higher species diversity and abundance of southern strays and ephemeral migrants than surveys from 1989-1995 (175 versus 60 species). Species accounts are provided for strays and ephemeral migrants recorded from the Outagamie County area and elsewhere in Wisconsin during the study interval.

Subsequent to the 1989-1996 study interval, 183 Macrolepidoptera and Rhopalocera species have been newly recorded from Outagamie County, including 173 species added from 2015-2022. I hypothesize that 96 of these new records are strays or ephemeral migrants outside of their permanent ranges, 85 of which are of southern origin. Forty additional species are thus far recorded from few specimens, and their status is unknown. Thirty-two of the newly recorded species appear to be new colonizations, as is also the case for four species historically recorded from single specimens. These species are now found consistently at one or more localities. The new colonizations are primarily southern species moving their ranges north (22 species) and Palearctic species expanding their ranges in the Nearctic (8 species, plus 11 microlepidoptera species). I hypothesize the remaining fifteen newly recorded species are residents which were likely missed by historical surveys. Species accounts are provided for all newly recorded species and new colonizations.

A steep Lepidoptera faunal change gradient is indicated between the Navarino Wildlife Area in southern Shawano County and the northernmost Outagamie County study sites 12-19 miles away. The Navarino Wildlife Area has a Lepidoptera fauna characteristic of the Northern Transition Zone/Central Sands biogeographic area of central Wisconsin, whereas Outagamie County study sites have Lepidoptera faunas characteristic of the Southern Transition Zone/Southeastern Ridges and Lowlands biogeographic area of southeastern Wisconsin. Recent surveys at the Navarino Wildlife Area found 56 species of Macrolepidoptera, four Rhopalocera, and at least 52 microlepidoptera which have not been recorded from Outagamie County or adjacent parts of Winnebago, Calumet, or Waupaca Counties. In addition, numerous species which are uncommon to rare in Outagamie County are more common at both the Navarino Wildlife Area and in the Central Sands biogeographic area. A second steep faunal change gradient in eastern Wisconsin is indicated between the Northern Transition Zone and the Canadian Zone.

A series of 69 color plates illustrate 457 Lepidoptera species, mostly comprised of specimens from the Outagamie County area. Species complexes are illustrated and discussed for the genera *Prochoerodes* (Geometridae), *Clostera* (Notodontidae) *Idia*, *Zanclognatha*, *Chytolita*, *Hypenodes*, *Zale*, *Catocala*, *Acrionicta*, *Bellura*, *Papaipema*, *Enargia*, *Chytonix*, *Lithophane*, and *Xestia* (Noctuidae).

Introduction

I have conducted extensive Lepidoptera surveys in Outagamie County, Wisconsin, and adjacent areas (Kons 1998, 2014a, 2014b, 2014c). I studied the area most intensively from 1989 to early August 1996, June 2012, September 2015, and from July 2016-2022. I have computerized over 110,000 unique records for over 560,000

individuals representing 2,111 species. The most intensively studied site is my suburban yard in Appleton, Wisconsin (1309 species), followed by three sites with a diverse assortment of natural habitats: Mosquito Hill Nature Center (1575 species), Fallen Timbers Environmental Center (1325 species), and the Navarino Wildlife Area in southern Shawano County (1432 species). More information on individual survey localities appears in Appendix A. This paper covers species which I hypothesize to occur in the area as migrants or strays, rather than permanent residents, as well as species which have recently colonized and/or been newly recorded from the area.

Throughout this paper, "Appleton" refers to a suburban yard at 719 West Summer Street (Outagamie County, Wisconsin) unless otherwise indicated. Lepidoptera records presented herein were collected and identified by the author unless otherwise attributed.

The following definitions are used herein.

Annual Migrant: A species which migrates into an area outside of its overwintering range annually (*i.e.* a seasonal resident).

Ephemeral Migrant: A species which migrates into an area outside of its overwintering range during some seasons but not others.

Stray: A species occurring outside of its permanent range as isolated occurrences.

Accidental: A species occurring outside of its permanent range under circumstances in which there is no possibility of enhancing its evolutionary fitness. Accidental occurrences may result from inadvertent transport by human activity, maladaptive behavioral defects, or from being forced into an area by wind.

Disperser: A species recorded within its permanent range but outside of habitat which could support a population. Examples include species with wetland obligate hostplants occurring in suburban areas with no wetlands.

Resident: A species which is present in some life stage throughout the year.

Ephemeral Resident: A species which establishes temporary populations which persist over multiple seasons outside of its permanent range.

Classification: My philosophy on classification is that higher taxa should be natural (monophyletic) groups but otherwise nomenclatural stability should be maintained with previous literature to the maximum extent possible. Under this philosophy only objective changes necessary to correct errors are accepted, and subjective changes not needed to correct errors are not accepted; for example, arbitrarily splitting valid taxa. Therefore, I do not recognize the proposed families Crambidae, Erebiidae, Euteliidae, and Nolidae. I am aware of no evidence to suggest the longstanding concept of Pyralidae included in the Hodges et al. (1983) checklist is not a natural group, thus there is no justification for splitting this family into Pyralidae and Crambidae. The former families Arctiidae and Lymantriidae are lineages within the Hodges et al. (1983) concept of Noctuidae (Mitchell et al. (2006), Zahiri et al. (2011, 2012a, 2012b, 2013)), thus these taxa needed to be down ranked to subfamilies. However, no other changes to the longstanding concept of Noctuidae in the Hodges et al. (1983) checklist are necessary. The classification adopted for taxa included herein appears in Tables 1 & 6.

Methods

Survey Techniques: Primary survey techniques used for attracting moths were MV and UV lights (sheets and traps) and rotten banana/brown sugar bait. Bait was placed in traps and/or applied to vegetation, towels, or placemats. Most records of strays and migrants were obtained using these survey methods. Other methods included searching of flowers, diurnal surveying with a net, and use of a malaise trap in the Appleton yard during 2016. I first used MV lights in Outagamie County in 2015. Bait traps used from 1989-1996 were of the inverted cone and minnow trap designs, whereas the type H design was used from 2012 onward. Kohn *et al.* (2017, Figure 2) shows examples of an MV/UV sheet (2:A), light trap (2:D), and type H bait trap (2:F). All of these survey methods are discussed in more detail in Kohn and Borth (2007).

Voucher Specimens/Photographs: All unique distribution records in the Tables and species accounts, and all records of strays, are based on collected voucher specimens (except for *Papilio cresphontes* and *Papaipema silphii*). The extent of the flight season of each species during each season is documented with voucher specimens. Nearly all individual records of uncommon ephemeral migrants are based on voucher specimens, and the few exceptions are based on photographs. Records of individuals for the more common ephemeral migrants are based on a combination of specimens and photographs; these species include *Hyles lineata*, *Hypena humuli*, *Condica sutor*, *Trichoplusia ni*, *Pseudoplusia includens*, *Megalographa biloba*, and *Magusa divaricata*. Many records of individuals found at bait include both live photos and voucher specimens collected after the live photos were taken.

Annual migrants are often common, and many of the species are relatively easy to identify, so recording abundance patterns without including sight (undocumented) records is not practical. Thus, records of individuals for annual migrants include voucher specimens, photo records, and many sight records. When multiple individuals of a species were found on the same date and location, the numbers recorded include at least one voucher specimen plus photo and/or sight records. Two exceptions are *Danaus plexippus* and *Vanessa atalanta*, which are among the most common and easily recognized Lepidoptera species in the area. For these species, I have only one or a few voucher specimens from a locality per season, and nearly all recorded numbers of individuals are sight records.

Prior to the 2016-2022 study interval, all of my computerized Lepidoptera records for the Outagamie County area are based on specimens, although there are uncomputerized notes on numbers observed for diurnal species. At this time my emphasis was primarily on recording what species were found on each date and at each locality. From 2016-2020, I kept detailed records on the minimum number of individuals encountered on individual nights for the suburban Appleton yard in order to study abundance patterns within and between seasons (see below). I retained a voucher specimen of each species found on each night, but the numbers of individuals recorded include many photo and sight records. On some survey nights outside of the Appleton yard, some species of annual migrants were too numerous for quantitative counts to be practical, so I recorded "over n individuals" in my database.

Voucher specimens for all species recorded from all survey localities are currently housed in my personal research collection, located at my residence and in a climate controlled storage locker in Appleton, Wisconsin. In addition, thousands of Outagamie County area voucher specimens (collected from 1989-1995) are deposited in the Milwaukee Public Museum; these specimens represent primarily resident species and annual migrants.

2016-2020 Survey of a Suburban Appleton Yard (719 West Summer Street): From 10 July 2016-2020, I surveyed my suburban Appleton yard every night of the season during which the dusk temperature was 38°F or higher, with two exceptions. I was absent from 18-19 August 2017 and 2 June-5 July 2018. During the 2017 absence, an MV trap sample was still obtained from each night.

A 175 watt MV light trap was run in the back yard from dusk to dawn on every survey night. Exact counts of all Macrolepidoptera individuals in the trap were recorded for each survey night, and exact counts of microlepidoptera individuals were recorded from 2019-2020, and from 2017-2020 for some distinctive species. Although some worn or minute microlepidoptera specimens were recorded as "undetermined microlepidoptera," this count does not include any of the species hypothesized to be migrants. This trap collected specimens in a container containing ethyl acetate wicks, thus there was no possibility of the same individual being recorded twice. The same BioQuip light ballast and Sylvania bulb were used throughout this interval, along with the same trap frame and collection container.

Two UV lights were run from dusk until dawn on the front porch, a 15 watt BioQuip BL light and a 33 watt BLB light. I recorded the minimum number of individuals which came to these lights. Annual migrants were usually photographed and not collected at these lights, so there is the possibility of the same individuals being recorded on subsequent dates.

Two bait traps (type H design), baited with rotten bananas, were run from dusk to dawn in the back yard on every survey night. The final check of these bait traps occurred just before sunrise. Each night I

recorded the exact number of individuals of each Macrolepidoptera species present in the traps, except during some nights when there were too many *Idia* (resident species) to obtain exact counts. Exact counts of microlepidoptera individuals were recorded from 2019-2020. Most individuals in the bait traps were released at sunrise.

A bait trail (mashed rotten bananas mixed with brown sugar) was painted in the yard each night, but there was some variation in the number of locations where bait was applied. Twenty towels and bamboo placemats were baited every night, but as the season progressed, leaves were baited in addition. On each night I recorded the minimum number of individuals present of each Macrolepidoptera species during the check of the bait trail with the most individuals of each species encountered. On other checks, it was not possible to know which individuals had already been counted, thus the minimum numbers recorded could potentially be much lower than the total number of individuals that came to the bait. Since most individuals of annual migrants were not collected on any given night, there is no way to know if the same individuals were being rerecorded over multiple nights. In early October of 2017, I marked 100 individuals of *Pseudaletia unipuncta*, *Agrotis ipsilon*, and *Peridroma saucia* with a Sharpie pen. The only marked individuals that I observed on a subsequent night were one *P. unipuncta*, two *A. ipsilon*, and three *P. saucia*, each found one or two nights after they were marked.

The amount of time spent checking the UV lights and bait was inevitably variable between survey nights. On most survey nights I checked the UV lights and bait every one to two hours during the entire night. During September and October of 2019, bait checks were more erratic. On the following dates, I only checked the bait and UV lights during the latter part of the night: 2018: 17-18, 20, 24 September; 2019: 27-28 March, 14-15, 25 May, 10 August; 2020: 2, 7, 8, 11, 18, 20, 25-26 April, 1-2, 14-15, 21-22 May, 3-4, 8, 18, 25 June, 1, 10, 16-17, 24-25, 31 July, 1, 13-14 August, 2, 5-6, 15 September, 4-9 November.

Figures 5 through 65 are based on the sums of all individuals recorded from the MV trap, UV lights, bait traps, and bait trail combined. The MV trap was the most consistent, quantitative approach for this study, with the extraneous variables including the length of the night and the amount of light pollution (moon phase, cloud cover, neighbor's porch lights). However, many species of migrants come more readily to bait than to lights, and the use of bait was often essential for detecting even the presence of some species of migrants. Unfortunately, the attractiveness of bait was variable within and between seasons, and this undoubtedly skewed the seasonal abundance patterns recorded for some bait loving species.

Results

I hypothesize that 222 Lepidoptera species recorded from Outagamie County and adjacent areas are strays or ephemeral migrants (Tables 1-2). An additional 13 species are northern strays at Outagamie County study sites, but are (or may be) resident species at the Navarino Wildlife Area in southern Shawano County (Tables 1-2).

Cumulative phenology data for migrants and strays are summarized by third of month intervals in Table 1, and distributional data are provided in Table 2. Table 3 provides individual records for ephemeral migrants and strays recorded during the 2022 season. Numbers to the left of species names in Tables 1-3 are the Hodges *et al.* (1983) check list numbers for the Moths of America North of Mexico. Figure 4 provides the percentages of strays and ephemeral migrants originating from south, west, and north of the Outagamie County area. Details for the individual species are provided in the species accounts (below).

Season abundance patterns recorded from the 2016-2020 study of the suburban Appleton yard are presented in Figures 5-40 for annual migrants and 41-65 for ephemeral migrants. Strays or ephemeral migrants with only a few records are not included in these figures, but their individual records are provided in the species accounts.

Since the 1989-1996 study interval, 183 Macrolepidoptera and Rhopalocera species have been newly recorded from Outagamie County, including 173 species added from 2015-2022. I hypothesize that 96 of these new records are strays or ephemeral migrants outside of their permanent range, 32 represent new colonizations, 15 are residents probably missed by historic surveys, and 40 are thus far recorded from few specimens and their status is unknown. The status of these species is summarized in Table 6, and discussed in the species accounts in Sections I and II (below).

Discussion

PART I: STRAYS AND MIGRANTS

SECTION I. A: CRITERIA

Criteria for hypothesizing that species are migrants rather than permanent residents: The designations of species as strays, ephemeral migrants, or annual migrants in the Outagamie County area usually represent hypotheses rather than facts. For *Danaus plexippus* the migratory biology has been extensively studied, and there is no conceivable doubt that it is an annual migrant. For other species a migratory hypothesis is derived from one or more of the following observations:

(1) Cumulative phenology records (Table 1) are concentrated or exclusive to the late summer and/or fall, whereas the species flies for much of the season farther south.

(Table 3 (many examples), Figures 21, 23, 24, 38, 39, 41, 44, 46, 48-54, 56-65).

For the phenology of these species in the Gulf Region, see Table 9 of Kons and Borth (2006).

(2) Dates of first recorded occurrence vary by a month or more between seasons.

(Figures 5, 6, 9-15, 17, 18, 21, 23, 24, 26, 27, 30, 32, 33, 34, 36, 37, 40-45, 47-58, 60, 62).

The start of the flight seasons of known resident species typically varies by no more than 2-3 weeks between seasons, with some exceptions for univoltine species which fly in the early spring.

(3) In some years, the numbers of individuals are relatively low during the first month or longer of the flight, followed by a rapid increase in abundance.

(Figures 6, 7, 9, 10, 14, 15, 16, 19, 22, 23, 25, 27, 29, 30, 31, 35-37, 45).

The rapid increase in abundance is hypothesized to correspond to the emergence of the progeny of the first migrating individuals.

(4) Phenology/abundance patterns are highly irregular between seasons.

(Figures 5, 6, 7, 9-20, 22, 24, 25, 27-37, 40, 42, 43, 45, 50, 51, 53, 59).

I have not hypothesized that species are migrants solely based on this criterion, but many species which meet one or more of the other criteria have highly irregular abundance patterns between seasons. In contrast, resident species typically have comparable abundance patterns between seasons. For example, univoltine species typically have consistent unimodal abundance patterns. North of the Austral Zone multivoltine resident species usually have consistent bimodal abundance patterns, or occasionally trimodal patterns. In Outagamie County there are only a few possible examples of resident species which breed continuously through much of the season without gaps between flights. Some of the exceptions are introduced species, including *Pieris rapae* and *Noctua pronuba*.

For species which come readily to bait, variation in attractiveness of bait between and within seasons can skew abundance patterns unless records from lights are analyzed separately. However, for some of these species, most or all records are from bait.

Ephemeral migrants might all have irregular seasonal abundance patterns, as there are no clear examples of an ephemeral migrant with a consistent abundance pattern between seasons. However, many ephemeral migrants have too few records from individual seasons to determine seasonal abundance patterns (Figures 41, 44, 46, 57, 48, 49, 52, 54-58, 60-65).

(5) The first individuals recorded during some seasons are in worn condition.

(Some examples are noted in the species accounts)

(6) All individuals encountered are in worn and tattered condition.

(*Ascalapha odorata* is the only species that meets this criterion, aside from strays with a few isolated records).

(7) Numbers of individuals in fresh condition are encountered during some seasons but not during others, in combination with one or more of the above observations.

(All species designated as ephemeral migrants in Table 1, Figures 41-65).

(8) Numbers of individuals are observed flying north at the beginning of the flight and/or south at the end of the flight.

(*Vanessa atalanta*, *Vanessa cardui*, *Danaus plexippus*).

SECTION I.B: SEASONAL SPECIES DIVERSITY

Seasonal Species Diversity of Southern Strays and Migrants: Figures 1 and 2 show how many species of southern strays and ephemeral migrants have been cumulatively recorded at different times of the year. The highest species totals have been recorded between late August and early October, with a peak in early September. Diversity patterns recorded from individual seasons are often markedly different from the cumulative diversity pattern, as shown for 2022 in Figure 1. The highest diversity peak in 2022 was in late October, with a smaller peak in late August. The diversity recorded between late August and mid October 2022 progressively declined, followed by an abrupt increase to the season maximum in late October.

The highest species diversity of annual migrants has been recorded between mid July and early October (Figure 3), with species diversity recorded for third of month intervals varying from 36 to 39. There is a steep slope of increase in diversity from late March to late May, a gradual increase from late May to mid July, and an abrupt drop off after early November (Figure 3).

SECTION I. C: OVERALL PATTERNS FOR STRAYS AND MIGRANTS

Most Lepidoptera species that migrate northward are multivoltine: Nearly all Lepidoptera species which migrate north of their permanent range are multivoltine. I found this to be the case both for northern Florida (Kons and Borth 2006) and the Outagamie County area (Table 1). I think this is because a univoltine species would be unable to breed and have the next generation make a return migration, without having to survive a winter. Southern strays and migrants presumably would be unable to survive winters north of their permanent ranges. Most of these species breed continuously without distinct broods, as suggested by the absence of gaps in the flight season and/or the presence of larvae during most of the flight in their permanent range.

I only identified one possible example of a univoltine species migrating or straying into the Outagamie County area in [small] numbers during a single season: three specimens of *Apamea cristata* were collected during 2022. However, *A. cristata* might be a recently established resident species that is difficult to detect with lights or bait. Other than this questionable example, all of the univoltine species I collected outside of their permanent range occurred as isolated single captures. All of them might be accidental occurrences. These species are: *Catocala piatrix*, *Catocala epione*, *Catocala vidua*, *Catocala maestosa*, *Catocala lacrymosa*, *Schinia obscurata*, *Schinia lynx*, *Schinia jaguarina*, *Schinia thoreau*, *Schinia bifascia*, *Schinia trifascia*, *Schinia nundina*, *Schinia tertia*, *Apamea vulgaris*, and *Papaipema beeriana*.

Some of the univoltine strays are *Catocala* species, relatively long lived moths which feed regularly as adults. These individuals could potentially live long enough to stray north and then return to their permanent range, but even if so, this does not explain why a univoltine species would migrate outside of its permanent range. *Catocala* individuals sometimes fly into manmade enclosures to roost during the day. I wonder if some of the individuals which have shown up outside of their permanent range were accidentally transported by human activity after flying into manmade enclosures such as trucks or cargo containers. A problem with this hypothesis is that most records of *Catocala* species outside of their permanent range represent southern species found in the north, and accidental transport by human activity does not explain why these moths would move in primarily a single direction. For example, in Outagamie County there are eight records of five southern species north of

their permanent ranges: *C. maestososa* (1), *C. lacrymosa* (1), *C. vidua* (2), *C. epione* (1), and *C. piatrix* (3). The only possible examples of species south of their permanent ranges are *Catocala antinympha* and *C. sordida*, recorded from three and one specimens from Appleton, respectively. Both of these species and their hostplants occur at the Navarino Wildlife Area in southern Shawano County, about 26 miles northwest of the Appleton yard. It is possible that their hostplants occur even closer in uninvestigated northern portions of the county. No *Catocala* species of western origin have been recorded from Outagamie County.

Other than *Catocala*, most univoltine strays are *Schinia* species. The related *Helicoverpa zea* and *Heliothis virescens* are well studied multivoltine, widespread, migratory species and agricultural pests. While *Schinia* are strong fliers that feed as adults, I am perplexed as to why there are so many isolated occurrences of *Schinia* outside of their permanent ranges. Besides being univoltine, some of these *Schinia* are habitat specialists of localized occurrence, which is also atypical for strays or migrants. To my knowledge *Schinia* are not prone to flying into manmade structures, thus I would not expect accidental transport by human activity to be unusually high for this genus. I wonder if some of these species are moving their ranges north, and might have recently colonized Outagamie County but are still too uncommon to be readily detected during surveys. *Schinia lynx*, *S. obscurata*, *S. trifascia*, and *S. nundina* are residents of Wisconsin's southern counties, thus Outagamie County is not far from their known ranges. However, some other species were recorded much farther from their known ranges, including the western *Schinia tertia* and the southern *S. bifascia*.

Most Lepidoptera species which migrate northward are widespread habitat generalists: Kons and Borth (2006) provide a detailed assessment of habitat dependency for many of the Macrolepidoptera and Rhopalocera species occurring in northern Florida. Species with numbers of specimens collected in fresh condition in a wide array of habitat types are designated as habitat generalists. Kons and Borth surveys have found that these results are broadly applicable throughout the Lower Austral Zone.

Most of the species which migrate north to Outagamie County in numbers are widespread habitat generalists in the Lower Austral Zone and were designated as such for northern Florida in Kons and Borth (2006). This applies to both annual and ephemeral migrants. In contrast, the few habitat specialists found in Outagamie County outside of their permanent ranges have been isolated occurrences.

It is logical that Lepidoptera species which migrate northward in numbers are habitat generalists. If suitable habitat is widespread, a long distance migrant has a good chance of encountering both suitable adult food sources and breeding habitat when it stops migrating. For example, *Danaus plexippus* is among the most common and widespread Lepidoptera species in Outagamie County and Wisconsin. Anywhere a migrating individual arrives in the area, it will not be far from one or more species of *Asclepias*, the larval host. Also, adults of *D. plexippus* feed on a wide variety of flowering plants, both native and exotic. Even in the suburban landscape, nectar and hostplants are readily available.

Most migrants recorded from Outagamie County occur in numbers in the suburban landscape: The longest species list of strays and migrants for Outagamie County is for the suburban Appleton yard. Here, 179 species of strays and ephemeral migrants have been recorded, in addition to the entire county list of annual migrants. This is by far the most intensively collected locality in this study, but it has the least natural habitat and lowest diversity of native plants among my study sites. In contrast, the longest overall species list is for Mosquito Hill, where 1575 species have been recorded, compared with 1309 species from suburban Appleton. The Appleton list includes many infrequently recorded species which are residents of the county but dispersers to the suburban yard, as suggested by the infrequent and/or irregular occurrence and absence of known hostplants and habitats in the immediate vicinity. Thus, the relative diversity of resident species at Mosquito Hill is higher than what is apparent from comparing the total number of species recorded between these localities. Mosquito Hill has the greatest variety of habitats and vegetative diversity among the Outagamie County study sites, with hydric, mesic, and xeric conditions in both woodland and grassland habitats.

It is difficult to compare the abundance of migratory species between suburban and more natural habitats. On any given night, more migrants might be encountered at a nature center where it is possible to have a longer bait trail and more widely spaced lighted sheets and traps, as well as having less light pollution relative to a small suburban yard. Due to these factors, I expect more individuals would be detected at a nature center than in

a suburban yard on a particular night, if the density of individuals in nature is comparable between the sites. On the other hand, the number of survey nights for suburban Appleton is far greater than for any other site. The bottom line is that relative abundance cannot be inferred by comparing the overall number of individuals recorded between suburban Appleton and other study sites.

However, it is clear that nearly all migratory species found anywhere in the area in numbers have been found in numbers in the suburban Appleton yard. The few exceptions are butterfly species: *Pholisora catulus*, *Colias* species, and *Junonia coenia*. These are widespread generalists of open habitats, but I have seldom seen them in the suburban landscape.

Some species of southern migrants have larval hosts available in the suburban landscape which are not present in natural habitats in the area. One documented example is *Manduca quinquemaculata*, an ephemeral migrant which utilizes tomato plants as one of its larval hosts. However, I have reared larvae for only a few of the ephemeral migrants recorded from Outagamie County, and am thus unaware of how many more examples like this there might be. The suburbs contain many ornamental and exotic plants that are not present in more natural habitats, as well as native plant species occurring north of their distribution in natural habitats (two examples are honeylocust and catalpa).

The climate of the suburbs is warmer than in surrounding natural habitats, due to heat retention by the extensive amount of asphalt and concrete, as well as heat escaping from buildings. On cool, clear nights in the fall, the temperature in suburban Appleton is often 5 degrees (F) warmer or more than fields and forests 2-3 miles away. The microclimate may be even warmer next to buildings with escaping heat. Fall freezes in the suburbs are less frequent, of shorter duration, and less severe relative to more natural habitats. The suburban landscape might enable southern migrants (including the immature stages) to persist later into the season by providing refugia from the colder conditions in natural habitats.

Do all Lepidoptera species that migrate northward have a return migration?

Rings *et al.* (1992) present the hypothesis that some noctuid species normally migrate from the southern United States to Ohio but do not return to their place of origin. Their list of such species included: *Anomis erosa*, *Anomis flava*, *Alabama argillacea*, *Anticarsia gemmatalis*, *Hypocala andremona*, *Thysania zenobia*, *Ascalapha odorata*, *Amyna bullula*, *Magusa divaricata* [called *orbifera*], *Spodoptera exigua*, *Spodoptera frugiperda*, *S. ornithogalli*, *S. dolichos*, *S. eridania*, and *Agrotis subterranea*. [On a side note, I think the actual list of migratory noctuids recorded from Ohio is much longer. I expect all of the species designated as annual or ephemeral southern migrants in northern Florida by Kons and Borth (2006) would also be migrants or strays when they are recorded from more northerly locations such as Ohio.]

I think the hypothesis that these species do not have a return migration is implausible, except possibly for species that occur only as isolated strays and accidentals. If none of the migrating individuals or their progeny survive by returning to the permanent range, the migratory behavior would have no evolutionary fitness, and I expect the genetic basis for this behavior would be eliminated by natural selection. For the best studied migrant, *Danaus plexippus*, it is well understood that individuals migrate north of where they could survive the winter to breed and take advantage of a widespread food source, and that many of their descendants present at the end of the season make a return migration. I suspect that every Lepidoptera species that migrates north of where it can survive the winter also has a return migration-how could the migratory behavior evolve and persist otherwise? In the next section, I present observations consistent with the hypothesis that southern migrants use north wind currents on the leading edge of cold fronts to migrate back south when freezing temperatures threaten.

An unusual case is *Ascalapha odorata*, which apparently migrates northward in numbers without breeding; all of the specimens I have encountered north of the Subtropical Zone (in southern Florida and Texas) have wear and tattering on the wings. Yet, during some seasons this species migrates far north of its tropical range in high enough numbers for multiple individuals to be detected over a period of a few weeks, such as during the 2017 and 2018 seasons in Outagamie County. Like *Catocala* species, these are robust, relatively long lived moths which could potentially live long enough to stray north and make a return migration in the same generation. Also like the *Catocala*, they fly into manmade enclosures to roost during the day, and could be accidentally transported as a result. However, the numbers which have shown up in Outagamie County

are greater than the one or two isolated strays recorded for several southern *Catocala* species such as *C. maestososa*, *C. lacrymosa*, *C. vidua*, *C. epione*, and *C. piatrix*. One conceivable hypothesis is that *A. odorata* may migrate northward during some seasons to escape harsh conditions during hot and/or dry summers in the permanent range, and then return to the breeding range when conditions have ameliorated. This hypothesis could also account for why the Outagamie County records were found between late June and early August and not later in the season. Kons and Borth (2006) reported that *Ascalapha odorata* was the only suspected case of a non breeding migrant in northern Florida (not including isolated occurrences of southern strays). This is potentially true for Outagamie County as well, as some individuals in fresh condition were found among all of the other southern migrants encountered in numbers.

Some individuals of southern migrants are certainly killed by cold temperatures before they can return south. For example, during some years there are still larvae of *Danaus plexippus* present on milkweed plants up until a hard freeze, after which time the larvae are not seen again. During some years there are individuals of the annual migrants *Agrotis ipsilon*, *Peridroma saucia*, *Pseudaletia unipuncta*, and/or *Hypena scabra* coming to lights or bait on the last night of the season warm enough for moth activity, as late as December in some years. On some of these nights there is only an hour or two immediately after dark when it is warm enough for moth activity. These individuals would have no realistic chance of flying south in time. However, on these nights few individuals are encountered, whereas these species were much more common in October and early November on nights with comparable weather conditions. It appears that the number of individuals which leave the area before conditions become too cold is much larger than the numbers which die off at the end of the season.

Wind Currents: Some migratory species are delicate, weak fliers, yet they appear hundreds of miles from their permanent ranges in the Lower Austral Zone or even farther south. Examples include *Plutella*, small species of Geometridae (Sterrhinae and Laurentiinae), and numerous species of Noctuidae (Hermiinae) and Pyralidae (especially Pyraustinae). It is unclear how many generations occur between the first migrating generation of a season and the individuals that ultimately arrive in Wisconsin, but even if multiple generations are involved, these moths must travel a long distance to reach Wisconsin. I can conceive of no way these delicate, weak fliers could travel such distances in nature without the aid of wind currents.

Some migratory species appear for the first time of a season on nights with strong south winds. For example, on 1 May 2011 at Poplar Drive in Milwaukee County I set up a bait trap up on a warm night with a strong south wind. For the first few hours nothing came to the bait. Then, abruptly the trap became filled with *Pseudaletia unipuncta*, and some *Agrotis ipsilon* were also present. These moths were in fair to worn condition, so it seems very likely that they migrated in during the night; if they had emerged during the night, I would expect them to have been in fresh condition.

In late October and early November of 2022, the following migrants showed up for the first time of the season on warm nights with strong south winds: *Tetanolita mynesalis*, *Hypena minualis*, *Hypocala andremona*, *Anomis illita*, *Anticarsia gemmatalis*, *Mocis latipes*, *Megalographa biloba*, and *Autographa californica* (see Table 3 for specific dates). Given the number of times southern migrants have shown up following a strong south wind, I think these moths were migrating northward in the wind currents.

I hypothesize that moths migrating north with wind currents sometimes get forced farther north than is advantageous. This includes arriving at northern localities too late in the season to produce progeny for a return migration, or arriving north of where there are any suitable hostplants. If the species noted above (from late in the 2022 season) blew in on south winds shortly before they were encountered, none of them would have had time to produce progeny before the end of the season. None of these species were found again in 2022 after the first night with a north wind subsequent to the date(s) on which they were recorded. For example, the species found from 22-24 October (*Hypocala andremona*, *Anomis illita*, *Anticarsia gemmatalis*, and *Mocis latipes*) were not recorded during unseasonably warm weather from 30 October-3 November and 9-10 November. They appear to have migrated back south at the first opportunity: a north wind at the leading edge of a cold front later in the night of 24 October.

The last warm nights of the 2022 season occurred on November 9-10. I put up over 2 miles of bait trail at the Navarino Wildlife Area in southern Shawano County. November 9 was a warm night with a strong south

wind, with the temperature ranging from 63-64-61°F. I walked the bait trail most of the night from dusk to dawn. November 10 was a warm day with a dusk temperature of 68°F and periods of rain. I checked part of the bait trail from 5:34-7pm, but heavy rain began around 6:50pm and lasted until about 10:05pm. I checked the bait again from 10:05-11:55pm, during which time there was a strong north wind and the temperature dropped from 55°F-48°F. At this time, the only precipitation was an intermittent light mist. During the following night, there was a hard freeze. Between 11 and 23 November there were freezing temperatures, including a night that dropped to 15°F, and no nights with temperatures 40F or above after dark.

I found three migrant species for the first time of the 2022 season on 9 November: *Tetanolita mynesalis* (1), *Hypena minualis* (1), and *Autographa californica* (1). Other migratory species found include *Prochoerodes lineola* species 1 (9), *Orthonama obstipata* (9), *Orthonama centrostrigaria* (over 350), *Eupithecia miserulata* (over 350), *Hypena humuli* (1), *Hypena scabra* (over 700), *Zale lunata* (128), *Autographa precatationis* (1), *Anagrapha falcifera* (1), *Condica sutor* (4), *Magusa divaricata* (7), *Elaphria grata* (2), *Elaphria versicolor* (1), *Galgula partita* (over 250), *Pseudaletia unipuncta* (82), *Agrotis ipsilon* (over 150), *Peridroma saucia* (over 400), *Nomophila nearctica* (12), *Udea rubigalis* (over 275), and *Plutella xylostella* (8). On the early check of the bait on 10 November the bait had already been degraded by rain earlier in the day, yet hundreds of moths were feeding on it. The following migrants were found: *Orthonama obstipata* (2), *Orthonama centrostrigaria* (over 60), *Eupithecia miserulata* (over 100), *Hypena scabra* (over 75), *Zale lunata* (23), *Anagrapha falcifera* (1), *Autographa precatationis* (1), *Condica sutor* (4), *Spodoptera frugiperda* (8), *Spodoptera ornithogalli* (1), *Magusa divaricata* (3), *Galgula partita* (over 60), *Elaphria grata* (1), *Pseudaletia unipuncta* (23), *Agrotis ipsilon* (over 125), *Peridroma saucia* (over 75), *Udea rubigalis* (14), *Nomophila nearctica* (1), and *Plutella xylostella* (4). After the rain stopped, the bait had been further degraded by rain, but there were still many moths feeding on it. From 10:05-11:55pm the minimum number of resident species observed feeding on the bait was 266, and hundreds of additional individuals were perched on nearby twigs. However, for the first 40 minutes of this check, the only migratory species and individuals found were: *Hypena scabra* (5), *Pseudaletia unipuncta* (2), *Agrotis ipsilon* (8), and *Peridroma saucia* (2). From 10:45-11:55pm the only migrants seen were *Hypena scabra* (1), *Agrotis ipsilon* (1), and *Peridroma saucia* (1).

What appears to have happened on 10 November is that most individuals of the migratory species cleared out of the area, aided by the north wind at the leading edge of the cold front. I suspect that the biological sensors of migratory moths can detect impending cold fronts, and that this triggers a migratory response to escape an area before temperatures drop to fatal levels.

SECTION I. D: ORIGIN OF STRAYS AND MIGRANTS

Most Lepidoptera strays and migrants recorded from Outagamie County are of southern origin: Of the 222 species of strays and ephemeral migrants recorded from the Outagamie County area, 90.5% are of southern origin, 3.2% of western origin, and 6.3% of northern origin (Figure 4). These percentages are similar for Macrolepidoptera alone: 89.8% southern, 3.4% western, and 6.8% northern. All 39 species of annual migrants are probably of southern origin.

Patterns of wind currents, discussed above, provide a partial explanation for these percentages. During each season, Lepidoptera have opportunities to move north and south with warm fronts and cold fronts, respectively. However, there are many cases in which southern species temporarily colonize northern areas, but relatively few where northern species migrate south.

Other than warm fronts and cold fronts, wind currents in Wisconsin typically move from west to east. There would be ample opportunity for western Lepidoptera species to migrate eastward on wind currents, but not for a return migration. I think this is why there appear to be no regular western migrations into the area, and strays and ephemeral migrants originating from the west are uncommon, and perhaps accidental.

There are no known examples of strays or migrants originating from east of the Outagamie County area. In addition to unfavorable wind currents, Lake Michigan on Wisconsin's eastern border is a potential barrier to dispersal or migration. However, the Lepidoptera fauna occurring from the east side of Lake Michigan east to the Appalachians contains primarily the same species that occur in Wisconsin. However, the Moth Photographers Group (2022) maps show that some southern species range farther north on

the east (Michigan) side of Lake Michigan than on the west (Wisconsin) side. If individuals did stray or migrate from the east, these movements would usually be undetectable as they would represent the same species as permanent Wisconsin residents or southern migrants.

The few species of northern strays and ephemeral migrants have permanent ranges much closer to Outagamie County than do many of the southern species. Every northern stray and ephemeral migrant documented from Outagamie County is a likely resident in the Canadian Zone of northeastern Wisconsin. Koss and Borth surveys in Marinette, Forest, Langlade, and Door Counties (northeastern Wisconsin) have documented a rich Canadian Zone fauna of Lepidoptera species that have never been recorded from the Outagamie County area. It appears that the vast majority of Canadian Zone species seldom or never stray as far south as Outagamie County.

SECTION I.E: DETECTION OF STRAYS AND MIGRANTS

The combination of lights and bait are important for detecting strays and migrants: Surveys relying exclusively on lights would miss significant numbers of species and individuals of strays and ephemeral migrants (Table 4). Many of the species which stray or migrate are relatively long lived and feed as adults.

During the suburban Appleton survey, 48% of the species of southern strays and ephemeral migrants were recorded from bait, 18% were recorded exclusively from bait, 36% had half or more of the individuals recorded from bait, and 24% had 70% or more of the individuals recorded from bait (Table 4). For individual seasons from 2016-2020, 53-65% of the species were recorded from bait, 12-37% were recorded exclusively from bait, 31-53% had half or more of the individuals recorded from bait, and 24-42% had 70% or more of the individuals recorded from bait (Table 4).

MV lights were much more effective than UV lights during surveys in the suburban Appleton study and elsewhere. Indeed, if this study had been based exclusively on UV lights, the sizeable majority of records of strays and ephemeral migrants included in this paper would never have been obtained. From 2016-2020, 63 Macrolepidoptera species of strays and ephemeral migrants were collected in the MV trap in suburban Appleton, whereas only 25 were collected at UV lights. Granted, there are other variables: the MV light was in a trap in the backyard whereas the UV lights were manually checked on the front porch. The relative advantage of MV lights might be greater in the suburban landscape, where there is more light pollution than in natural habitats outside of a city. On the other hand, the effectiveness of MV lights can be enhanced if they can be located on overlooks, in flyways (such as along trails), or in open areas at the edge of a woods; these type of locations are not available in the suburban yard.

Late in the season, the importance of bait increases. In many cases, on nights in October and early November, most or all strays and ephemeral migrants were recorded at bait. This was the case from 22 October - 10 November 2022 (Table 3).

Most annual migrants come readily to both lights and bait. During the suburban Appleton study, from 2016-2020, 96% of the Macrolepidoptera annual migrant species were recorded from bait and 100% from lights; 48% of the species had half or more of the individuals recorded from bait, and 52% of the species had half or more of the individuals recorded from lights (Table 5). During individual seasons, 24-26 of the 26 Macrolepidoptera species of annual migrants were recorded at lights, and 21-24 were recorded from bait (Table 5). Also, for individual seasons, 30-67% of the annual migrant species had half or more of the individuals recorded from bait.

SECTION I.F: DIVERSITY AND ABUNDANCE OF STRAYS AND MIGRANTS

The diversity and abundance of southern strays and ephemeral migrants was higher from 2015-2022 than from 1989-1995: From 1989-1995, I recorded 60 species of southern strays and ephemeral migrants in Outagamie County, including 42 species of Macrolepidoptera, 13 Rhopalocera, and five microlepidoptera. From 2015 (part of September only) and July 2016-2022, I recorded 175 species, including 116 species of Macrolepidoptera, six Rhopalocera, and 53 microlepidoptera. Furthermore, many of the species recorded from 1989-1995 have been found in greater numbers with recent surveys, as elaborated for individual species in

the species accounts (below). The greater diversity of strays and migrants recorded from lights with recent surveys can partly be explained by having a more attractive light, but this is not the case for bait, if results of the Kons (1996) Schmeckle Reserve study are included.

From 1992-1996, I attended the University of Wisconsin-Stevens Point in the spring and the fall, and at these times of year most of my survey effort was directed toward Schmeckle Reserve in Stevens Point, with Outagamie County surveys limited to some weekends. I had an extensive bait trail and UV lights at Schmeckle Reserve 4-7 nights a week during the spring and fall, from fall 1992 to spring 1996. Strays and ephemeral migrants recorded from Schmeckle Reserve are included in Kons (1996), and noted in the species accounts (below). Stevens Point is at the same latitude as Outagamie County, and I expect that during any given season, the migrant fauna would be similar between the two areas. All of the species of strays and ephemeral migrants recorded from Schmeckle Reserve from 1992-1996 were also found in Outagamie County during the same interval, except for single specimens of *Schinia chrysell*, *Autographa californica*, and *Mocis latipes*. I have multiple recent records of *Autographa californica* and *Mocis latipes* for Outagamie County. Species designated as strays or migrants at Schmeckle Reserve in Kons (1996) include: SPHINGIDAE: *Manduca sexta*, *Sphinx eremitus*, *Hyles lineata*; NOCTUIDAE: *Hypena humuli*, *Mocis latipes*, *Mocis texana*, *Catocala innubens*, *Trichoplusia ni*, *Ctenoplusia oxygramma*, *Pseudoplusia includens*, *Rachiplusia ou*, *Megalographa biloba*, *Autographa californica*, *Amyna stricta* [as *octo*], *Magusa divaricata* [as *orbifera*], *Spodoptera frugiperda*, *Spodoptera ornithogalli*, *Helicoverpa zea*, and *Schinia chrysell*. Many additional species of annual migrants were recorded, but at the time of this study I did not yet have sufficient data to distinguish most species of annual migrants from residents, except for those which occur primarily or exclusively late in the season.

With my extensive bait trails at Schmeckle Reserve, my baiting effort was actually more intensive from 1992-1996 than with recent surveys. My small suburban yard in Appleton had a much smaller bait trail. My surveys of Mosquito Hill, Fallen Timbers, and the Navarino Wildlife Area had extensive bait trails, but these sites have fewer fall survey dates than Schmeckle Reserve or suburban Appleton. Thus, for species primarily or exclusively recorded from bait, the sampling bias was greater for the 1992-1995 study interval than for recent surveys.

However, for the use of lights, the sampling bias was greater for recent surveys than for 1989-1995. From 1989-1995 I used only 15 or 22 watt UV lights outside of the Appleton yard. In the yard, I also had 150 watt white spotlights and an 80 watt UV electric 'bug zapper' with the zapper disconnected. I have no doubt that the 175 watt MV light I have used extensively in the yard with the recent surveys is more attractive than the UV lights. On numerous nights I have deployed multiple light traps in the same area, one with an MV light and one to three with 15 watt UV lights. The MV trap nearly always yields substantially greater numbers of Lepidoptera individuals and species. I have used one 175 watt MV light on a sheet or in a trap on many recent survey dates at Mosquito Hill, Fallen Timbers, and the Navarino Wildlife Area.

From 1989-1995, I conducted much more diurnal survey work than during recent surveys. I think the greater diversity of strays and ephemeral migrants of Rhopalocera recorded from 1989-1995 is simply due to much more diurnal survey effort. *Hylephila phyleus* does appear to be more common and more frequent in recent years, as I recorded only one worn specimen from Outagamie County from 1989-1995, despite the greater diurnal survey effort.

From 1989-1995, I was not identifying most microlepidoptera specimens to species, although I did make extensive collections for future study. I was attempting to collect representatives of the different species encountered among localities and seasons. Few of the species of strays and ephemeral migrants that I have found during recent surveys are represented in the 1989-1995 collections; however, most of the likely resident species are represented in collections from both intervals.

SECTION I.G: ANNUAL MIGRANTS

Annual Migrants: All of the species of annual migrants recorded in this study are multivoltine, widespread habitat generalists in their temporary and permanent ranges. All occur commonly in the suburban Appleton yard except for the *Colias* species, which are widespread in common field habitats.

The majority of annual migrants recorded (29/39 species) are widespread in the Gulf Region where they fly for much of the season, as reported for northern Florida in Kons and Borth (2006). These species include: GEOMETRIDAE: *Prochoerodes lineola* species 1, *Pleuroprucha insulsaria*, *Orthonama obstipata*, *Orthonama centrostrigaria*, *Eupithecia miserulata*; NOCTUIDAE: *Cisseps fulvicollis*, *Rivula propinqualis*, *Hypena scabra*, *Zale lunata*, *Condica vecors*, *Ogdoconta cinereola*, *Helicoverpa zea*, *Spodoptera frugiperda*, *Spodoptera ornithogalli*, *Galgula partita*, *Pseudaletia unipuncta*, *Agrotis ipsilon*, *Peridroma saucia*; PIERIDAE: *Colias eurytheme*; NYMPHALIDAE: *Vanessa atalanta*, *Danaus plexippus*; GELECHIIDAE: *Dichomeris ligulella*; ATTEVIDAE: *Atteva aurea*; PLUTELLIDAE: *Plutella xylostella*; PYRALIDAE: *Udea rubigalis*, *Nomophila nearctica*, *Agriphila ruricolellus*, *Agriphila vulgivagellus*; PTEROPHORIDAE: *Emmelina monodactyla*.

Nine species of annual migrants recorded in this study are rare or absent in the Gulf Region, but could originate from the Upper Austral/northern Lower Austral or Sonoran Zones. These species include GEOMETRIDAE: *Haematopis grataria*; NOCTUIDAE: *Pseudeustrotia carneola*, *Autographa precationis*, *Anagrapha falcifera*, *Hyppa xylinoides*, *Lacanobia subjuncta*, *Lacinipolia renigera*, *Discestra trifolii*; PIERIDAE: *Colias philodice*. The genus *Hyppa* needs further taxonomic study, and multiple species may be present in Wisconsin, only one of which is a probable migrant.

SECTION I.H: ACCIDENTALS

Accidental Occurrences: Several possibilities could account for accidental occurrences of species outside of their permanent or temporary ranges. As discussed for *Catocala* (above), individuals of some species regularly fly into manmade enclosures, and if these enclosures are vehicles or shipping containers, these individuals could be accidentally transported by humans. People transporting plants, soil, or other materials could inadvertently transport immature stages. I suspect that this explains how one of the neighborhood youngsters captured a fresh individual of *Citheronia regalis* in a wood pile in suburban Appleton during 1981. This species does not feed as an adult and has not been documented in Wisconsin to my knowledge. A defect in normal migratory or dispersal behavioral could lead to an isolated occurrence of a species in an area where it has no chance to propagate its alleles. Wind storms or fronts can blow flying insects off course. For example, nights with tropical storm force winds from the edges of hurricanes have produced some odd records for Gainesville Florida, including the tropical/subtropical species *Phuphena tura*. As discussed previously, I think migrating moths utilize wind currents, and sometimes get forced farther north than is advantageous.

SECTION I.I: SPECIES ACCOUNTS FOR STRAYS AND EPHEMERAL MIGRANTS RECORDED FROM THE OUTAGAMIE COUNTY AREA

Note:

Records cited from Kons (2016, 2019) which are shown as live photographs are also represented by voucher specimens that were collected after the photographs were taken.

Numbers appearing in parentheses following species names refer to Hodges *et al.* (1983) 'MONA' numbers, which serve as a citation for the author and year of description. I followed the MPG (2022) 'MONA' numbers for taxa described or recorded from North America subsequent to Hodges *et al.* (1983). I assigned provisional MONA numbers for taxa that are still undescribed or unrecognized by current taxonomy.

"Season" refers to the time of year when Lepidoptera adults are active.

Strays and Ephemeral Migrants of Southern Origin Collected in Outagamie County, Wisconsin, and Adjacent Areas

GEOMETRIDAE

***Macaria promiscuata* (6331):** This species is a rare stray from the Upper Austral Zone found once in Appleton: MV Trap, 3 September 2017.

***Psamatodes abydata* (6332):** This species is a rare stray from the southwestern states, found once in suburban Appleton: MV Trap, 15 August 2017.

***Macaria aequiferaria* (6335):** North of the Gulf States, I have primarily encountered this species in cypress habitats (Kons and Borth 2006, 2012, 2021), but in 2022 I collected two specimens in Appleton (Table 3), as well as three fresh specimens in a suburban yard in Wheaton, Illinois on 15 August. I had previously collected one specimen in Appleton on 15 August 2017 in an MV trap. While I still suspect cypress is a larval host, the three fresh specimens from Wheaton suggest that it may not be the only host. I do not know if the Wheaton specimens are migrants or residents, as I had not previously sampled that area. There is a *Juniperus virginiana* tree (a relative of cypress) in the Wheaton yard, but I have not found *M. aequiferaria* in *Juniperus virginiana* habitats in Wisconsin.

***Macaria multilineata* (6353):** This species might be a resident in southwest Wisconsin, but in Outagamie County it is a rare stray found twice in suburban Appleton: MV Trap, 31 July 2017, 3 August 2018.

***Glenoides texanaria* (6443):** While this species is a widespread habitat generalist in the Upper and Lower Austral Zones, it rarely occurs in Wisconsin as isolated strays. I have collected it once in suburban Appleton: 9 July 2018 in an MV trap. Kyle Johnson (pers. comm.) had previously collected a specimen in Green County on 16 September 2012. In 2018 Kons and Borth found six individuals as far north as Hancock County, IL, at the Kibbe Research Station.

***Iridopsis defectaria* (6586):** This species is a widespread habitat generalist in the Upper and Lower Austral Zones, but I have collected only two specimens in Wisconsin: Appleton: UV Trap, 27 August 2021; Dane County: Swamplovers Preserve, MV Trap, 24 August 2021.

***Prochoerodes lineola* complex species 1 (6982):** This is actually an annual migrant, but I include a species account because I think that the current taxonomy is incorrect, and that there are actually two species of *Prochoerodes* in Wisconsin. One is a plain brown to brownish tan species that exhibits little infraspecific variation in pattern within the same gender (females are darker brown with a slight violet cast). This is the migratory, multivoltine species. It occurs statewide, and during some years it persists into November. It is widespread throughout eastern North America. Species 2 is more variable in pattern, with the coloration varying from yellow to yellowish brown to light brown. This species is a resident in the Canadian Zone and the Northern Transition Zone (including the Navarino Wildlife Area). I have only one worn specimen from Outagamie County (24 August 2023 at Mosquito Hill), and no records for the southern counties. It is univoltine and flies during late July and August.

***Dichorda iridaria* (7053):** This species is a widespread habitat generalist in the Upper and Lower Austral Zone, but it is a rare stray to Outagamie County collected three times: 5 August 1990; 18, 20 July 1991.

***Lobocleta ossularia* (7094):** This species is a rare southern stray found once in suburban Appleton: MV Trap, 8 October 2018. It is a widespread habitat generalist in the Lower Austral Zone, as reported for northern Florida in Kons and Borth (2006).

***Idaea violacearia* (7120):** This species is a rare stray from the Lower Austral Zone where it is associated with xeric grasslands. It is more localized than most species that stray far from their permanent range. I have collected one specimen from Outagamie County: Mosquito Hill, hilltop, mesic hardwood forest/grassland, 4 July 2021. This species exhibits some geographic variation. The Outagamie County specimen looks like specimens from the Austral/Sonoran boundary area of Oklahoma and Texas.

***Cyclophora packardi* (7136):** This species is widespread in the Austral Zone, although in the Gulf Region it is most often found in xeric oak-pine habitats, as reported for northern Florida in Kons and Borth (2006). From 1992-1993 I collected three specimens from the Southern Kettle Moraine State Forest in Waukesha and Walworth Counties from late July to early August, none of which were in fresh condition. Two were from mesic hardwood forest and one from a prairie remnant. I am uncertain if the species is an uncommon resident or migrant to the southern Wisconsin counties. There were no records from the Outagamie County area from 1989-1996. However, I recorded three specimens from 2018-2019: Fallen Timbers: MV trap site 2, sedge meadow, 24 September 2018; Appleton: MV trap, 7 & 15 September 2019. In 2022 I did not find any specimens in Outagamie County, but found 21 individuals at the Navarino Wildlife Area from late May to late June and early to late August, including some individuals in fresh condition. This species was again present in numbers at the Navarino Wildlife area in May of 2023, during which time none were found in Outagamie County. This situation merits taxonomic study. I wonder if the Navarino material is a separate, bivoltine resident species and if

the Outagamie County material is an ephemeral migrant from the Austral Zone? I included only the Outagamie County material in Table 1.

***Cyclophora nanaria* (7140):** From 1989-1995, I collected only one specimen in Wisconsin: Waukesha County, sand prairie along railroad tracks west of Highway S, UV light, 17 August 1993. From 2016-2022 I collected ten specimens in suburban Appleton between late July and early October, some in fresh condition. In the south central U.S. (Lower Sonoran Zone) this species is common and widespread (Kons and Borth surveys), but I have only occasionally found it in the Lower Austral Zone. I am uncertain how far north the permanent range extends, but Kons and Borth found a fresh specimen early in the season as far north as Stoddard County, Missouri (Kons and Borth 2021). Appleton records include: MV Trap, 26 July, 15, 16 September, 11 October 2016; bait trail, 2 August 2018; MV Trap, 25, 27, 30 September 2019; MV Trap, 22 July, 13 September 2020.

***Coryphista meadii* (7290):** This species varies greatly in abundance and with first date of occurrence between seasons, and sometimes the first specimens recorded during a season are in worn condition. This suggests that the species is migratory rather than a permanent resident, although it undoubtedly breeds in the area during some seasons; for example, many fresh specimens were encountered in 2018 and 2019. The individuals encountered during 2022 were generally in fair to worn condition, although I found fresh individuals in Wheaton, IL, from 13-17 August. This species has been found in Outagamie County every season from 2016-2022, so it may be an annual migrant now, although it probably wasn't present every season from 1989-1995.

***Disclisioprocta stellata* (7417):** This is a common and widespread habitat generalist in the Gulf Region, as reported for northern Florida in Kons and Borth (2016). It is an annual migrant as far south as Gainesville, Florida, based on the large variation in dates of first recorded occurrence between seasons (Kons and Borth 2016). I have recorded one stray from Outagamie County: Appleton, netted shortly after dark, 19 September 2022. Kyle Johnson (pers. comm.) had previously collected this species in Dane County on the UW-Madison campus.

SPHINGIDAE

***Agrius cingulata* (7771):** This tropical species occurs as an ephemeral migrant in the Gulf States, but it is a rare stray as far north as Wisconsin. I have collected one specimen in Appleton: MV trap, 14 October 2020. As a small child I captured one in Appleton in 1980, but did not preserve the specimen. Robert Borth found a specimen in downtown Milwaukee (Milwaukee County) on 2 October 1995.

***Manduca sexta* (7775):** This species is an ephemeral migrant in Wisconsin's southern counties. It is most often found in the southwest counties, but it is a rare stray as far north as Outagamie County. Records include: Mosquito Hill: UV light on hilltop, 19 September 1992; MV trap on prairie planting, 15 September 2021; Appleton: 1981.

***Manduca quinquemaculata* (7776):** In 1987 I obtained three larvae from Appleton from tomato plants. One was reared to an adult in mid September and the other two pupated but were parasitized. I have one other adult specimen from Appleton: late June, 1987. I collected an additional specimen in eastern Waupaca County nectaring at petunias: private residence near Roland Lake, 16 August 1989. Before 1987 I encountered additional individuals in Appleton but they were not documented, and I heard a number of reports of people finding hornworms on tomato plants in Appleton (these could have been *M. sexta* or *M. quinquemaculata*). From 2016-2022 there have been multiple tomato plants in the Appleton yard every year, but no larvae have been found, nor have any adults been found at lights or flowers. This is an atypical case of a species which apparently migrated into the area in greater numbers historically than presently, although there are few actual specimens to document this.

***Dolba hyloeus* (7784):** In the Outagamie County area I have collected this species five times. Besides the 2022 record from the Navarino Wildlife Area in Table 3, there are four specimens from Fallen Timbers: nectaring on petunias, 6, 14, and 21 August 1992; MV trap, 18 June 2021. The 2022 specimen was in worn condition, although some of the previous specimens are in good condition. Hostplants which could support a temporary breeding population at the Navarino Wildlife Area include *Vaccinium* and *Comptonia*, but neither of these larval hosts occurs at Fallen Timbers.

***Ceratomia amyntor* (7786):** While the larval host (*Ulmus*) is widespread in Outagamie County (including Appleton), only two specimens have been found despite the massive collecting effort, and this species readily comes to lights. Therefore, the species appears to be a rare stray to Outagamie County. Most Wisconsin specimens I have examined are from the southwestern counties (for example, Robert Borth has recorded 13 individuals from Green and Grant Counties), and I am uncertain if it is a permanent resident in these areas. The local records include: Appleton: UV Trap, 14 June 2012; Mosquito Hill (Table 3).

***Sphinx eremitus* (7796):** In some years, numbers of fresh individuals have been found, including during 1992 and 2021. In 2021, at least 16 individuals were seen at Mosquito Hill in early and mid July. Numerous additional likely individuals were seen nectaring on buttonbush (*Cephalanthus*), but were not examined closely enough to reliably identify. Subsequently, the species appears to have migrated out of the area, as none were found in surveys later in the season. However, in 1992 the species was common at Fallen Timbers from 4-21 August, with none found during surveys in July. The two specimens from 2022 (Table 3), were both in worn condition. On 9 June 2023, I collected a specimen in fresh condition near the top of the hill at Mosquito Hill, the earliest record to date for the area.

***Sphinx chersis* (7802):** The single fresh 2022 specimen from Mosquito Hill is the first time I encountered this species in Outagamie County from 2016-2022. In 1981, I reared a specimen in Appleton from a mature larvae found in the wandering phase, and I have one other adult specimen from Appleton: 31 July 1991. South of Wisconsin Kons and Borth have collected this species primarily at MV lights, and it comes readily to MV lights in northern Texas. The species might be underrepresented in Outagamie County collections from 1988-1996 because I was not using MV lights; however, I used MV lights extensively from 2016-2022.

***Erinnyis obscura* (7837):** Tom Rochealeau (pers. comm. 1991) collected a specimen in Outagamie County on 2 September 1971. Kyle Johnson collected a specimen at an MV sheet on 24 September 2017 in Delta County of Upper Michigan. This species is a widespread habitat generalist in Florida and Texas, but it is an ephemeral migrant even as far south as northern Florida (Kons and Borth 2006). To my knowledge, records north of the Lower Austral/Sonoran Zones are isolated strays.

***Aellopos titan* (7849):** Richard Merkhofer collected one specimen nectaring on *Asclepias* in his yard adjacent to Plamann Park during the day in early July of 1992. I might have glimpsed one on top of the hill at Mosquito Hill on 4 July 2021, but I did not get a good look at it; it was a dark sphinx with a white band on the abdomen. This is a tropical species which occasionally strays north, far from its permanent range.

***Eumorpha pandorus* (7859):** I have collected this species twice in the Outagamie County area; in addition to the 2022 Navarino record in Table 3, I have a Mosquito Hill specimen from 11 August 1994. This species was common nectaring at *Saponaria officinalis* in Waukesha and Walworth Counties (southeastern Wisconsin) in 1993; however, none were found at one of the same localities (Ottawa Lake Recreation Area along Highway 67) in 1992 and 1994, so this species is likely an ephemeral migrant in that area.

***Hyles lineata* (7894):** This species is often uncommon or absent in Outagamie County, but during some seasons it migrates into the area and establishes temporary breeding populations. I reared a specimen from a larva found in the wandering phase in Appleton in 1981. The 2022 individuals (Table 3) were mostly in good condition, so I suspect that the species was breeding in the area.

NOCTUIDAE

***Cisthene plumbea* (8067):** This species is a rare stray from the Lower Austral Zone, collected once in suburban Appleton: MV trap, 14 September 2015. In its permanent range it is a common and widespread habitat generalist, as reported for northern Florida in Kons and Borth (2006).

***Utetheisa bella* (8105):** This species is a rare stray from the Lower Austral Zone found once in Outagamie County: Wiouwash Trail just north of the Winnebago County border, flushed during the day, 20 October 2017. Some authors consider *U. bella* to be the same species as *U. ornatix*. This is an ambiguous case. On the west coast of Florida and south Texas *U. bella* and *U. ornatix* phenotypes fly together and I have seen no intermediates. However, Vernon Brou has collected specimens in southern Louisiana that are intermediate between the *bella* and *ornatrix* phenotypes, shown in Brou (2009). Other than areas near the Gulf Coast, all the U.S. specimens I have collected and examined

are *bella* phenotypes. All specimens I have examined from Central America are *ornatrix* phenotypes. The *ornatrix* phenotype apparently does not migrate northward or inland from coastal areas in the U.S. For example, thousands of individuals I have seen from Gainesville, Florida (interior of the north Florida peninsula) are all *bella* phenotypes, even though the Gulf Coast west of Gainesville has both *bella* and *ornatrix* phenotypes. This appears to be a case of two species with different migratory behavior, which occasionally hybridize in some areas but remain distinct in much of their ranges.

***Idia scobialis* (8330):** I have collected this species twice in Wisconsin and once in Outagamie County: Mosquito Hill, hilltop, mesic hardwood forest, bait trail, 25 July 2020. My other record is Waukesha County: Ottawa Lake Fen, UV trap, 9 August 1992. I suspect that these records are strays, as only single specimens have shown up in extensively sampled areas, and other specimens I have collected or examined are from the Austral Zone.

***Idia denticulalis* (8333):** This species is a rare stray from the Austral Zone, which I have collected twice in Wisconsin and once in Outagamie County: Mosquito Hill, hilltop, mesic hardwood forest, bait trail, 25 July 2020. My other record is from Green County: Muralt Bluff Prairie, UV sheet, 18 July 1992. It is widespread in part of its range, including eastern Texas and the Upper Austral Zone portion of the Appalachians.

***Zanclognatha near lituralis* (8340.1):** *Zanclognatha lituralis* includes two species that can be separated by pattern and COI 5' mitochondrial DNA, neither of which are a particularly good match to the drawing in the original description. This situation is discussed in Kons et al. (2017, page 106). The species most often called *lituralis* is a resident species throughout Wisconsin. The second species is apparently a southern stray, as I have found only two somewhat worn specimens in the state. Records include: Appleton: MV Trap, 28 August 2021; Dane County: Swamplovers Preserve: MV Trap, 24 August 2021.

***Zanclognatha pedipilalis* complex species B (8348b):** *Zanclognatha pedipilalis* includes two phenotypes which I suspect represent separate species. One is a univoltine resident species which I have found in the area every year when I conducted surveys in woodland habitats during its flight season from late May to early July. The second species is multivoltine in the Upper Austral Zone, but in Outagamie County I have only found it during August and during three seasons. In previous seasons, I only encountered single individuals, but in 2022 I found four on a bait trail at Mosquito Hill on 23 August (Table 3). The other records are Appleton, MV Trap, 7 August 2018, 25 August 2020.

***Zanclognatha protumnusalis* complex species 3 (8348.3):** Three *protumnusalis* complex species occur in Wisconsin, not including *dentata*, which I called "near *protumnusalis*" in all my check lists produced before it was described. The most common and widespread species matches the type of *protumnusalis*, and is a resident species statewide. A second species looks like an intermediate between nominotypical *protumnusalis* and *dentata*; it is generally smaller than *dentata* and has more dark markings than *protumnusalis*. I have seen this species primarily from boreal forest in the Door County peninsula, but I also have a few specimens from hydric hardwood forest at Fallen Timbers. The third species is widespread in the Lower Austral Zone, and the single Wisconsin specimen I have collected is presumably a stray: Outagamie County: Old Stone Bridge Trail: bait trail, mesic hardwood forest with extensive buckthorn/field, 16 June 2020.

***Zanclognatha cruralis* complex species B (8351b):** *Zanclognatha cruralis* also includes two phenotypes which I suspect represent separate species. One is a univoltine resident species which I have found in the area every year when I conducted surveys in woodland habitats during its flight season from early June to mid July. The second species is multivoltine in the Upper Austral Zone, but in Outagamie County I have found only three worn specimens from early August to mid September. In addition to the 2022 Mosquito Hill records in Table 3, there is an Appleton specimen from 5 August 2018 at bait. I am uncertain if this species might be established in southwest Wisconsin; I collected one specimen in fresh condition at Swamplovers Preserve in Dane County on 24 August 2021 in an MV trap.

***Tetanolita mynesalis* (8366):** From 1989-1996, I collected only one specimen in the Outagamie County area (Appleton: 9 August 1991), but since 2016 I have collected ten specimens, some in fresh condition. The 2022 record from the Navarino Wildlife Area (Table 3) was on a warm night with a strong wind from the south, two nights prior to a hard freeze. The other Appleton records are: MV Trap, 15, 16 October 2016; UV light, 17 October 2016; MV Trap, 28 October 2016; bait trail, 28 October 2016; MV Trap, 15 June, 6 October 2017; MV Trap, 8 October 2018;

bait trail, 30 September 2019. In the Lower Austral Zone where this species is a permanent resident it flies throughout the season; for example, it is recorded from mid January through December in northern Florida (Kons and Borth 2006). All but two specimens from Outagamie County are from late September to early November. Most Ohio records reported in Rings et al. (1992) are from August-October, so I suspect it is a migrant rather than a resident in the Upper Austral Zone as well.

***Tetanolita near palligera* (8367.1):** I found three specimens in Outagamie and northern Winnebago County from 1989-1995, but I have no recent records. The records are Outagamie County: Appleton, 13 September 1991, 30 August 1995 (shown in Kons 2019); Winnebago County: Breezewood Lane, 24 August 1991. This species has been confused with *Tetanolita floridana*, but COI 5' sequences place it closer to *T. palligera*. It can be separated from *T. floridana* by pattern as well. True *T. floridana* has not been found in or near Wisconsin to my knowledge.

***Bleptina sangamonia* (8372)?:** I collected one possible specimen at Mosquito Hill: 4 August 2021, MV trap at the edge of a floodplain forest/wet - mesic prairie planting. This worn specimen should be dissected for confirmation. *B. sangamonia* inhabits the Upper Austral and northern Lower Austral Zones.

***Bleptina inferior* (8371):** This species is a rare stray from the Lower Austral Zone found once in Appleton: MV Trap, 9 October 2020. It is a common and widespread habitat generalist that flies throughout the season in the Gulf States, as reported for northern Florida in Kons and Borth (2006). I have not collected or examined any other specimens from Wisconsin.

***Renia discoloralis* (8381):** I am uncertain if this species is migrating to the Outagamie County area, or if it has become a recently established resident species that has colonized from the south. From 1989-1996 the only Wisconsin specimen I am aware of is a worn specimen I collected on 8 August 1992 at the Whitewater Lake Recreation Area in Walworth County. During the same season, I surveyed this site multiple times in July without finding any additional specimens. I first found it in Outagamie County on 27 July 2019, a single fresh specimen from the Appleton yard. In 2020, single fresh specimens were found at Mosquito Hill and Fallen Timbers, on 24 July and 1 August, respectively. Two fresh specimens were found at bait on the top of Mosquito Hill on 5 August 2021. Combined with the 2022 records in Table 3, this species has now been found in the area in fresh condition at a similar time of year for four consecutive seasons, albeit in different localities.

***Renia adspersgillis* (8386):** I have collected three specimens in Appleton in fairly good condition: 14 July 1996; UV trap, 26 June 2012; bait trap, 12 July 2016. The three specimens collected in 2022 (Table 3) were all in fairly worn condition. Mosquito Hill has been surveyed during the flight season in past seasons without encountering this species, whereas this was the first year I surveyed the Navarino Wildlife Area during the summer. In the Lower Austral Zone this species is widespread in many habitats (Kons and Borth 2006), but it was irregularly encountered and likely a disperser in second growth mesic hardwood forests in southwest Gainesville, FL. This species is locally common at least as far north as southern Indiana (Kons and Borth 2012). The 1996 specimen is shown in Kons (2019) under "Herminiinae."

***Palthis asopialis* (8398):** This species is a rare stray from the Upper Austral Zone, collected once in Appleton: MV trap, 9 September 2015. I have collected it twice in Waukesha County in southeastern Wisconsin: Southern Kettle Moraine State Forest, Horse Trail on Highway Z, mesic hardwood forest, UV sheet, 26 August 1994; sand prairie along railroad tracks west of Highway S, UV sheet, 17 August 1993.

***Redectis vitrea* (8401):** This species is a rare stray from the Austral Zone. The only collection from the area is Mosquito Hill: MV trap, wet-mesic prairie planting near edge of floodplain forest, 2 September 2020. I have one other Wisconsin specimen: Waukesha County, Ottawa Lake campground, mesic hardwood forest/field, 17 July 1992.

***Colobochyla interpuncta* (8411):** This species is a rare stray from the Austral Zone where it is widespread. I have collected three specimens in Wisconsin, including one from Outagamie County: Appleton: MV Trap, 8 September 2015. Other records are Dane County: Swamplovers Preserve, MV trap, prairie planting overlook/mesic hardwood forest, 24 August 2021; Waukesha County, Ottawa Lake campground, mesic hardwood forest/field, 9 August 1992.

***Dyspyralis puncticosta* (8427):** This species is a rare stray from the Upper Austral Zone, which I have collected three times in Wisconsin, including two specimens from Outagamie County: Mosquito Hill, mesic hardwood forest/

grassland on top of hill, bait trail, 25 July 2020; Fallen Timbers, hydric hardwood forest, MV trap site 21, 27 July 2021. The other specimen is from Waukesha County: sand prairie along railroad tracks west of Highway S, UV sheet, 26 July 1993.

***Hypena minualis* (8457):** My extensive surveys in Outagamie and Portage Counties from 1989-1996 yielded no specimens, although I did collect a specimen in southeastern Wisconsin: Waukesha County, Genesee Prairie Fen State Natural Area, UV sheet, 17 September 1993. Since 2016 I have collected five specimens in Appleton: UV light, 16 September 2015; UV light, 31 October 2016 (2), bait trail, 31 October 2016; bait trail, 8 October 2017. The 2022 specimen from the Navarino Wildlife Area (Table 3) was found on a night with a strong wind from the south, two nights before a hard freeze. Three Appleton individuals from 31 October 2016 are shown in Kons (2016) [note that the two specimens shown are the same individuals as two of the live photos]; this was another night with a strong wind from the south. Rings et al. (1992) suggested that the status of this species in Ohio was unknown, but since all reported records are from late August-October I think it must be a migrant there. Kons and Borth (2006) report that it is an annual migrant in northern Florida, with most records from late July-December, but some records from February and April. In subtropical Florida it flies year round.

***Hypena humuli* (8461):** This is one of the few species that irregularly migrates northward into Wisconsin but is absent from the Gulf Region except as a rare stray. However, it is clearly an ephemeral migrant in Outagamie County, as it is absent during some seasons and common during others. When present, the flight season can begin as early as late March or as late as October. I did not find it in the area during September 2015 or during 2016, but it has been present in numbers every season since. It was uncommon in 2022 and usually encountered singly, except on 1 September when 11 individuals were found at bait at Mosquito Hill. Some Appleton records are shown in Kons (2019).

***Tathorhynchus exsiccatus* (8466):** This southern stray was found in Outagamie County during one season, 2016, when three specimens were collected in an MV trap in Appleton. Two worn specimens were collected on 23 July 2016, and one fresh specimen was collected on 15 September (shown in Kons (2019)). I have one other Wisconsin specimen from Waukesha County: Ottawa Lake campground, mesic hardwood forest/field, 19 July 1993. Kons and Borth have primarily found this species in the eastern Sonoran Zone and the Austral/Sonoran boundary area, whereas in our experience it is much more uncommon and local in the Austral Zone. The typical habitat where we have found it south of Wisconsin is xeric grasslands.

***Parahyphenodes quadralis* (8430):** I am uncertain if this species is migrating to the Outagamie County area, or if it has become a recently established resident species that has colonized from the south. The absence of any specimens from Appleton leads me to suspect that it may now be a resident species that requires better habitat than what is present in the suburbs. The local records are all from areas with wetlands, although this species is a widespread habitat generalist in northern Florida (Kons and Borth 2006). It has not yet been found at any of my study localities consistently. The few records thus far are: Outagamie County: Fallen Timbers: hydric hardwood forest, bait trail, 16 July 2020; Mosquito Hill: UV trap site 3, floodplain forest, 1 July 2020; MV trap site 10, wet-mesic prairie planting near floodplain forest edge, 5 August 2021; floodplain forest/sedge meadow, on vegetation, 5 August 2021; Shawano County: Navarino Wildlife Area: UV trap site 13, mesic-hydric hardwood/white pine/hemlock forest, 5 August 2022.

This species historically occurred primarily in the Austral Zone. I have only one Wisconsin record from 1989-1996, presumably a stray: Waukesha County: Ottawa Lake Campground: 15 July 1992. Rings et al. (1992) gave only two records for Ohio, both from the southern half of the state. I found numbers of fresh individuals in boreal forest/wetlands in Door County (Canadian Zone) from 18-19 August 2017, and Kyle Johnson (pers. comm.) has recent material from even farther north in Upper Michigan. This species appears either to have expanded its range or to be migrating into areas with a much colder climate than where it historically occurred.

***Sigela brauneata* (8432):** This is a rare stray from the Austral Zone found once in Appleton: MV Trap, 8 October 2018. This species is a widespread habitat generalist in the Lower Austral Zone, as reported for northern Florida in Kons and Borth (2006).

***Hemeroplanis scopulepes* complex species 1 (8467):** This is a species complex with two species going under one name; each species can be differentiated by COI 5' mitochondrial DNA and wing pattern. One species is a resident

of the Lower Austral Zone, and the other of the Lower Sonoran Zone. One stray of the Lower Austral Zone species has been found in Appleton: MV Trap, 20 October 2016. Rings et al. (1992) reported only two specimens from Ohio collected over 50 years ago.

***Metalectra tantillus* (8502):** This species is widespread in the southern Upper Austral and Lower Austral Zones, and apparently strays north on occasion. I have collected it twice in Wisconsin and once in Outagamie County: Mosquito Hill, mesic hardwood forest/grassland on top of hill, bait trail, 25 July 2020; Green County: Muralt Bluff Prairie, UV sheet, 18 July 1992.

***Nigetia formosalis* (8440):** This species is a rare stray from the Austral Zone. I have collected it twice in Wisconsin and once in Outagamie County: Mosquito Hill: wet-mesic prairie planting near edge of floodplain forest, MV trap, 2 September 2020; Walworth County, Whitewater Lake Recreation Area, east campground, mesic hardwood forest, UV light, 8 August 1992.

***Gabara subnivosella* (8522):** The taxonomy of *Gabara* is a mess, with more species present than are recognized by current taxonomy, inconsistent application of names, and mixed series in collections. I provide more details in Kons et al. (2017). For the northernmost species, which rarely strays into Wisconsin, I tentatively apply the name *subnivosella*. My only Wisconsin specimen is from Appleton: MV Trap, 9 July 2018. Earlier in the same season (3 July) Kons and Borth found four fresh specimens at the Kibbe Research Station in Hancock County, Illinois. We are uncertain if the species is a resident this far north, or if these individuals are part of the northward migration that yielded the Wisconsin specimen. The Kibbe records are from mesic prairie, and *subnivosella* typically occurs in grassland habitats.

***Hypsoropha hormos* (8528):** This species is a rare stray from the Lower Austral Zone, found once in Appleton: MV trap, 26 June 2019. It is a widespread habitat generalist in the Lower Austral Zone, as reported for northern Florida in Kons and Borth (2006).

***Hypocala andremona* (8642):** The 2022 record from the Navarino Wildlife Area is the only specimen of this tropical species I have found in the Outagamie County area to date. I am aware of only one other specimen from Wisconsin, from 2 October 2018 in Pepin County, collected by Kyle Johnson. Both of these specimens are in remarkably fresh condition. The only reported larval host I am aware of is persimmon (*Diospyros*) (Kimball 1965). According to the USDA plants database, the closest *Diospyros* species to Wisconsin is in Peoria County in central Illinois (USDA 2022). The Navarino specimen was collected on a night with a strong wind from the south. The occurrence in Wisconsin may be accidental; perhaps a migrating individual got caught in the strong south wind and was transported too far north. Rings et al. (1992) reported that this tropical species was rarely collected in Ohio and as far north as southern Ontario.

***Anomis erosa* (8545):** This tropical species is an annual migrant as far south as northern Florida (Kons and Borth 2006), but it is a rare stray as far north as Wisconsin. I have one Appleton specimen from a bait trap on 16 September 2015. In northern Florida it is a widespread habitat generalist (Kons and Borth 2006).

***Anomis illita* (8551):** Prior to 2022, I had only collected a single specimen in the Outagamie County area, Appleton: bait trap, 27 September 2018. I did not collect or examine any Wisconsin specimens from 1989-1996. The four specimens from two localities on 24 October 2022 (Table 3) appeared on the third night of a warm spell with a strong south wind. This tropical species is an ephemeral migrant as far south as Gainesville, Florida (Kons and Borth 2006), but it occurs year round and is presumably a resident in subtropical Florida. Rings et al. (1992) did not report this species from Ohio, thus migrations as far north as Wisconsin may be a recent phenomenon.

***Alabama argillacea* (8554):** The only local record is one Appleton specimen from 1981. The only reported hostplant genus in North America is *Gossypium* (cotton) (Rings et al. 1992). USDA (2022) shows no Wisconsin distributional records for this plant genus, so Wisconsin records might all be accidentals. Wagner (2009) suggests this species might not have been recorded in North America since 1998, when Vernon Brou last found it in Louisiana, although it was once a prolific migrant in eastern North America and a major pest of cotton. I collected a series of specimens in Alachua and Levy Counties in northern Florida during 1997, but that is the only year during which I found it in Florida from 1996-2016. Wagner (2009) suggests that the decline is probably due to intensive pest management practices where cotton is grown, and a decline in cotton production in favor of other crops from the U.S. cotton belt through Central America.

***Anticarsia gemmatalis* (8574):** From 1989-1996 I only collected three specimens of this tropical migrant in Outagamie County and none in Portage County: Fallen Timbers, UV trap and bait trail, 7 October 1994 (2); Mosquito Hill, hilltop, UV trap, 8 October 1994. Since 2016 I have found 28 individuals in Outagamie and two in southern Shawano Counties. I have only found it in this area in the late fall, from October through early November. It is an annual migrant as far south as Gainesville, Florida (Kons and Borth 2016), and in some years with mild winters it survives and can be found year round, whereas other years it is found only in the late summer and fall. Rings et al. (1992) report it is an abundant migrant in Ohio. Some Appleton records are shown in Kons (2016, 2019).

***Melipotis perpendicularis* (8598):** This tropical species is an ephemeral migrant in the Gulf Region but a rare stray northward. Remarkably there are two recent records for Appleton: UV light, 8 August 2019; MV trap, 29 July 2020. I am aware of one other Wisconsin record, collected by Robert Borth in boreal forest in the Door County peninsula, MV sheet, 28-29 July 1995. A photograph of this specimen is shown on BOLDSystems (2022).

***Melipotis fasciolaris* (8599):** This tropical species is an ephemeral migrant as far south as Gainesville Florida (Kons and Borth 2006), where it can be common to absent, depending on the year. In northern Florida this species is a widespread generalist found in many habitats (Kons and Borth 2006). Until recently, I was not aware that this species migrated north of the Gulf Region. However, I collected three specimens in Appleton in 2019: MV trap, 20, 30 September, 9 October. During the same year, Kyle Johnson collected a specimen in Crawford County in southwestern Wisconsin on 23 September. In northern Florida, I have found this species more often at bait than at lights, although in the Lower Rio Grande Valley of Texas it came more readily to lights.

***Melipotis indomita* (8600):** This species is a common and widespread generalist in the southwestern states but a rare stray as far north as Wisconsin. I have collected one specimen from Appleton: bait trap, 9 July 2018.

***Melipotis jucunda* (8607):** From 1989-1996 I did not collect or examine any specimens from Wisconsin, but I have collected three specimens recently: the Navarino Wildlife Area record in Table 3 and two specimens from Appleton in 2018: MV trap, 8 July; bait trail, 8 August. This species exhibits different ranges of phenotypic variation in different parts of its range. In the northern part of the Lower Austral Zone in southern Indiana, southern Missouri, and coastal Virginia there is little infraspecific pattern variation, and the Navarino and the later Appleton specimen are typical of the phenotype present in these areas. The earlier Appleton specimen looks like a phenotype present in western Oklahoma and central/western Texas, suggesting the two specimens recorded from Appleton may originate from different parts of the range.

***Ascalapha odorata* (8649):** I have collected twelve specimens of this tropical species in Outagamie County between late June and early August. Two are from 1991 and 1995, and the remainder are from 2017, 2018, and 2020. The records include: Appleton: bait trap, 31 July 1991; bait trap, August 1995; bait trail, 28 June, 21 & 22 July 2017; bait trail, 28 July, 8 August 2018; bait trap, 18 July 2020; bait trail, 23 July 2020; Mosquito Hill, hilltop bait trail, 10, 24 July 2020; Fallen Timbers: bait trail, 20 July 2020. All of the specimens have been somewhat worn with chipping in their wings, thus there is nothing to suggest the species ever breeds in the area. While I have seen numerous individuals from Gainesville, Florida, those specimens have not been in fresh condition either so apparently it does not breed even that far south. While all the local records are between late June and early August, it flies as late as November in Gainesville, Florida (Kons and Borth 2006). As discussed in the introduction, this is the only southern migrant with more than a couple records where no individuals have been found in fresh condition. The three 2017 specimens are shown in Kons (2019) under Noctuidae: Erebininae.

***Lesmone detrahens* (8651):** This species migrates north during some seasons from its permanent range in the Lower Austral Zone where it is a widespread generalist, as reported for northern Florida in Kons and Borth (2006). From 1989-1995, I found a single specimen in Outagamie County: Mosquito Hill, prairie planting, UV trap, 23 August 1993. Since 2016 six specimens have shown up in Outagamie County, all at bait. Records include: Fallen Timbers, Aspen Circle, hydric hardwood forest, bait trail, 18 Sept. 2018, 5 September 2021; Old Stone Bridge Trail, mesic hardwood forest/fields, bait trail, 1 September 2018 (2); Appleton, bait trap, 4 August 2018, MV trap, 5 August 2018. Unlike most ephemeral migrants, more individuals were found in more natural habitats than the suburban Appleton yard from 2016-2020.

***Zale aeruginosa* species 2 (8694):** This name is being applied to what is likely a complex of two allopatric species, a univoltine species (species 1) which occurs in the Canadian and Northern Transition Zones, and a multivoltine

species (species 2) which occurs in the Upper and Lower Austral Zones and is common in the Gulf Region. More taxonomic research is needed to confirm there are two species and what characters separate them.

Species 2 is represented by one stray from Appleton. It was collected in an interval from July-September 2011 by Hugo Kons Sr. Other Wisconsin specimens I have collected or examined are species 1, which can be common at bait in the Canadian and Northern Transition Zones, but is poorly known in Outagamie County.

***Caenurgia chloropa* (8733):** This species is a rare stray from the Austral Zone where it is widespread in grassland habitats. I have collected one specimen in Appleton: MV trap, 8 September 2015.

***Mocis latipes* (8743):** From 1989-1996 I only collected one specimen from Wisconsin: Portage County: Schmeckle Reserve, bait trap, 22 September 1993 (Kons 1996). Since 2016 I have collected 23 specimens in the Outagamie County area. It is clearly an ephemeral migrant rather than established, as all records are from the late summer or fall, and it is not present every season. In northern Florida this is a common and widespread habitat generalist found year round (Kons and Borth 2016), but to my knowledge it only occurs as a migrant north of the Gulf Region. The phenology records on MPG (2022) north of the Gulf Region are primarily from the late summer and fall, consistent with a migratory hypothesis. Two 2016 records from Appleton are shown in Kons (2016).

***Mocis texana* (8745):** The core range of this species is the Upper Austral and northern Lower Austral Zones, where it is widespread. While it has been found a number of times in southwestern Wisconsin by Robert Borth and Tom Barina, it rarely strays north to Outagamie County. Unlike the preceding congener, there is no trend of increasing records in recent years. The four area records are: Appleton: bait trap, 29 August 1991, bait trail, 4 September 2018; Mosquito Hill: hilltop, mesic hardwood forest/grassland, bait trap over cliff, 29 August 1991; Fallen Timbers: hydric hardwood forest, Aspen Circle bait trail, 18 September 2018.

***Catocala piatrix* (8771):** While I have collected and examined numerous specimens of this species from southwestern Wisconsin (Dane County and west), it is a rarity in Outagamie County recorded by three specimens. Given the massive baiting effort in Outagamie County, and that this species comes readily to bait when it is working, I suspect the few Outagamie County specimens are southern strays. The 2022 record from Mosquito Hill in Table 3 is the only recent specimen from Outagamie County, and the specimen is worn. Other records are Mosquito Hill, 23 August 1994, bait trail on south side of hill; private yard adjacent to Plamann County Park, inverted cone bait trap, collected by Richard Merkhofer.

***Catocala epione* (8773):** This is one of the most common and widespread of the Juglandaceae feeding *Catocala* species over much of eastern North America. It is a resident species in Wisconsin's southern counties, but only one worn specimen has turned up in Outagamie County: Mosquito Hill: mesic hardwood forest on south side of hill, bait trap, 16 August 1990. Mosquito Hill has a diverse array of Juglandaceae feeding *Catocala* species, with thirteen species reported in Kons (2014) plus recent colonizations of *C. residua* and *C. insolabilis*. I have made numerous recent surveys of the Juglandaceae habitats during the flight season of *C. epione*, and have re-recorded all of the Juglandaceae feeding *Catocala* species found in the 1990s other than two species recorded from single individuals: *C. epione* and *C. vidua*. All indications are the record was an isolated stray, despite its presence in an area with hostplants.

***Catocala vidua* (8792):** The core range of this Juglandaceae associated species is the Upper Austral and northern Lower Austral Zones. It occasionally shows up in southern Wisconsin. However, to my knowledge, records are isolated single captures, with no evidence of resident populations. I have collected it twice in Outagamie County: Mosquito Hill, mesic hardwood forest, south side of hill, bait trap, 15 September 1991; Appleton, bait trap, 14 September 2019. Recent surveys in Juglandaceae habitats at Mosquito Hill have not produced any additional records.

***Catocala maestosa* (8793):** The core range of this species is the Lower Austral Zone, but it rarely strays north to Wisconsin. I have one record from Appleton: bait trap, 29 August 1991. I am aware of one other Wisconsin specimen, collected by Robert Borth in Milwaukee County: Poplar Drive, bait trap, 18 September 2008.

***Catocala lacrymosa* (8794):** This species inhabits the Upper and Lower Austral Zones, but I am aware of only isolated single captures for Wisconsin. I have only one record (of a worn specimen) from Outagamie County: Appleton: bait trap, 16 September 2015.

***Catocala luciana* (8808):** This is the only species recorded from the coverage area that I classify as an ephemeral resident. The permanent range of *Catocala luciana* is the Great Plains east of the Rocky Mountains and west of the Eastern Deciduous Forest Biome. However, evidently this species establishes temporary populations in suburban areas of the Upper Midwest east of the permanent range. I recorded this species in Appleton between 1990 and 1995 but did not find it with recent surveys. The local flight was mid August to mid September, but only two specimens were found in August. From 1992-1995 my September Appleton surveys were limited to some weekends. Records include: 28 August, 4, 10, 14, 15 September 1990, 7 September 1991, 17 September 1992, 20 August 1995. All these specimens were collected in bait traps, mostly the minnow trap design. I ran bait traps in the same area throughout August and September from 1988-1989 without finding any *luciana*.

This species was historically found at Whitefish Bay in Milwaukee, Wisconsin, by George Balogh and Robert Borth, with the last record from 10 August 1967. Both the suburban Appleton site and Milwaukee site contained the exotic poplar species *Populus alba*, although I do not know if this association is purely coincidental. When I was finding *luciana* in Appleton there were at least six *Populus alba* trees within one city block, including a large one in the neighboring yard. All them were cut down sometime after 1996. When September Appleton surveys resumed in 2015 there was only one immature *Populus alba* tree in my yard; it had been started from a sprout the year after the tree was cut down in the neighboring yard.

***Paectes pygmaea* (8959):** The taxonomy of the *Paectes pygmaea* species group is problematic, with four species going under two names as discussed in Kons et al. (2017). An adult male and associated genitalia of each of the four species is shown in Kons (2013), along with diagnostic genitalic characters that separate each species. *Paectes pygmaea* inhabits the Upper and Lower Austral Zones, and rarely strays north to Wisconsin. Two records for Outagamie County are: Mosquito Hill, floodplain forest edge/wet-mesic prairie planting, MV trap, 24 July 2020; Appleton, MV Trap, 17 July 2016. I have one other Wisconsin specimen: Waukesha County, Ottawa Lake Campground, mesic hardwood forest/fields, UV light, 10 August 1993.

***Paectes abrostoloides* (8962):** This species is common and widespread in the Lower Austral Zone and rarely strays north to Wisconsin. I have found the larvae on *Liquidambar styraciflua* numerous times in Florida, and while *P. abrostoloides* shows up in many habitats, in my experience this tree is present where the moth is common. USDA (2022) maps for *L. styraciflua* show that the main distribution begins in southern Illinois and Indiana, with no occurrences near Wisconsin. I have three Wisconsin specimens of *P. abrostoloides*: Outagamie County: Appleton: 2018: MV Trap, 27 August, bait trap, 3 October; Walworth County, Whitewater Lake Recreation Area, mesic hardwood forest, UV light, 8 August 1992.

***Garella nilotica* (8974):** From 1989-1996 I only collected one specimen in Outagamie County, from 8 September 1995 in a UV trap on the south side of Mosquito Hill. I have collected over 54 specimens in the area since 2016 (some additional records have not yet been entered into the database, and a number of other likely individuals were seen but not collected), and the species has been found in Outagamie County every year since 2016. It still appears to be a migrant rather than a resident. During some years (including 2022) it was found only in the fall, whereas in other years it has been found as early as June. It could be considered an annual migrant now, although historically it apparently did not migrate into the area during most seasons. Several Appleton specimens are shown in Kons (2019), under “Noctuidae: Chloephorinae.”

***Meganola phylla* (8983.1):** This species is a common and widespread generalist in the Lower Austral and southern Upper Austral Zones. It rarely strays north to Outagamie County. The two records are: Mosquito Hill, hilltop, mesic hardwood forest/grassland, UV trap, 30 July 1995; Appleton, MV Trap, 2 August 2018.

***Nola cereella* (8991):** This species is an annual migrant and widespread habitat generalist in the Gulf Region, as reported for northern Florida in Kons and Borth (2006). It is a rare stray as far north as Wisconsin, found once in Outagamie County: Appleton: MV trap, 8 September, 2015.

***Amyna stricta* (9070):** This migrant is uncommon as far north as Outagamie County, and has only been found from late August-late October. Only one specimen was found in 2022, on a night with a strong south wind (Table 3). At the latitude of Gainesville, Florida, it is an annual migrant that is variable in abundance and flight season (Kons and Borth 2006). During some years it might survive mild winters there, as some specimens have been found in January and February, but the bulk of north Florida records are from the fall. The northern extent of the permanent range appears to be subtropical areas, and it flies year round in south Florida. Several Appleton records are shown in Kons (2016, 2019).

***Amyna bullula* (9069):** This tropical species rarely strays north to Gainesville, Florida, but strays are less uncommon in Texas. Rings et al. (1992) reported a single Ohio record from 1902. Remarkably, there is a recent record from Appleton: MV trap, 27 September 2018.

***Oruza albocostaliata*, or species near (9025):** I tentatively regard single specimens I have collected in Jackson and Shawano Counties (Table 3) as southern strays. The Jackson County record is: Kling Road, oak-pine forest with small barrens openings, UV trap, 3 July 1993. These specimens are worn, but they also appear a little different phenotypically from my large series of specimens from the Lower Austral Zone. Also, both are from localities where I have done few collecting trips between early July and early August. An alternative hypothesis is that these specimens represent a disjunct second species in the Central Sands biogeographic region of Wisconsin (I consider the Navarino Wildlife Area to be part of the Central Sands based on the habitats and Lepidoptera fauna, as discussed at the end of this paper), but I do not have enough material for a taxonomic evaluation. The specimens that have been sequenced for COI mitochondrial DNA on BOLDSystems (2022) are typical phenotypes from the southeastern states.

***Hyperstrotia pervertens* (9037):** This species inhabits the Upper and Lower Austral Zones, and rarely strays north to Wisconsin. I have two Wisconsin specimens: Outagamie County: Appleton: MV trap, 10 July 2018; Green County: Muralt Bluff Prairie: dry prairie/mesic hardwood forest, UV sheet, 18 July 1992.

***Hyperstrotia flavigutta* (9039):** This species occurs primarily in the Lower Austral Zone, where it is usually associated with xeric habitats (Kons and Borth 2006), although it occurs in mesic-hydric fields in southeastern Indiana (Kons and Borth 2012). Apparently this species sometimes strays well north of its range as I found one specimen at Mosquito Hill: wet-mesic prairie planting near edge of floodplain forest, MV trap site 10, 2 September 2020. This species does not fit the usual pattern of species that migrate long distances being widespread habitat generalists, as it is somewhat localized in occurrence in its native range.

***Marimatha nigrofimbria* (9044):** This is one of the most abundant and widespread habitat generalist noctuids in the Upper and Lower Austral Zones, but it is an uncommon ephemeral migrant as far north as Outagamie County. I have collected five specimens from the area: Appleton: 29, 30 September 1995; UV light, 22 September 2017; MV trap, 5 September 2018; Mosquito Hill: wet-mesic prairie planting near floodplain forest edge, MV trap, 2 September 2021.

***Perigea xanthioides* (9689):** With the exception of the single Outagamie County record from Mosquito Hill in Table 3, all other specimens I have collected or examined from Wisconsin are from the southwestern Counties, including Swamplovers Preserve in Dane County. Reported hostplants include *Eupatorium purpureum* and *Veronia* (Covell 1984), both of which occur at Mosquito Hill, as well as other local study sites where I have not found *P. xanthioides*. In northern Florida [and elsewhere in the southeastern U.S.] this species is a widespread habitat generalist (Kons and Borth 2006) present in many localities lacking these plants; thus, I think there must be additional hostplants.

***Condica mobilis* (9693):** A fresh specimen collected on 27 September 2017 in Appleton (shown in Kons (2019), under "Noctuidae: Condicinae") is the only area record to date. *Condica mobilis* is a widespread resident in the Gulf States, including northern Florida (Kons and Borth 2006). Rings et al. (1992) only reported one record from Ohio, from Scioto County in 1987.

***Condica sutor* (9699):** From 1989-1996, I collected only one specimen of this species in Wisconsin: Kenosha County, Chikwaukee Prairie State Natural Area, UV Sheet, 24 September 1994. Since 2016, I have collected or photographed 57 individuals in the Outagamie County area, and additional likely individuals were seen but not documented and recorded. In the Gulf Region this species is a widespread generalist, and it flies year round in northern Florida (Kons and Borth 2006). The local records are from mid August to early November, and it is not present during every season, strongly indicating migratory status. In 2022, this species did not show up until early November, when it was found on two nights with a strong south wind. Photos of some Appleton records are shown in Kons (2016, 2019).

***Condica confederata* (9714):** This tropical species occurs as an ephemeral migrant in northern Florida (Kons and Borth 2006). I collected one specimen in Appleton: MV trap, 21 October 2017. Rings et al. (1992) report two Ohio records, from 1880 and 1933. Kons and Borth (2021, Figure 11) report a 2018 record from Stoddard County Missouri from 8 June, remarkably early in the season so far north of the permanent range.

***Micrathetis triplex* (9644):** This species is common and widespread in the Sonoran Zone of Texas, and also occurs in south Florida. Brou (2010) reports that it migrates to Louisiana, with most records from the fall. It apparently migrates northward as well, as I have collected one specimen in Outagamie County: Mosquito Hill: hilltop, mesic hardwood forest/grassland, MV trap, 10 July 2020.

***Mouralia tinctoides* (8884):** This tropical species is an ephemeral migrant as far south as northern Florida (Kons and Borth 2006). Surprisingly, I collected one specimen in Appleton: MV trap, 21 October 2017, the same night *Condica confederata* was found. Prior to this collection I had not collected or examined a specimen north of the Gulf Region. The MPG (2022) distribution map shows most records from Florida to Texas, but there are distribution dots for eastern Kentucky, northern Georgia, and northern South Carolina.

***Argyrogramma verruca* (8885):** This species is a common and widespread habitat generalist in the Gulf Region, as reported for northern Florida in Kons and Borth (2006). It is a rare stray as far north as Wisconsin, where I have collected a specimen in Appleton: MV Trap, 17 August 2017.

***Enigmogramma basigera* (8886):** The core range of this species is the Lower Austral Zone, where it is a widespread habitat generalist. It apparently strays northward on occasion, but perhaps infrequently as Rings et al. (1992) reported only one record for Ohio, yet the species is common in southeastern Indiana (Kons and Borth 2017). I have collected two specimens in Wisconsin: Outagamie County: Appleton, MV Trap, 30 September 2019; Kenosha County, Chiwaukee Prairie, UV sheet, 24 September 1994.

***Trichoplusia ni* (8887):** This species migrates into the Outagamie County area during most seasons but it is usually encountered in low numbers on individual survey nights. There is no obvious trend of greater abundance in recent times versus the early and mid 1990s; for example, only three individuals were found during 2022, but all were in fresh condition. Lingren and Green (1984) reported that this species is of subtropical origin and only overwinters in the Gulf States, Georgia, and South Carolina. Several Appleton records are shown in Kons (2016, 2019).

***Ctenoplusia oxygramma* (8889):** I only collected three specimens of this species in Outagamie and Portage Counties from 1989-1995: Mosquito Hill, prairie planting, diurnal, 30 September 1995; Portage County: Schmeckle Reserve: 16 September 1993, 5 September 1995. However, I have recorded 35 individuals in Outagamie County since 2016. Several Appleton records are shown in Kons (2016, 2019). It is an annual migrant as far south as northern Florida, where it is a widespread habitat generalist (Kons and Borth 2006).

***Pseudoplusia includens* (8890):** There are still seasons when this species is rare or absent, but in its best years it is clearly more common than during the best years from 1989-1995. It was not common in the Outagamie County area during 2022 (Table 3). It was much more common in 2021, when I saw at least 34 individuals on 16 Sept. at Mosquito Hill (photographs and specimens) but the actual number was probably over 200, including additional individuals not examined closely enough to identify but which were probably this species. Individuals without specimens or very clear photographs cannot be positively identified due to similarity with *Autographa precatonensis*, which usually flies with it. On this single night the minimum number of individuals observed was greater than the total number I documented in Outagamie and Portage Counties from 1989-1995. Kons and Borth (2006) reported that this species was an annual migrant as far south as northern Florida; subsequently it did survive some mild winters in Gainesville, with records every month during some seasons. However, numbers are highest in northern Florida from August to October, as is the case in Wisconsin. Several Appleton records are shown in Kons (2016, 2019).

***Rachiplusia ou* (8895):** This migrant is usually uncommon in Outagamie County even during its best years. Only a few specimens were found in Outagamie County from 1989-1995: Appleton: 3 July 1991, 26 September 1992, 30 August 1995; Mosquito Hill, prairie planting, diurnal, 30 September 1995. At least 16 were found at Schmeckle Reserve in Portage County from 1992-1995, although it was only found on eight different nights (Kons 1996). Recent records include: Outagamie County: Appleton: MV trap, 10 September 2015; UV light, 10 September 2016; MV trap, 15 September 2016; 16 June, 20 July 2017; UV light, 21 July 2017; MV trap, 23 September 2017; bait trail, 25, 26 September 2017; nectaring on gold *Lantana*, 26 September 2017; bait trail, 31 July 2018; MV trap, 4, 11 August 2018; UV light, 20 September 2018; MV trap, 8 October 2018; UV light, 29 August 2021; Mosquito Hill: MV trap, 3 September 2021; Fallen Timbers: UV trap site 2, 17 September 2018; MV trap site 20, 5 September 2021; Fox Cities Paper Trail by Fox Valley Tech.: UV trap, 8 October 2021; Power Line Cut at NW Corner of N Bluemound Drive X Hwy 96: UV trap site 3, 26 September 2020; netted, 30 August 2021; Winnebago County: Wiouwash

Trail just S of county line: sedge meadow, netted, 30 August 2021; UV trap site 1, 8 October 2021; 2022 (Table 3). Several Appleton records are shown in Kons (2016, 2019).

***Megalographa biloba* (8907):** This migrant is usually uncommon in the Outagamie County area. In 2022, it did not show up until early November, but in some seasons it has been found as early as late May. One Appleton specimen from 7 October 2017 is shown in Kons (2019).

***Tarachidia semiflava* (9085):** In the Lower Austral Zone this is a widespread generalist found in many habitats, as reported for northern Florida in Kons and Borth (2006). This species apparently undertook a northward migration in 1995, when I collected two specimens in mid June: Appleton, lighted sheet, 16 June; Mosquito Hill: hilltop, mesic hardwood forest/grassland, UV trap, 18 June.

***Spragueia leo* (9127):** This species is a common and widespread habitat generalist of the Upper and Lower Austral Zones. It apparently strays northward on occasion. I collected one specimen in Appleton in an MV trap on 15 August 2018. I had one previous Wisconsin specimen from Waukesha County: Ottawa Lake Campground, mesic hardwood forest/fields, UV sheet, 11 August 1993. Given that I only found one specimen in Waukesha County with extensive collecting there in 1992 and 1993, and that this species comes readily to the UV lights I was using, at least at that time this specimen was almost certainly a stray as well. The current MPG (2022) map has four distribution dots for southwest Wisconsin. I did not see any specimens of *S. leo* in collections Robert Borth and Tom Barina made from southwest Wisconsin in the early and mid 1990s, so perhaps the species is migrating north more frequently or expanding its range northward in recent years.

***Acontia aprica* (9136):** This species is common and widespread in grasslands with an extensive range in the Austral and eastern Sonoran Zones, but it appears to be a rare stray in Wisconsin. The only area record is: Mosquito Hill: MV sheet, prairie planting near floodplain forest edge, 23 August 2022. I also have two somewhat worn specimens from southeastern Wisconsin: Kenosha County, Chiwaukee Prairie, UV sheet, 18 August 1993; Waukesha County: Scuppernong Prairie State Natural Area: flushed from mesic prairie during the day, 28 July 1993.

***Acontia terminimaculata* species complex (9145):** There may be two species going under this name. Most specimens are a species that occurs along the Atlantic and Gulf Coasts. A possible second and much more poorly known species has been found disjunctly in the Midwest and eastern Canada. My only Wisconsin specimen of the possible second species is one worn individual from the top of Mosquito Hill that I collected on 21 July 1992; I have seen another Wisconsin specimen in better condition collected by James Parkinson but I did not record the data. Given that only one worn specimen has shown up on Mosquito Hill with repeated sampling, it is presumably either a stray or disperser. I don't know of any locality where the Midwest species has been found reliably and I am unsure of its permanent range. Rings et al. (1992) report two county records of *terminimaculata* in Ohio, both based on single specimens. The National Museum of Natural History has specimens from Illinois. Rockburne and Lafontaine (1976) reported *terminimaculata* from Marmora, Ontario and Trenton, in eastern Quebec. Rockburne and Lafontaine (1976) report that *terminimaculata* has been reared on basswood (*Tilia americana*), but I doubt this is used as a host in nature. The USDA (2022) distribution map shows that *Tilia americana* is absent from nearly the entire range of the coastal species. *Tilia americana* is a common and widespread plant in Wisconsin, yet the moth is clearly not.

***Cirrhophanus triangulifer* (9766):** I collected one worn specimen in Appleton in an MV trap on 24 August 2018, which is undoubtedly a stray. Rings et al. (1992) report that the species is common in Ohio and have distributional records from the northern edge of the state. In southeastern Indiana (Posey County) Kons and Borth have collected this species in open wetlands and mesic fields.

***Callopietria floridensis* (9630):** The first time I collected this species in Wisconsin was on 1 November 2016 when a single specimen was found in Appleton, shown in Kons (2019). I subsequently recorded over 25 individuals in 2018 from four localities in Outagamie County (Kons 2019), although most individuals were found at bait in the suburban Appleton yard. I have found small numbers in the county every year since. I have found this species at bait much more often than at lights, both in Wisconsin and in the Gulf States. This species was reported as an annual migrant in northern Florida in Kons and Borth (2006), but subsequently it did survive during some seasons with mild winters and was found year round in Gainesville. It is a widespread generalist found in many north Florida habitats (Kons and Borth 2006). I also have recent specimens from Dane County, Wisconsin: Swamplovers Preserve: MV Trap, 24 August 2021; and Wheaton, IL: MV Trap, 15 August 2022.

***Heliothis virescens* (11071):** This is a common and widespread migrant and agricultural pest in the Austral and Sonoran Zones, but it rarely strays into Wisconsin. Kyle Johnson (pers. comm. 2023) collected a specimen at Mosquito Hill on 25 September 2017. I have one Wisconsin specimen from Waukesha County: Ottawa Lake Fen: UV trap, 9 August 1992.

***Heliothis phloxiphagus* (11072):** I am uncertain if Outagamie County specimens originate south or west of the area, but the species certainly does not appear to be a resident. On 26 May 1990, I collected one fresh specimen nectaring on Lupine at the upland portion of the prairie planting at Mosquito Hill, and observed an additional four probable individuals. I returned to the same area on 6 June and 20-21 June and did not see any more. I have also searched the Lupine at similar times of year during numerous subsequent seasons without seeing any more. Apparently the species was migrating through the area in numbers in late May of 1990 but gone by 6 June. I have encountered one other specimen in the area, a worn individual collected at an electric bug zapper near Roland Lake (Waupaca County) on 16 August 1988. The habitat in the area was mostly mesic fields and agriculture, with some mesic hardwood forest. In Texas, Oklahoma, and Missouri this species comes readily to MV lights in dry prairie and other xeric grassland habitats.

***Schinia lynx* (11117):** While this species is likely a resident in Wisconsin's southern counties, it appears to be a rare stray to Outagamie County as only one specimen has shown up: Appleton: MV trap, 25 July 2017. Most Wisconsin specimens I have collected or examined are from prairie or prairie planting, but Kons and Borth have found it in fields in Posey County, Indiana (Kons and Borth 2017).

***Schinia obscurata* (11118):** I am uncertain how far north this species is a resident, but in Outagamie County it appears to be a rare stray. The only records from the area are the Navarino Wildlife Area record in Table 3, and Mosquito Hill: 10 July 2020, UV trap at the edge of mesic hardwood forest facing an upland prairie planting (site 6). While xeric grasslands are a typical habitat for this species, if it was established in the area, multiple records would be expected from Mosquito Hill, given the amount of sampling effort.

***Schinia jaguarina* (11132):** Kons and Borth have collected this species in Texas, Oklahoma, Missouri, and Florida in various types of xeric grasslands. The only specimen I have collected in Outagamie County is from Mosquito Hill: UV trap site 6, mesic hardwood forest/facing into prairie planting, 10 July 2020. Dry prairie is a typical habitat for this species, but if it was a resident rather than a stray, more records would be expected by now, as this species comes readily to lights. There are multiple fresh specimens from LaCrosse County (western edge of Wisconsin) in the National Museum of Natural History, and perhaps the species is a resident in that poorly studied part of the state?

***Schinia thoreau* (11141):** The only specimen I have collected in Outagamie County was in an MV trap in Appleton on 20 July 2019. The reported host, *Ambrosia trifida*, colonized the neighborhood in 2021, but I do not recall seeing it in the area previously. No more specimens of the moth have shown up, but the Appleton survey was scaled back after 2020. I have not seen the hostplant at my other study sites in the Outagamie County area. It was present at Swamplovers Preserve near where I ran a light trap from 14-24 August 2021, but I did not find the moth. Kons, Borth, and Barina had no Wisconsin records of this species from 1989-1995, but the current MPG (2022) map shows several distribution dots for southern and western Wisconsin. I suspect these records (if authentic-the similar *Schinia rivulosa* occurs in those areas) represent recent colonizations or migration trends. The early Appleton collection date is surprising, even more so given the specimen was not in fresh condition. In southwestern Indiana (Posey County) Kons and Borth have collected *S. thoreau* in fresh condition in mid and late August.

***Schinia bifascia* (11142):** I have collected one specimen in Wisconsin/Outagamie County: Fallen Timbers: prairie planting/field near edge of hydric hardwood forest, MV trap, 17 September 2018. Rings et al. (1992) state this species is locally common in Ohio but limited to the Bluegrass Region of Adams and Scioto Counties (extreme southern Ohio); thus, an Outagamie County specimen is rather surprising, even as a stray. Kons and Borth have found this species common in fields in southern Indiana (Posey County) (Kons and Borth 2017).

***Schinia trifascia* (11149):** While this species is a resident of Wisconsin's southern counties, it appears to be a rare stray to Outagamie County, where I have collected only one specimen: Fallen Timbers: hydric hardwood forest/field, UV trap, 16 August 1994. This species was common at Swamplovers Preserve in Dane County from 14-24 August 2021, but uncommon in the Southern Kettle Moraine State Forest in Waukesha and Walworth Counties from 1992-1993. In north Florida this is an abundant widespread habitat generalist (Kons and Borth 2006). Many of the

Wisconsin specimens I have collected or examined are from prairies or prairie plantings, but some are from common field habitats.

***Schinia gaurae* (11168):** This species inhabits various grassland habitats south of the Transition Zone in both the Austral and Sonoran Zones. I have only collected one specimen in Outagamie County/Wisconsin, presumably a stray: Mosquito Hill: wet-mesic prairie planting near edge of floodplain forest, MV trap site 10, 2 September 2020.

***Schinia nundina* (11177):** The only Outagamie County record is from Mosquito Hill in the same MV trap sample as for *S. gaurae* (above). I tentatively consider this species to be a stray since only one worn specimen has turned up in Outagamie County, and most Wisconsin specimens I have collected or examined in good condition are from the southern counties. However, this species is often uncommon at lights and may be difficult to detect at sites where it is present. Upland prairie is a typical habitat for this species in Wisconsin, and Mosquito Hill has upland prairie planting near where the trap was placed, as well as xeric grassland with some prairie vegetation on the top of the hill. Furthermore, in southeastern Indiana, Kons and Borth found this species in mesic grasslands adjacent to floodplain forest, so the area right around the trap could be potential habitat as well. The UW-Stevens Point collection contains two specimens in fairly good condition from Stevens Point (Portage County), with no specific locality. I searched for this species without success at Emmons Creek Public Hunting Area (Portage County) in an extensive oak-pine barrens grassland with plentiful *Solidago*; I thought this locality would have good prospects if *S. nundina* was a resident as far north as Portage County. It also did not turn up in the extensive surveys of Schmeeckle Reserve (Kons 1996), which contains a small amount of xeric grassland habitat.

***Schinia tertia* (11179):** This species is a rare stray from the Sonoran Zone, found once in Appleton: 9 September 2015, diurnal on *Solidago* blossoms.

***Acrionicta clarescens* (9246):** Surveys by Kons, Borth, and Barina in the early and mid 1990s turned up a few specimens in the southern Wisconsin counties of Grant, Green, Waukesha, and Walworth, but we had no records farther north. Recent surveys in Outagamie County have yielded six specimens, generally in good condition, but it does not appear to be established as it has not been found consistently in any locality. Outagamie County records include: Mosquito Hill, bait trail on hill just below summit, mesic hardwood forest, 2 September 2020; Appleton, bait trap, 10 August 2018; MV Trap, 4 September 2018; bait trail, 4 September 2018; MV Trap, 12 August 2019; MV Trap, 19 June 2020.

***Acrionicta impleta* species 2:** Two diagnosable phenotypes have been called *impleta*, a univoltine phenotype that I have seen only from the Canadian and Transition Zones, and a multivoltine phenotype that occurs mostly in the Upper and Lower Austral Zones. I have collected both phenotypes in Outagamie County and Appleton, but only one specimen of the multivoltine phenotype which I presume is a stray. The univoltine phenotype occurs at Mosquito Hill, Fallen Timbers, and the Navarino Wildlife Area, and one specimen from Appleton surely represents a disperser. I have not compared genitalia or COI 5' sequences, but since the wing pattern difference corresponds to a voltinism difference, and both phenotypes have been found in sympatry with no intermediates, I consider the two phenotypes to represent separate species. The Appleton record of the multivoltine species is 18 August 1991.

***Apamea cristata* (9331):** 2022 was the second season I found this species in the area; there was a single previous specimen from Appleton: bait trap, 8 July 2018. The two July specimens from 2022 were worn, but the June Navarino specimen was in remarkably good condition (Table 3). Robert Borth has collected a fresh specimen from Dewey Heights Prairie in Grant County (southwest corner of Wisconsin). It might occur as isolated strays in the Outagamie County area, but the fresh condition of the Navarino specimen raises the possibility that it has recently become established. Some Apameini rarely come to lights and bait and thus are difficult to detect by surveys with standard techniques, so it is possible to obtain few records of a resident species even with extensive surveys.

***Apamea vulgaris* (9332):** This species may be resident in Wisconsin's southwest counties, as Robert Borth has collected two fresh specimens at Nelson Dewey State Park in Grant County. However, the four specimens that have shown up in Outagamie County have all been quite worn, so the species appears to occur there only as a stray. The records are from Appleton: 9 June 1991 (dissected); bait trap, 9 July 2018; bait trail, 22 July 2018; bait trap, 13 June 2021 (dissected). There may be additional records of very worn specimens, but additional dissections would be needed to check these identifications. While fresh specimens are readily identifiable, very worn specimens can be confused with other species.

***Papaipema beeriana* (9508):** This species is a habitat specialist usually found in wet prairie remnants with plentiful *Liatris*, the larval host reported by Hessel (1954). It is locally common in wet prairie/fen/sedge meadow complexes in southeastern Wisconsin, including the Kettle Moraine Fen and Low Prairie (Waukesha County) (Kons 2001), Scuppernong Prairie and Genesee Prairie-Fen (Waukesha County), and Chiwaukee Prairie (Kenosha County). There are a few records from other habitats, including Canadian Zone oak-pine barrens in Marinette County (28 August 1995), and Lake Michigan interdunal wetland in Sheboygan County (13 September 1991, Robert Borth). On 1 September 1995, I collected a somewhat worn specimen at Fallen Timbers. The record is baffling in part because it is earlier in the season than all of my records from southeastern Wisconsin, and also at the time I was not aware of any *Liatris* at Fallen Timbers. Yet the specimen looks like a typical *P. beeriana* from the prairies of southeastern Wisconsin. *Liatris* was subsequently planted at Fallen Timbers, and I have surveyed this habitat multiple times without finding any more *P. beeriana*. The prairie planting at Mosquito Hill has wetland and upland species of *Liatris*, and likewise multiple surveys have not uncovered *P. beeriana*. The sand barrens at the Navarino Wildlife Area have multiple species of upland *Liatris*, and I did not find *P. beeriana* there with a trap placed in the area with the highest density of *Liatris* that I could find, although survey in this habitat was limited to a couple of UV trap samples when weather was not optimal. The 1995 specimen appears to be a stray, and the species has not colonized sites that now appear to have suitable habitat. However, several other *Papaipema* species have expanded their range northward and colonized Outagamie County, as they have been found in numbers during multiple seasons with recent surveys but were not found in surveys from 1992-1995. These species include *Papaipema rigida*, *P. sciata*, *P. nelita*, *P. baptisiae*, and *P. silphii* (undocumented). *Papaipema circumlucens* may be another addition as a fresh female was found at Mosquito Hill in 2022, near a possible larval host, *Apocynum*.

***Achatodes zae* (9520):** This species has shown up in Outagamie County as three isolated records of specimens in fair to worn condition; thus, I suspect these specimens are strays. However, in my experience this species is usually uncommon even in its core range in the Upper and Lower Austral Zones, although it does not appear to be particular in habitat. It may be a species that seldom comes to lights and bait, making it difficult to detect during biodiversity inventories. However, Rings et al. (1992) reported it is abundant in Ohio. Outagamie County records include: Appleton: 25 July 1990; bait trail, 11 July 2018; Mosquito Hill: mesic hardwood forest/upland prairie planting, bait trail, 18 July 2021.

***Bellura densa* complex species 1 (9526):** I have found the typical southern phenotype of *Bellura densa* only once in Outagamie County, in suburban Appleton in an MV trap on 16 August 2020. The specimen was in fresh condition, but because only one specimen has turned up with extensive collecting, I don't think it is established in the area. It certainly is not a resident of the suburban yard as the reported hostplants (cattails, pickerelweed, and water hyacinth (Covell 1984)) occur in emergent wetlands. The emergent wetlands of the the Wiouwash Trail in northern Winnebago County are replete with cattails, but surveys in these habitats during the flight season have not uncovered it. I collected four specimens in Waukesha County wetlands from 1992-1993, and I suspect these are from a resident population, given the species' presence in appropriate habitat for two consecutive seasons. These records include: Ottawa Lake Fen State Natural Area: calcareous fen/sedge meadow/emergent wetlands on lake margin, 9 August 1992, 10 August 1993; Ottawa Lake Campground, mesic hardwood forest/field (a disperser, probably from the wetlands around the lake), 9 August 1992; Scuppernong Prairie State Natural Area, wet-mesic prairie/fen/sedge meadow/varied wetlands, 11 August 1993.

In 2022 I encountered a *Bellura* at the Navarino Wildlife Area that is similar to typical *B. densa* in pattern but much smaller in size. A single 15 watt UV trap run for part of a night at the edge of an emergent wetland collected 31 individuals, and some other individuals were found at an MV sheet in uplands in close proximity to this wetland. All individuals are fairly uniform in size, and distinctly smaller than any *B. densa* in my long series from the southern states. In contrast, my specimens from Appleton and Waukesha County are normally sized and indistinguishable from some specimens from Florida and Texas. There was a species of Lily in the wetland that I have not seen at any of my other collecting sites, and I suspect that this is the hostplant. The wetland is treeless with sedge meadow and some bog plants, including cranberry and leatherleaf. Given the consistent difference in size, and the abundance in a northern locality disjunct from the range of typical *B. densa*, I think this Navarino material represents a resident population of a separate species. Overall the taxonomy of *Bellura* is problematic, and the number of species in the southern states is unclear. *Bellura* species I have collected in Wisconsin include: *obliqua* (widespread), *brehmei* (Canadian and Northern Transition Zones), *vulnifica* (Outagamie County and north), *gortynoides* (Waukesha County), *densa* complex (discussed above), and a phenotype sometimes identified as *anoa* (Waukesha County).

***Properigea costa* (9589):** I have mainly encountered this species in xeric grasslands such as short grass prairie in the Austral/Sonoran boundary area of Oklahoma and Texas. I have seen two specimens from Wisconsin. Robert Borth collected a fresh specimen at Dewey Heights Prairie in Grant County, and I have collected one specimen on the top of Mosquito Hill: MV trap site 4, 10 July 2020. I suspect the Mosquito Hill specimen is a stray as only one specimen has been found there despite multiple surveys during its flight season, and this species comes readily to lights in its core range. On the other hand, there is xeric grassland with prairie elements on the top of Mosquito Hill, as well as upland prairie planting adjacent to the south side of the hill.

***Trachea delicata* (9626):** The core range of this species is the Upper Austral Zone, and Rings et al. (1992) reported it to be common in Ohio. During some years it migrates into Outagamie County, and this is one of the few ephemeral migrants that was more common historically than recently. I recorded it in the area in 1990, 1992, 1995, and 2021. The only record from 2016-2022 is one worn specimen found in Appleton: UV trap, 28 June 2021. Historical records include: Mosquito Hill: floodplain forest, UV trap, 18 June 1995; Fallen Timbers: bait trap, hydric hardwood forest, 20 July 1990, UV sheet, hydric hardwood forest edge/field, 23 June 1992; Appleton: 10 & 16 June, 7, 8, 9, 20 & 23 July, 1991; Winnebago County: Breezewood Lane: 25 August 1990.

***Magusa divaricata* (9637):** This tropical species is one of the most frequently encountered ephemeral migrants in the Outagamie County area. It is present during most seasons, and may first appear as early as July or as late as October. Some Appleton records from 2016 and 2017 are shown in Kons (2016, 2019). It is a habitat generalist with many records from the suburban Appleton yard. It is highly polymorphic with numerous different forewing pattern forms.

***Spodoptera exigua* (9665):** This species is a widespread habitat generalist and agricultural pest in the Lower Austral Zone, but it is a rare stray as far north as Outagamie County. My only record is: Appleton: UV trap, 28 June 2012.

***Spodoptera dolichos* (9671):** This species is a widespread habitat generalist in the Gulf Region, as reported for northern Florida in Kons and Borth (2006). It is a rare stray as far north as Wisconsin, where I have collected three specimens, all from Outagamie County: Fallen Timbers, bait trap, 2 November 1990; bait trap, 7 October 1995; Appleton: bait trap, 16 October 2016 (shown in Kons (2016)). The Appleton specimen is in fresh condition, whereas the other two specimens are worn.

***Spodoptera eridania* (9672):** This species is a widespread habitat generalist in the Gulf Region, as reported for northern Florida in Kons and Borth (2006). I have found three fresh specimens in Wisconsin, all from Appleton: bait traps, 15 & 16 September 2015; bait trail, 17 October 2016 (shown in Kons (2016)).

***Elaphria versicolor* (9678), *Elaphria grata* (9684):** These species are intriguing by having resident populations in the area during the summer, but apparently also migrating into the area in the fall during some seasons. The October and November records were from nights with a strong south wind when a variety of other migrants were recorded.

***Elaphria chalconia* (9679):** Through 1996, the only Wisconsin specimen I had examined was an old record from Milwaukee County in the National Museum of Natural History. When I collected in Appleton during June of 2012, I found two specimens on 8 and 28 June. These remain the earliest records to date. From 2016 through 2022, an additional 14 specimens have turned up, with flight dates ranging from mid August through early November. In the Gulf States this is a common and widespread generalist that flies throughout the year, as reported for northern Florida in Kons and Borth (2016). Seven Appleton records are shown in Kons (2016, 2019).

***Sericaglaea signata* (9941):** The only specimen I have collected in the area is the 2022 Navarino Wildlife Area record in Table 3. I have one other Wisconsin specimen, in worn condition, from April 1994 at the Dodge County wayside on Highway 41. Rings et al. (1992) report this species is abundant in Ohio.

***Discestra trifolii* complex species 1 (10223):** Two readily diagnosable wing pattern phenotypes occur in eastern North America. These phenotypes have different distributions and biologies, and I have seen no intermediates including where they are sympatric; thus, I think they represent separate species. Species 1 is a widespread habitat generalist in eastern North America except for the southeast. Phenology patterns suggest it is an annual migrant in the Outagamie County area, with first dates of recorded occurrences varying from mid May to early September between seasons (Figure 26). Species 2 is confined to the Canadian Zone, and in Wisconsin it occurs in the Door

County peninsula and along Lake Superior in Douglas and Ashland Counties. From 18-19 August 2017, the two species were flying together on the Door County peninsula near Baileys Harbor.

***Leucania adjuta* (10456):** I have collected twelve specimens in the Outagamie County area since 2016, mostly in fresh condition: Outagamie County: Mosquito Hill: UV trap site 22, south side of prairie planting near floodplain forest edge, 12 October 2021; Fallen Timbers: bait trail, hydric hardwood forest, 9 October 2021; Appleton: 2017, bait trail, 25, 26 September (2), 6 (2), 7, 17, 21 October; MV trap, 20 October; Shawano County: Navarino Wildlife Area: bait trail 3, mesic-hydric hardwood forest along hiking trail south of Pike's Peak flowage, 28 October 2021. Through 1996, I had only collected two Wisconsin specimens: Waukesha County: Scuppernong Prairie: UV trap, 10 September 1994; Kenosha County: Chiwaukee Prairie: UV light, 3 October 1992. This species is a common and widespread habitat generalist in the Gulf Region, as reported for northern Florida in Kons and Borth (2006).

***Leucania ursula* (10461):** This species is moving its range northward and is now common as far north as Dane County, Wisconsin, where I found many individuals at Swamplovers Preserve in 2021. Extensive surveys in southeastern Wisconsin during 1992 and 1993 produced only one specimen, possibly a stray: Waukesha County, sand prairie along railroad tracks west of Highway S, 17 August 1993. On 2 September 1999, Robert Borth collected a fresh specimen at Scuppernong Prairie in Waukesha County. I subsequently collected fresh specimens at Poplar Drive (Milwaukee County): 27 June 2009 and Mequon (Ozaukee County): 7 September 2015. I don't have enough recent data from southeast Wisconsin to know if it is established there. With extensive collecting, only three isolated records of single specimens have shown up in Outagamie County: Mosquito Hill, MV Trap site 6, mesic hardwood forest/upland prairie planting, 11 July 2021; Appleton, bait trail, 4 September 2018; UV light, 9 August 2021.

***Agrotis maldefida* (10661):** This species is a rare stray from the southwest found once in Appleton: bait trap, 8 July 2018.

***Agrotis subterranea* (10664):** This species has been found in Outagamie County during two seasons. I collected one specimen in a UV light trap at Mosquito Hill on 29 September 1995. Three specimens collected in Appleton on the bait trail on 21 and 22 October 1995 are shown in Kons (2019). This species is a widespread habitat generalist in the Lower Austral Zone that flies throughout the season, as reported for northern Florida in Kons and Borth (2006).

***Anicla infecta* (10911):** From 1989-1995, I collected only one specimen in Wisconsin, on 29 September 1995 at Mosquito Hill in a light trap. From 2016 to 2022, I collected 25 specimens in Outagamie and southern Shawano Counties, a number of which are in fresh condition. This species is a widespread habitat generalist in the Lower Austral Zone that flies throughout the season, as reported for northern Florida in Kons and Borth (2006).

HESPERIIDAE

***Erynnis horatius* (3952):** This species is widespread in oak habitats in the Lower Austral and southern Upper Austral Zones, but it is a rare stray north to Wisconsin. The only Outagamie County record is: Appleton: nectaring on *Solidago*, 9 September 2015.

***Pyrgus communis* (3966):** This species is common and widespread in the Lower Austral and Sonoran Zones and migrates northward. It is a rare stray as far north as Outagamie County, where I have one record: Fallen Timbers, meadow on Goldenrod Lane Trail, 22 August 1989.

***Pholisora catullus* (3977):** This ephemeral migrant was found during 1988, 1989, 1991, and 1992. It was common in 1989 and 1991, with over 50 individuals seen on some dates at Fallen Timbers and Mosquito Hill. I have not encountered it on recent surveys.

***Hylephila phyleus* (4013):** This is one of the most common and widespread butterflies of the Lower Austral Zone. Historically it was an ephemeral migrant in Wisconsin's southern Counties, but a rare stray to Outagamie County. I recorded a single worn specimen from 1988-1995, from Appleton in late August 1988. In recent years it has become an uncommon ephemeral migrant, found in 2020 and 2022. Most individuals have been found nectaring on New England Aster, a popular nectaring source at the end of the season. Records include: Fallen Timbers: meadow on Goldenrod Lane, 6 September 2020; Mosquito Hill, prairie planting, nectaring on New England Aster, 15 September

2020; Appleton, NW corner of Bluemound Drive X Hwy 97, power line cut, nectaring on New England Aster, 7 October 2020, 1 collected, 2 other probable individuals seen; Prairie Hill Park, 2022 (Table 3).

***Atalopedes campestris* (4049):** This ephemeral migrant was found in Outagamie County during, 1981 1989, 1991, and 1994. I have no recent records, even though Robert Borth (pers. comm.) has found it common as far north as Mequon, Wisconsin (Ozaukee County) during some recent seasons. In the southern counties of Waukesha and Kenosha, I found it nectaring on New England Aster along with *Hylephila phyleus* during 1994. In central Wisconsin I have found it nectaring on *Liatris* and flying with *Hesperia leonardus*. In the southern U.S. it can be common in many different types of open habitats.

***Lerodea eufala* (4111):** This species is widespread in the Lower Austral and eastern Lower Sonoran Zones, but it is a rare stray north to Wisconsin. I have one collection from Outagamie County: Fallen Timbers, 27 June 1988.

PAPILIONIDAE

***Papilio cresphontes* (4170):** This species can be common in southern and western Wisconsin during some seasons (Robert Borth, pers. comm.), although to my knowledge there are no permanent populations of this species in the state. I have not encountered it during my surveys in Outagamie County. However, Richard Merkhofer photographed the species on 16 September 1991 in his back yard adjacent to Plamann County Park, and he also reports seeing the species in the area during recent years. In addition, Sylvia Barbarich photographed an individual in her backyard in suburban Appleton on 25 August 2013. *Zanthoxylum americanum*, one of the larval hostplants, occurs at both Mosquito Hill and Fallen Timbers, but I have never found *P. cresphontes* at these localities.

PIERIDAE

***Zerene cesonia* (4224):** This species is an ephemeral migrant in southern Wisconsin, but in Outagamie County it is a rare stray found once: Fallen Timbers, start of Deep Forest Trail, opening in hydric hardwood forest, 12 May 1991. In the permanent range, this species is associated with xeric grasslands, and is more localized than most migratory species.

***Eurema lisa* (4237):** This species is a common and widespread generalist of open areas in the Gulf Region. It is an annual or ephemeral migrant in the Upper Austral Zone, and present in numbers during some years in southwest and west central Wisconsin along the Mississippi River, at least as far north as La Crosse County. However, I have rarely found it in the Outagamie County area. The few records are Outagamie County: Appleton: mid June 1987; 20 August 1991; Mosquito Hill, prairie planting, 19 June 1995; Winnebago County: Breezewood Lane: 24 August 1990.

LYCAENIDAE

***Strymon melinus* (4336):** This species is a common and widespread generalist of the Lower Austral Zone. As far north as Outagamie County it appears to be a rare stray. Voucher specimens are in fair to worn condition; however, as a small child I found one in good condition in Appleton but failed to preserve the specimen or record the data. The vouchered records are: Outagamie County: Appleton: 1981, 11 August 1989, 9 October 2019; Mosquito Hill: prairie planting, 11 August 1989; Winnebago County: 11 June 1989.

***Hemiargus isola* (4360):** This species is a widespread generalist in the Austral/Sonoran Zone boundary area and Lower Sonoran Zone in Oklahoma and Texas. It migrates into Wisconsin during some seasons, but is a rare stray to the Outagamie County area. I did not record it during the initial survey of Outagamie County butterflies (Kons 1998), but I have collected two recent specimens from the area: Outagamie County: NW corner of Bluemound Drive X Highway 96, power line cut, 26 September 2020; Navarino Wildlife Area (Table 3).

NYMPHALIDAE

***Libytheana carinenta* (4411):** This is a widespread habitat generalist of the Austral Zone, but a rare stray north to Outagamie County. My only record is: Mosquito Hill: hillside, mesic hardwood forest, 11 August 1994.

***Vanessa cardui* (4435):** This migrant can be one of the most common butterflies in the area during some seasons and completely absent during others. The numbers in Tables 1-2 are mostly summed from unique species records

rather than numbers of individuals observed. From 1988-1995 it was found during 1988, 1989 (abundant), 1990 (rare), 1991, 1992 (abundant), and 1995 (uncommon). In mid and late August of 1992 hundreds were present at the same time nectaring on *Liatris* at the Mosquito Hill prairie planting. In recent years it was common during the fall of 2017 and uncommon during 2019 and 2020. This species rarely comes to rotten banana bait, unlike the related *V. atalanta* which can be common in bait traps. It is a widespread generalist, and even occurs in numbers in the suburban landscape during some seasons.

***Junonia coenia* (4440):** This is a common and widespread species of open habitats in the Austral Zone, but it is an ephemeral migrant as far north as Outagamie County. The numbers in Tables 1-2 are mostly summed from unique species records rather than numbers of individuals observed. From 1988-1995, it was present during 1990, 1991, and 1994. The best site was low areas of the open meadows at Fallen Timbers on Goldenrod Lane Trail, where over 20 were seen in one day on 1 September 1991. I have found this species each year from 2020-2022, but have only seen 1-3 individuals on individual survey dates.

***Euptoeita claudia* (4447):** This widespread southern species is a rare stray as far north as the Outagamie County area. My only records are Outagamie County: Mosquito Hill: prairie planting, 9 September 1995; Winnebago County: Wiouwash Trail at Winneconnie (near Breezewood Lane site), 26 August 1990.

“MICROLEPIDOPTERA”

The number of microlepidoptera species that are strays and migrants is almost certainly underrepresented because I have much less expertise with these families and less data entered and analyzed. For some families there are still many specimens I cannot identify, most notably members of the diverse family Gelechiidae. Minute species that can only be identified under a microscope have not been evaluated for migratory status. Most computerized data for Outagamie County microlepidoptera are from 2019-2022, although I made extensive collections throughout the study interval. For species that have occurred as isolated occurrences or ephemeral migrants present only during certain seasons, I consulted the MPG (2022) maps to hypothesize whether they originate from the south, north, or west. I didn't find any candidates of species straying or migrating from the north, and few from the west, but Pyralidae in particular appears to have many species that stray or migrate from the south. For most strays, I simply provide the data of records identified thus far, without additional discussion.

TINEIDAE

***Acrolophus morus* (367):** I am uncertain if this is a fall migrant or a univoltine fall resident species, and I am uncertain if this species is multivoltine or univoltine in the southern part of its range. It does not appear to have been present every season in Outagamie County, notably during 2022 when I conducted many fall surveys, so I have tentatively designated it as an ephemeral migrant. Alternatively, it might have been relatively uncommon and gone undetected during the seasons it was not recorded. Records include the following: 2017: Appleton, UV Light, 21 September. 2018: Appleton, power line cut at northwest corner of N Bluemound Drive X Highway 96, UV Trap, 20 September; Fallen Timbers, MV Trap, hydric hardwood forest/field/prairie planting, 17, 18 September. 2019: Appleton: UV light, 21 & 30 September; bait trail, 26 September. 2020: Fox River Walk, mesic hardwood forest along Fox River, UV Trap, 25 September (4). 2021: Fallen Timbers, UV Trap site 24, 20 September; Mosquito Hill, floodplain forest edge on *Eupatorium* leaf, 1 October.

***Acrolophus popeanella* (373):** Appleton: UV light, 21 August 2022.

***Acrolophus propinqua* (374):** Appleton: UV light, 22 August 2022.

***Acrolophus texanella* (383):** Appleton: MV Trap, 5 September 2016.

DEPRESSARIDAE

***Ethmia zelleriella* (992):** Appleton: MV trap, 10 June 2017.

***Gonioterma mistrella* (1032):** See Table 3.

PLUTELLIDAE

***Plutella porrectella* (2363):** See Table 3.

YPSOLOPHIDAE

Ypsolopha barberella (2370): Appleton: MV Trap, 15 July 2017, 17 October 2020; 2022 record in Table 3; Shawano County: Navarino Wildlife Area, sandy oak-pine barrens, UV trap, 23 May 2023.

CHOREUTIDAE

Prochoreutis inflatella (2629): Appleton: MV Trap, 4 September 2016 (2); Mosquito Hill, wet-mesic prairie planting/floodplain forest edge, UV trap site 20, 16 September 2021; Fallen Timbers, MV trap site 21, hydric hardwood forest, 18 June 2021.

TORTRICIDAE

Eumarozia malachitana (2749): Appleton: UV Light, 5 May 2018, shown in Kons (2019).

Rhyacionia buoliana (2867): Appleton: MV Trap, 1 July 2017.

Cydia garcana (3457): Appleton: MV Trap, 6 July 2017.

Diedra cockerellana (3630): Appleton: MV Trap, 25 September, 20 October 2017.

Atroposia oenotherana (3842): Appleton: MV Trap, 16 August 2016 (shown in Kons (2019)), 20 August 2018.

EPIPYROPIDAE

Fulgoraecia exigua (4701): Appleton: MV Trap, 8 September 2015. I also have a Wisconsin specimen from Dane County: Swamplovers Preserve: MV Trap, 24 August 2021. I found three specimens in Wheaton, IL, in mid August 2022.

PYRALIDAE

Eustixia pupula (4794): Appleton: MV Trap, 8 July 2018.

Microtheoris ophionalis (4796): Appleton: MV Trap, 7 July 2018.

Hellula rogatalis (4846): Appleton: MV Trap, 16 September 2015.

Dicymolomia julianalis (4889): Table 3. This species is regularly encountered during some years but rare or absent during others. I found it in the area during 2017: 20 June-28 August (examples shown in Kons (2019)), 2018: 17 September; 2020: 6-24 September; 2021: 18 June-12 October; 2022: 22 June-17 September (Table 3).

Chalcoela iphitalis (4895): Appleton: MV Trap, 18 June 2019. This species was numerous in Wheaton, Illinois (DuPage County) during mid August of 2022.

Oenobotys vinotinctalis (4940): Appleton: MV Trap, 25 September 2016.

Hahncappsia mancalis (4967): Appleton: power line cut at northwest corner of N Bluemound Drive X Highway 96: UV Trap, 4 September 2018.

Hahncappsia pergivalis (4968): Appleton: UV Trap, 31 August 2021.

Achyra rantalis (4975): Appleton: bait trail, 5 September 2018; MV Trap, 15 September 2018; UV light, 19 September 2019, MV Trap, 26 & 30 September 2019; NW corner of Bluemound Drive X Highway 96: power line cut, field and prairie planting, UV trap, 5 September 2019.

Helvibotys helvialis (4980): Appleton: MV Trap, 20 August 2018.

Uresiphita reversalis (4992): Mosquito Hill: 22 August 1994, another reared from an undetermined plant in the upland portion of the prairie planting emerged during late August 1994; Appleton, four specimens from June 2018.

Pyrausta inveterascalis (5036): Appleton: UV light, 8 July 2017, shown in Kons (2019); Mosquito Hill: UV trap site 7, 24 July 2020; lighted shed, 12 August 2020; Fallen Timbers: MV trap site 20, 6 September 2020.

Pyrausta onythesalis (5042): Appleton: MV Trap, 27 August 2017.

Pyrausta rubricalis (5051): Appleton: MV Trap, 29 August 2017.

Pyrausta subsequalis (5060): Appleton: UV light, 1 August 2017, shown in Kons (2019).

Pyrausta laticlavata (5070): Appleton: MV Trap, 3 September 2017.

Lineodes integra (5107): Appleton: bait trail, 17 October 2016, shown in Kons (2016).

Samea multiplicalis (5151): Appleton: bait trail, 26 October 2017.

Ategumia ebulealis (5158): Appleton: bait trail, 17 October 2016 (Kons 2016).

Hymenia perspectalis (5169): Appleton: MV Trap, 5 September 2016; bait trail, 8, 17, 18 October 2017; UV light, 7 (2) & 8 October 2017; bait trail, 10 October 2018; UV light, 11 September, 10 October 2019, MV trap, 5 October 2019, bait trail, 6 & 10 October 2019; Mosquito Hill, various sites at lights and bait, 12-13 October 2021 (13), one nectaring on Indian Plantain; Fallen Timbers: MV trap site 1, prairie panting/hydric hardwood forest edge, 17 September 2018; various sites at lights and bait, 9-10 October 2021 (10).

Spoladea recurvalis (5170): Appleton: common from 10-31 October 2016 at lights and bait; 12 September-21 October 2017, examples shown in Kons (2016, 2019); lights and bait, 24 September-9 October 2020 (6); Power line cut at northwest corner of Highway 96 X Bluemound Drive: field/prairie planting, UV trap, 9 October 2018, 11 October 2020 (2); Fox River Walk: UV trap, 9 October 2020; Mosquito Hill: MV trap site 10, 12 October 2021; Fallen Timbers: at lights and bait, 9, 10, 19 October 2021 (3, 1, 1, respectively).

Diasemioides janassialis (5172): Appleton: MV Trap, 28 August 2017; Mosquito Hill: MV trap site 10, prairie planting near floodplain forest edge, 30 September 2021; Fallen Timbers: MV trap site 21, hydric hardwood forest, 19 September 2021.

Apogesha stenialis (5177): Appleton: MV Trap, 30 June 2017; see also Table 3.

Glyphodes sibillalis (5198): I recognize this distinctive species as an ephemeral migrant as far south as Gainesville, Florida. It only showed up in Outagamie County during 2016, when three specimens were collected in the MV trap in Appleton: 7, 20, 24 September.

Diaphania hyalinata (5204): This is another distinctive ephemeral migrant as far south as Gainesville, Florida. Appleton: bait trail, 17 & 28 October 2016; 26 September, 6 October 2017 (3); examples shown in Kons (2016, 2019).

Palpita quadrastigmatis (5218): Appleton: bait trail, 8 August 2018, shown in Kons (2019).

Terastia meticulosalis (5239): Appleton: MV trap, 12 July 2016

Patania silicanis (5243): Outagamie County: Mosquito Hill: bait trail on west side of hill near base, 9 November 2020; Fallen Timbers, 9 October 2021, bait trail (1), MV trap site 24 (1); bait trail, 10 October 2021 (33), MV trap site 25, 10 October 2021 (2); Appleton, bait trail, 10 October 2021; Mosquito Hill: 12 October 2021, 18 individuals at lights and bait; Shawano County: Navarino Wildlife Area: MV trap site 1, 28 October 2021.

Diastictis argyralis (5253): Appleton: MV Trap, 29 August 2017.

***Psara obscuralis* (5268):** Appleton, MV Trap, 10 August 2018; Fallen Timbers: MV/UV light traps, 19 June, 17 & 21 July 2020.

***Herpetogramma bipunctalis* (5272):** Appleton: MV Trap, 5, 7 September 2016; 31 August 2018; bait trail, 17 October 2016, examples in Kons (2016, 2019); Power line cut at northwest corner of Highway 96 X Bluemound Drive: field/prairie planting, 14 September 2020; Mosquito Hill: prairie planting, nectaring on *Solidago* and *Helianthus*, 15 September 2020; MV trap site 10, 12 October 2021; Fallen Timbers: bait trail, 6 September 2020; MV trap and bait, 10 October 2021 (6).

***Herpetogramma phaeopteralis* (5274):** Appleton: 2016, common from 5 September-31 October; 8-21 October 2017; 31 August 2018; examples shown in Kons (2016, 2019); Fox Cities Paper Trail by Fox Valley Tech.: UV trap, 8 October 2021; Mosquito Hill: various sites at lights and bait, 12 October 2021 (19); Fallen Timbers: various sites at lights and bait, 9-10 October 2021 (37); Winnebago County: Wiouwash Trail, UV trap, sedge meadow/shrubby wetland, 8 October 2021.

***Pilocrocis ramentalis* (5281):** Appleton: bait trail, 17 October 2016; 26, 27 September, 7, 21, 22 October 2017; 14 October 2020; examples shown in Kons (2016, 2019); Old Stone Bridge Trail: bait trail, 14 October 2020; Mosquito Hill: MV Trap site 10, 12 October 2021; Fallen Timbers: bait trail, 10 October 2021 (2).

***Conchylodes ovulalis* (5292):** Appleton: MV Trap, 8 July 2018.

***Platytes vobisne* (5394):** Appleton: MV Trap, 14 July 2019.

***Euchromius ocella* (5454):** Appleton: bait trail, 4 October 2017; MV Trap, 28 September 2017; UV light, 4, 21 October 2017; MV trap, 25 & 30 September 2019; 6, 12 & 26 September 2020; Fox River Walk: UV trap, 25 September 2020; Mosquito Hill: MV trap site 10, building lights, 12 October 2021 (5); Fallen Timbers: MV trap site 20, 6 September 2020; 2022 records in Table 3.

***Pococera humerella* (5617):** Appleton: UV light, 26 August 2022.

***Galleria mellonella* (5622):** Appleton: UV light, 21 September 2017 (shown in Kons 2019).

***Achoria grisella* (5623):** Appleton: MV Trap, 5 & 12 September 2016 (shown in Kons 2019).

Strays and Ephemeral Migrants of Western Origin Collected in Outagamie County, Wisconsin, and Adjacent Areas

NOCTUIDAE

***Autographa californica* (8914):** From 1989-1995 I only collected one Wisconsin specimen of this western species, from Schmeckle Reserve in Portage County on 19 October 1993 (Kons 1996). Robert Borth also collected a specimen in Jackson County during this interval. Since 2016 I have collected 13 specimens in Outagamie and southern Shawano Counties, the most individuals found of any migrant originating from the western U.S. Most of these specimens were in good condition, so it might breed in the area during some seasons. Appleton specimens from 26 Sept. and 22 Oct. 2017 are shown in Kons (2019). Records include: Outagamie County: Appleton: bait trail, 26 September 2017; MV trap, 1 October 2017; bait trail, 21 October 2017; MV trap, 23 July, 1, 2, 4, 7 August 2019; bait trail, 7 October 2019; MV trap, 26 July 2020; Mosquito Hill: bait trail, 13 August 2020; Fallen Timbers: on vegetation about 6 inches from ground during the afternoon, hydric hardwood forest on Aspen Circle Trail, 23 July 2020; Shawano County: Navarino Wildlife Area (Table 3). I have little experience collecting in the core range of this species, but I suspect it is a widespread habitat generalist. It was one of the few Lepidoptera species common on the Las Vegas Strip during late April 2009 (an area with little if any natural habitat), along with *Hyles lineata* and *Euxoa auxiliaris*. Here it was common at dusk nectaring on *Lantana*.

***Dargida procinctus* (10428):** The historic range of this species is the western U.S.; the MPG (2022) distribution map suggests it is widespread along the west coast from California to southern Canada with more scattered records east to Arizona and Montana. To my knowledge, all of the upper Midwestern records are recent. I am uncertain if it has recently become established in Outagamie County or if it is still migrating into the area. I first found it in 2018 when

I found four fresh specimens at bait in Appleton: 11, 19 & 21 August, 19 September. Since then, I have collected three additional specimens, all in fresh condition, and all at bait. Besides the two 2022 records in Table 3 I have a specimen from the Old Stone Bridge Trail in Appleton from 7 October 2020.

***Euxoa auxiliaris* (10731):** This widespread western species rarely migrates into Wisconsin. I have collected it three times in the area: Appleton: 1981; bait trail, 10 October 2019; NW corner of N Bluemound Drive X Hwy 96: power line cut, UV Trap site 3, 30 September 2019.

***Diarsia esurialis* (10920):** I was shocked to collect a specimen of this west coast species in fair condition at Mosquito Hill during 2022 (Table 3). Lafontaine (1998) reports the range extending along the west coast from the base of the Aleutian Island chain south to central California, and inland in the Cascades in British Columbia, Washington, and Oregon. The MPG (2022) distribution map is consistent with Lafontaine (1998) except for a disjunct distribution dot in Minnesota.

***Parabagrotis exsertistigma* (11047):** I have collected two specimens of this western species in Outagamie County: Appleton, MV Trap, 24 July 2016; Mosquito Hill: MV trap site 4, 24 July 2020. The Appleton specimen is in fresh condition, while the Mosquito Hill specimen is worn. Kyle Johnson (pers. comm.) recently collected an additional Wisconsin specimen in Oconto County. The MPG (2022) distribution map shows all distributional records from the western half of North America except for single dots in Iowa and Manitoba. This species may be expanding its range eastward, but thus far only two isolated occurrences have been documented in Outagamie County with extensive sampling.

PYRALIDAE

***Pyrausta nicalis* (5032):** This species was found during a single season, when I collected three specimens in good condition. Appleton: MV Trap, 9, 13, & 17 July 2017. These are shown in Kons (2019).

***Pyrausta pythialis* (5035):** I have only found one specimen in Wisconsin, the 2022 record from the Navarino Wildlife Area in Table 3. The specimen is in fresh condition, and this was the first year I sampled this locality during its flight season, so I cannot rule out it being established there. I tentatively classify it as a stray because I have no other Wisconsin specimens and it is well east of the range shown in MPG (2022). Kyle Johnson (pers. comm. 2023) has multiple recent specimens from northern Minnesota.

Strays and Ephemeral Migrants of Northern Origin Collected in Outagamie County, Wisconsin, and Adjacent Areas

GEOMETRIDAE

***Spargania magnoliata* (7312):** The only specimen I have collected in the area is from Fallen Timbers on 16 June 1993. The specimen was taken at the interface between the hydric hardwood forest and the meadow. I suspect this specimen is a stray given the worn condition and that only one individual was found in a well sampled area. The only other Wisconsin specimen I have examined is from Vilas County, deep in the Canadian Zone.

***Eupithecia mutata* (7575):** I have collected this species twice south of the Canadian Zone; both specimens are from 2020 in the suburban Appleton yard in the MV trap: 21 and 27 June. Kons and Borth have collected fresh specimens in oak-pine barrens northwest of Dunbar in Marinette County.

SPHINGIDAE

***Hyles gallii* (7893):** This species is locally common in the Canadian Life Zone of Wisconsin, including the Namekogan Barrens in Burnett County (Kons and Borth). It appears to be an uncommon stray or migrant south into the Transition Zone, where I have collected it six times during two seasons, including the three 2022 records in Table 3. Four of the specimens are from the intensively collected suburban yard in Appleton. The three previous Appleton records are from 2017 in MV trap samples: 5 July (2), 12 July.

NOCTUIDAE

***Manulea bicolor* (8043):** This species is a common and widespread generalist of the Canadian Zone that occurs in many habitats, including oak-pine barrens, bogs, conifer-hardwood forest, and boreal forest. It apparently strays south on occasion as I have two isolated records of single specimens: Outagamie County: Fallen Timbers: hydric hardwood forest edge/meadow, UV trap, 4 August 1992; Brown County: Village of Howard: UV sheet, 15 August 1991.

***Zanclognatha inconspicualis* species complex (8344):** In Wisconsin I have found this species exclusively in the Canadian Life Zone with one exception: Appleton: MV trap, 6 July 2018. *Zanclognatha inconspicualis* is common in the boreal forest of the Door County peninsula, where it flies with the more poorly known *Zanclognatha deceptricalis*. *Zanclognatha inconspicualis*, *Zanclognatha deceptricalis*, and *Zanclognatha gypsalis* are readily separable by wing pattern. Since all have different distributions, I do not think there are less than three separate species. However, *Zanclognatha theralis* and *Z. inconspicualis* may be the same species, and the pattern differences are minor. In Wisconsin, I have collected *Z. theralis* from boreal forest next to an extensive bog near Lyman Lake in Douglas County, and from oak-pine barrens at the Namekogan Barrens in Burnett County. Similar species or geographic disjuncts of *inconspicualis* occur south of the Canadian Zone in the Appalachians of Virginia and the Ozarks of Arkansas, and *Z. inconspicualis* is sympatric with *Z. gypsalis* in the Canadian Zone of the Appalachians (Pochahontas County, WV).

***Mycterophera inexplicata* (8413):** The 2022 Navarino Wildlife Area record (Table 3) is the only time I have encountered this species south of the Canadian Life Zone. This combined with the worn condition of the specimen is consistent with the hypothesis that the record represents a stray from the north. However, this was the first season I surveyed this locality during the flight season, so additional survey during future seasons is needed to verify that this species is not a resident there. Koss and Borth have collected series of this species in Canadian Zone bogs, barrens, and boreal forest in Forest, Marinette, and Douglas Counties in Wisconsin.

***Autographa ampla* (8923):** This species is recorded primarily from the Canadian Zone, but there are isolated single captures southward that are presumably strays. I have one record from suburban Appleton: 26 June 1991, lighted sheet. Rings et al. (1992) report three specimens from the Transition Zone of northeast Ohio. This species is recorded from many hostplants (Rings et al. 1992) and from this would be expected to be a generalist. However, I have seldom encountered this species. Most of my specimens are from oak-pine barrens, but it also occurs in mixed conifer/hardwood forest.

***Syngrapha epigaea* (8927):** This species is primarily recorded from the Canadian Zone, but it also occurs in the Northern Transition Zone in the Central Sands Biogeographic Area. Two isolated captures from Outagamie County are presumably strays: Fallen Timbers, hydric hardwood forest, diurnal, 11 August 1990; Appleton: MV trap, 4 August 2019. I would expect this species as a possible resident at the Navarino Wildlife Area, but have not recorded it there as yet. From the wide variety of widespread hostplants reported in Rings et al. (1992) this species should be a generalist. However, most of my specimens are from oak-pine barrens, although other individuals are recorded from bog, mixed hardwood-conifer forest, and boreal forest.

***Euxoa perpolita* (10865):** The only area record is Mosquito Hill: hilltop, UV trap, mesic hardwood forest/grassland, 6 September 1992. This is the only Wisconsin specimen I have collected/examined south of the Canadian Zone, although it occurs in the Transition Zone on Lake Michigan sand dunes at Ludington, Michigan. It was common in Marinette County in oak-pine barrens on 28 August 1995.

***Diarsia jucunda* (10919):** The only area record is Mosquito Hill: floodplain forest, UV trap, 7 July 1995. In the Canadian Zone it occurs in oak-pine barrens, boreal forest, and conifer-hardwood forest.

PIERIDAE

***Colias interior* (4220):** This species is locally common in the Canadian and Northern Transition Zones but it is a rare stray south to Outagamie County. I have two old records from suburban Appleton: early August 1981, late June 1987. I also collected one worn specimen in Brown County: Village of Howard, dry open field, 14 July 1991. The typical habitats for this species include barrens, bogs, and open oak-pine woodlands with an Ericaceous understory. I thought some of the Navarino Wildlife Area habitats had potential for this species but I did not find any during my 2022 surveys.

NYMPHALIDAE

Nymphalis vau-album (4430): While I have recorded 42 individuals from Outagamie County, most specimens have some wear and tattering, and this species has not been found consistently at any locality. Also, while this species overwinters as an adult, I have only found three individuals in the area in the early spring. The best survey technique is bait traps. In recent years, I often take the bait out of the traps during the day in the late summer and fall due to an abundance of bald faced hornets, and have only deployed these traps in the Appleton yard. This undoubtedly greatly reduces the chance of detecting this species when it is present. This species sometimes roosts under the roofs of manmade structures at night or under rainy conditions, including the shelter on the prairie planting at Mosquito Hill. I first encountered this species in Appleton in 1990, although I had been quite familiar with this distinctive species since 1981, and would have recognized it had it shown up in the yard sooner. Other years I found this species in Outagamie County are 1991, 1992, 1994, 1995, 2016, 2017, 2018, 2019, 2021, and 2022.

Speyeria atlantis (4459): The only area record is: Fallen Timbers: meadow on Goldenrod Lane Trail near shelter, 1 September 1990. This species can be common in oak-pine barrens in the Canadian Zone, and it occurs in a variety of other habitats as well, including bog and open mixed hardwood/conifer forest. It also occurs less commonly in the Central Sands biogeographic region, where I have found it in oak-pine barrens at Emmons Creek Public Hunting Area in Portage County. In 2022, I searched for it unsuccessfully at the Navarino Wildlife Area in southern Shawano County in a variety of habitats, including sandy oak-pine barrens and bogs.

Phyciodes batesii (4482): This species is locally common in the Canadian Zone and Central Sands biogeographic area of the Northern Transition Zone, but it appears to be a rare stray south to Outagamie County. It is typically found in or in close proximity to xeric grassland habitats. My only area record is: Fallen Timbers: meadow on Goldenrod Lane Trail, 7 July 1992. I would expect this species to be present at the Navarino Wildlife Area, but I did not record it there during 2022 surveys.

The following species have been found at one of the Outagamie County study sites and the Navarino Wildlife Area (southern Shawano County). The records from the Outagamie County study sites are considered strays from the north, but they are (or may be) resident species at Navarino, which has more similar habitats to sites where these species occur in the Canadian Zone and/or central Wisconsin. They might also occur in unsampled parts of northern Outagamie County, such as the Deer Creek Wildlife Area, which has more northerly plant communities than the Outagamie County sites studied to date. The Navarino site is about 26 miles northwest of the suburban Appleton, 19 miles northeast of Mosquito Hill, and 12 miles northwest of Fallen Timbers.

Speranza brunneata (6286): I have two specimens from suburban Appleton in 2017: UV light, 17 June 2017; MV trap, 18 June 2017. At the Navarino Wildlife Area this species occurs in oak-pine barrens, oak-pine uplands, and bogs. It is an abundant species in the Canadian Zone; in 1995 hundreds of individuals came to a UV sheet on individual nights in oak-pine barrens in Marinette County.

Macaria fissinotata (6348): The only Outagamie County record is a specimen from Mosquito Hill on the hilltop on 30 June 1992. None of the reported hostplant genera are present in the area: *Tsuga* (hemlock), *Picea* (spruce), and *Abies* (fir). *Tsuga* is present at the Navarino Wildlife Area where I collected two specimens on 30 May and 22 June 2022. The only native conifer at the Mosquito Hill site is white pine. While the Mosquito Hill specimen looks like a typical *fissinotata*, I wonder if some forms of *Macaria pinistrobata* might be indistinguishable from *fissinotata* in maculation. *Macaria pinistrobata* is present at Mosquito Hill and other localities where white pine is the only conifer present.

Hydriomena perfracta (7229): I have two local records: Outagamie County: Mosquito Hill: UV sheet, hilltop, mesic hardwood forest/grassland, 22 June 1992; Shawano County: Navarino Wildlife Area: UV sheet site 14, open tamarack bog adjacent to hardwood swamp and oak-pine uplands, 8 June 2022. The Mosquito Hill record is the only time I found this species in an area with southern mesic hardwood forest. Bogs are a typical habitat for this species, and it is common in an area with bog and hardwood/conifer forest at Boulder Lake Campground in Oconto County. It can also be common in oak-pine barrens, although I did not find it in this habitat at Navarino.

***Catocala antinympha* (8775):** This species is undoubtedly a resident of the Navarino Wildlife Area, where the hostplant, *Comptonia peregrina*, is common. I have not seen this plant anywhere in Outagamie County, nor does USDA (2022) include Outagamie County in the distributional map. I have collected four fresh specimens in suburban Appleton: bait trap, 25 July 2017; bait trail, 15 July 2018; bait trap, 17 & 26 July 2018. One is shown in Kons (2019).

***Catocala sordida* (8846):** I expect this species is a resident of the Navarino Wildlife Area, where there is plentiful *Vaccinium* (the larval host), although thus far I only have one worn specimen: 5 August 2022. A single Appleton bait trail record from 15 August 2019 is undoubtedly a stray, but the species could be a resident of unsampled areas in northern Outagamie County, such as the Hortonville Bog.

***Syngrapha octoscripta* (8926):** I collected a fresh specimen at an MV sheet on 2 August 2022 at the Navarino Wildlife Area. The sheet was in oak-pine uplands, but in close proximity to a wetland with bog elements, a typical habitat for this species. Two specimens from suburban Appleton are undoubtedly strays: UV trap, 27 July 1996; MV trap, 29 July 2017. This species could be a resident of unsampled areas in northern Outagamie County, such as the Hortonville Bog.

***Syngrapha abstrusa* (8940):** This species is probably a resident of the Navarino Wildlife Area, where I collected a specimen at a UV sheet in a bog on 23 June 2022. This is a typical habitat for this species in the Canadian Zone and Central Sands Biogeographic Area of the Northern Transition Zone, although the species also occurs in barrens and boreal forest. A single specimen from suburban Appleton (dissected) is undoubtedly a stray: UV trap, 30 June 1996. The similar *Syngrapha alias* appears to be restricted to the Canadian Zone whereas *Syngrapha abstrusa* occurs in the Canadian and Northern Transition Zones, based on dissected specimens.

***Syngrapha rectangula* (8942):** In Wisconsin, Kons and Borth have found this species in a variety of Canadian Zone habitats, and farther south it occurs in bogs in the Northern Transition Zone. A single specimen from suburban Appleton is undoubtedly a stray, although the specimen is in fresh condition: MV trap, 26 June 2020. A specimen from the Navarino Wildlife Area was collected at the same MV sheet sample noted for *Syngrapha octoscripta* above.

***Polia nimbosea* (10275):** This species occurs in the Canadian and Northern Transition Zones in habitats including barrens, bogs, hardwood-conifer forest, and boreal forest. I collected a specimen in sandy oak-pine barrens at the Navarino Wildlife Area on 10 July 2022 at MV light. I have single specimens from two well sampled areas in Outagamie County: suburban Appleton: UV trap, 18 July 1995; Mosquito Hill: UV trap, hilltop, mesic hardwood forest/grassland, 7 July 1995.

***Euxoa declarata* (10755):** I have found this species primarily in oak-pine barrens in the Canadian Zone, with three isolated records southward: Outagamie County: Mosquito Hill: UV trap, prairie planting, 23 August 1994; Brown County: Village of Howard, 17 August 1991; Shawano County: Navarino Wildlife Area: MV sheet, oak-pine barrens, 28 August 2022. The Mosquito Hill record is likely a stray given the sampling effort there, but the other two areas were more sparsely sampled during the flight season, and just for a single season.

***Hesperia sassacus* (4033):** This species is locally common in xeric grasslands in northern and central Wisconsin, particularly oak-pine barrens. There are two local records: Outagamie County: Fallen Timbers: mesic to hydric meadow near shelter, 29 June 1989; Shawano County: Navarino Wildlife Area: sandy oak-pine barrens, 18 June 2022. The Fallen Timbers specimen is undoubtedly a stray, as only one worn specimen was found in an extensively surveyed area, and no xeric grasslands occur in the area. More surveying is needed to evaluate the status at Navarino, but oak-pine barrens are a typical habitat for this species.

***Callophrys henrici* (4326):** While this species ranges south to Florida and Texas, the range appears to be disjunct. To my knowledge, Wisconsin resident populations are limited to the Canadian and Northern Transition Zones. I have found the species in numbers at the Navarino Wildlife Area in intermediate succession uplands with a mosaic of barrens and immature oaks, during both 2022 and 2023. However, I have only a single record from Outagamie County, from flooded hydric hardwood forest at Fallen Timbers on 29 April 1990. This is an unusual habitat for this species in Wisconsin; most records are from xeric uplands, especially scrub forest/barrens mosaic. Also, I have searched extensively for this species at Fallen Timbers from late April through May in numerous subsequent seasons without finding any more individuals. This species could potentially be a resident in northern Outagamie County, but the Fallen Timbers record appears to be a stray.

***Agonopterix walsinghamella* (869):** This species has the same hostplant as *Catocala antinympha* (above), *Comptonia peregrina*. It is undoubtedly a resident species at the Navarino Wildlife Area where the host is common, although thus far I only have recorded a few specimens from there from 29 May, 5 August, and 23 October 2022. I have one specimen from suburban Appleton: MV trap, 26 May 2018.

Strays or Dispersers of Unknown Origin Recorded from Outagamie County

***Caradrina multifera* (9657):** This is a species with which I have little experience, but I have one Appleton specimen from 1981. I have examined Wisconsin specimens from Douglas and Bayfield Counties (extreme northwest Wisconsin) and Robert Borth collected this species on Lake Michigan sand dunes in Sheboygan County.

***Xystocheila rufago* complex (9942):** Two species go under this name, including an overwintering species of oak barrens/savanna in the Upper Midwest, and a univoltine spring species and habitat generalist in Florida. I have one specimen from Appleton: lighted sheet, 16 April 1991. I thought the xeric grasslands with oaks at Mosquito Hill were the best prospective habitat among Outagamie County sites, but repeated surveys have not uncovered it. I did find a single specimen in the sandy oak-pine barrens at the Navarino Wildlife Area on 24 October 2022.

SECTION I:J: UNDOCUMENTED STRAYS AND ACCIDENTALS FROM THE OUTAGAMIE COUNTY AREA

There are several species of strays and accidentals that I have seen in the area but failed to document. Due to the lack of vouchers, I do not include these species in the area checklists or in my Wisconsin Lepidoptera database. I briefly mention these here as species that should be watched for and for which vouchers are needed.

***Citheronia regalis* (7706):** In 1981, one of the neighborhood youngsters found a fresh specimen in a large wood pile in an adjacent yard in suburban Appleton. As this species does not feed as an adult and is undocumented anywhere in Wisconsin to my knowledge, I strongly suspect the Appleton individual was accidentally transported from wherever the woodpile originated, perhaps in the pupal stage.

***Eumorpha fasciata* (7865):** I missed a probable specimen nectaring on petunias in Waupaca County on 16 August 1989. I am aware of one documented Wisconsin occurrence, a specimen collected by Tom Rochealeau in Dane County (southwest Wisconsin) on 18 August 1995. This species is an ephemeral migrant as far south as Gainesville, Florida (Kons and Borth 2006); larvae are common some years and completely absent in the same areas during others. To my knowledge records north of the Lower Austral Zone are isolated strays.

***Sunira verberata* (9960)?:** I cannot verify the presence of this species anywhere in Wisconsin, but on 20 September 2017 I photographed a specimen in Appleton that I now think is this species. The photo is shown in Kons (2019). At the time I failed to recognize the significance of this individual, as the similar *Sunira bicolorago* is one of the most common and widespread Lepidoptera species in the area, and I was not thinking of *S. verberata* as a possible occurrence in the area. When I looked through my *Sunira* vouchers for 2017 I did not find an associated voucher specimen for the photograph, but I vouchered only a small fraction of the *Sunira* I encountered. Given the similarity in wing pattern between *S. verberata* and *S. bicolorago*, and that Appleton is well south of the documented range of *S. verberata*, genitalic examination and/or DNA sequencing of a voucher specimen would have been essential to authenticate the record. The individual is in fresh condition, and I wonder if it might have been accidentally transported from the north by human activity. In subsequent seasons I have been watching for this species, but have not encountered any other promising candidates.

***Achalarus lyciades* (3904):** In 1980, when I was a small child I captured an individual in the suburban Appleton yard and observed it in a bug catcher. Unfortunately, at the time I lacked the equipment or expertise to preserve specimens, and I did not realize this would have been an extremely unusual record for the area. I have never seen another individual in Wisconsin. I have encountered this species in various grassland habitats in the Upper and Lower Austral Zones, but usually in low numbers.

***Phoebis sennae* (4228):** I have not documented this species in Outagamie County, although I saw a probable individual fly through the suburban yard in August 1988. It is a documented ephemeral migrant in southwestern Wisconsin, and in some years, including 1987, Robert Borth has found it in numbers at Nelson Dewey State Park in Grant County.

***Phoebis philea* (4229):** I saw a likely individual on 16 June 1991 at Riverside Park in Neenah (Winnebago County). There is a historic record from Door County collected by William Seiker on 19 July 1930 (Ebner 1970). This species is a widespread generalist in south Florida and south Texas that rarely strays as far north as the Upper Midwest.

SECTION I.K: SPECIES ACCOUNTS FOR PROBABLE/POSSIBLE STRAYS AND EPHEMERAL MIGRANTS RECORDED FROM ELSEWHERE IN WI DURING THE STUDY INTERVAL

This list is not comprehensive and based primarily on my own field work.

GEOMETRIDAE

***Rindgea cyda* (6415):** This is an abundant and widespread generalist of the southwestern U.S., but remarkably I collected one specimen in good condition in Wisconsin: Ozaukee County: Mequon, suburban yard/hardwood forest across pond, MV trap, 7 September 2015. Ferguson (2008) reports a larval host is Mesquite (*Prosopis*). Ferguson (2008) hypothesized records from Iowa, Colorado, Missouri, Arkansas, Oklahoma, Kansas, and Missouri probably represent vagrants. However, I have little doubt it is a resident species in at least southwestern Oklahoma, as Kons and Borth found it in Comanche County during all four years we sampled there (2002, 2003, 2009, 2018), and it can be common at the Wichita Mountains National Wildlife Refuge.

***Hypomecis umbrosaria* species complex (6439):** The taxonomy of *Hypomecis* is a mess and the genus is in need of revision. The only names that currently can be applied with some confidence are for the southern species *luridula*, *buchholzaria*, and *longipectinaria*, albeit even the latter two are frequently misidentified. A variety of phenotypes with different distributions get put under the names *umbrosaria* and *gnopharia*. The genus occurs in the Lower and Upper Austral Zones, and one species rarely strays north into Wisconsin. My only record is: Walworth County, Whitewater Lake Campground, mesic hardwood forest, 9 July 1992.

***Euchlaena deductaria* (6735):** My only Wisconsin specimen is from Waukesha County: sand prairie/oak savanna west of Highway S, UV trap, 13 July 1993. This is a common and widespread generalist in the Austral Zone, as reported for northern Florida [as *pectinaria*] in Kons and Borth (2006). This species was reported as *pectinaria* in Kons et al. (2014).

***Tornos scolopacinarius* (6486):** I am unsure if this is a stray or uncommon resident species at the northern limit of its range. I have only one Wisconsin specimen, but it is in good condition: Waukesha County: Ottawa Lake Campground, mesic hardwood forest/field, UV sheet, 26 July 1992.

***Melanchroia chephise* (6616):** A fresh individual of this species was photographed by Edgar Spalding in the UW-Madison Botany Garden (Dane County) on 18 October 2016 (Devitt 2016). The photo is included in Devitt (2016). This species is an uncommon ephemeral migrant as far south as Gainesville, Florida (Kons and Borth 2016), and the species regularly occurs in south Florida and south Texas. In northern Florida I have most often found it nectaring. It appears to be strictly diurnal, as I have never found it at lights.

***Epimecis hortaria* (6599):** This species is a widespread generalist of the Upper and Lower Austral Zones, but it appears to be a rare stray in Wisconsin. My only record is: Waukesha County, Ottawa Lake Campground, UV Sheet, 10 August 1993.

***Patalene olyzonaria* (6974):** My only Wisconsin specimen is from Waukesha County: Southern Kettle Moraine State Forest: Horse Trail on Highway Z, UV sheet, 26 August 1994. There were a few red cedar trees (the larval host) in the area. However, if this species is a resident in that area I would expect more than one specimen given the collecting effort in the Southern Kettle Moraine. This species comes readily to lights and it should be easy to detect resident populations. There are numerous red cedars at Mosquito Hill but I have never found this species there.

***Nemoria bistriaria* (7046):** This species is common and widespread in the Upper Austral Zone, but it appears to be a rare stray north to Wisconsin. Tom Barina collected a specimen at Muralt Bluff Prairie (Green County) in 1991, and I have a recent specimen from Kenosha County: Prairie Springs Park: flushed from field around lake during the day, 18 August 2022.

***Timandra amaturaria* (7147):** I collected one specimen at the Scuppernong Springs Nature Trail (Waukesha County) across the road from the Ottawa Lake Recreation Area on 17 July 1992. The specimen was flushed from vegetation during the day in hydric hardwood forest. While hydric hardwood forest is a typical habitat for this species (Kons and Borth 2006), the specimen may be a stray given only one individual was found in the area despite substantial collecting effort. I have sampled the Ottawa Lake Recreation Area numerous times during July in 1992 and 1993.

SPHINGIDAE

***Ceratomia catalpae* (7789):** The larval host, *Catalpa*, is not native to Outagamie County but has been planted in many places within the city of Appleton. However, I have never found the moth in the area, although during some years it migrates into Wisconsin's southwest counties. Robert Borth found it at Muralt Bluff Prairie in Green County on 10 July 1991.

***Ceratomia hageni* (7790):** This is a typical species of mixed grassland/woodland habitats in the Austral Zone west of the Appalachians and in the Sonoran/Austral Zone boundary area. I am aware of two strays recorded from Wisconsin's southern counties. Robert Borth collected a specimen at Muralt Bluff Prairie on 26 August 1995, and Waldemar Kmentt (pers. comm. with Robert Borth) collected a specimen at a gas station in Rock County.

***Erinnyis ello* (7834):** To my knowledge, this species was not recorded in Wisconsin during the years I surveyed in Outagamie County, but Robert Borth collected a recent specimen in southeastern Wisconsin: Walworth County: Whitewater Lake Recreational Area: MV sheet on overlook, 7 August 2008. Also, Kyle Johnson collected a specimen in good condition at an MV sheet near Rochester, Minnesota, on 2 October 2017. This species is a rare stray as far south as northern Florida (Kons and Borth 2006). It is a resident in south Florida and south Texas.

***Eumorpha achemon* (7861):** From 1990-1992, this species was recorded in Wisconsin's southern counties. I found a fresh specimen from Waukesha County: Ottawa Lake Recreation Area along Highway 67, nectaring on *Saponaria officinalis* shortly after dark, 25 July 1992. Robert Borth found six specimens from 3-18 July from 1990-1992 at Muralt Bluff Prairie in Green County. I have not seen any material from the Outagamie County area, although MPG (2022) shows a distributional dot near Outagamie County. In the southern states, this species typically occurs in areas with mixed grassland and woodland. In the Kons-Borth experience, it is uncommon in the Gulf Region, but found much more regularly in the Austral/Sonoran boundary area. We have most often found it at powerful MV lights, including a 400 watt light on a sheet or even more powerful lights at gas stations or tennis courts.

***Xylophanes tersa* (7890):** Robert Borth collected a stray specimen in Washington County (southeastern Wisconsin) nectaring on *Saponaria officinalis* in July 1992. This species is a widespread generalist of the Lower Austral Zone, as reported for northern Florida in Kons and Borth (2016).

NOCTUIDAE

***Haploa clymene* (8107):** I have only collected one specimen from Wisconsin: Kenosha County, Chiwaukee Prairie, UV sheet, 18 August 1993. I am uncertain if this is a southern stray or an uncommon resident species that barely ranges into extreme southern Wisconsin.

***Virbia immaculata* (8124):** I have two Wisconsin records: Waukesha County, Scuppernong Prairie, UV Trap, 17 August 1993; Dane County: Swamplovers Preserve, MV Trap, 24 August 2021. While my Wisconsin records are from prairie or prairie planting, in Posey County in southeastern Indiana this species occurs in mesic field habitats. The Swamplovers specimen is in good condition, so it is unclear if this species is a stray or if it might be established now in southern Wisconsin.

***Apantesis vittata* (8170):** I had long suspected *vittata* was a southern geographic variant of *nais*, and a single variable species has been called both *nais* and *vittata* in the Gulf Region (Kons and Borth 2006). Another *Apantesis* species occurs sympatrically in longleaf pine savanna in eastern Texas, that is not recognized by current taxonomy. On 18 August 2021 I collected *vittata* in an MV trap at Swamplovers Preserve (Dane County), well within the range of *nais*, a univoltine species that flies earlier in the season. The specimen is in somewhat worn condition, and represents the

only *vittata* I have collected or examined from Wisconsin. This suggests the specimen might be a stray. On the other hand, I lack clear cases of any *Apantesis* species dispersing more than short distances from their habitat of origin. *Apantesis phalerata* has expanded its range northward, so perhaps *Apantesis vittata* is doing the same. In the southeast, *Apantesis vittata* is a common and widespread habitat generalist, as reported for northern Florida [as *nais*] in Kons and Borth (2006). In Wisconsin, *Apantesis nais* occurs primarily in xeric grassland habitats.

***Renia salusalis* species 2 (8378):** This is a complex of two species, both of which are widespread habitat generalists. To my knowledge only one of the species ranges north into the Upper Austral Zone, where it is widespread. I have one worn specimen of this species from southeastern Wisconsin, presumably a stray: Waukesha County: Ottawa Lake Campground, mesic hardwood forest/fields, UV sheet, 13 July 1993.

***Arugisa lutea* (8509):** This species is a rare stray (or accidental transport) from the Lower Austral or southern Upper Austral Zone where it is a widespread habitat generalist, as reported for northern Florida [as *latiorella*] in Kons and Borth (2006). Rings et al. (1992) reported it only from southernmost Ohio, where they stated it is locally common. My only Wisconsin specimen is from Waukesha County: sand prairie/oak savanna west of Highway S, UV sheet, 17 August 1993. This species sometimes roosts in manmade structures during the day, and in Gainesville, Florida I observed an individual fly into a cardboard box through the hand hole.

***Eudocima apta* (8543):** This tropical species occurs sporadically in the United States and Canada. While the number of U.S. records has increased in recent years, it is still rarely recorded north of Florida and Texas (Kons and Borth 2022). Kyle Johnson collected a specimen on a bait trail in Upper Michigan in September 2016. Despite the massive baiting effort, it has not shown up in the Outagamie County area.

***Matigramma pulverilinea* (8679):** I have collected two somewhat worn specimens in Wisconsin: Ozaukee County, Mequon, suburban/hardwood forest across pond, MV trap, 7 September 2015; Dane County, Swamplovers Preserve, MV trap, upland-mesic-hydric prairie planting/mesic hardwood forest, 24 August 2021. This species can be common in xeric grasslands in the Sonoran/Austral Zone boundary area, but I have seldom encountered it farther east. Swamplovers Preserve has extensive xeric grassland, but since the only Wisconsin specimens I have collected/examined are worn it is probably a stray. Kons and Borth found two specimens in mesic field habitats in Posey County, Indiana in 2015, one of which was in fresh condition.

***Zale bethunei* (8705):** I collected one worn specimen in a bait trap at the Whitewater Lake Recreation Area in Walworth County on 9 July 1992. Rings et al. (1992) report the hostplant is *Pinus virginiana*, and USDA (2022) shows the closest records of this plant to Wisconsin are from northeastern Missouri. Localities Kons and Borth have collected fresh specimens of this species are all within the range of *Pinus virginiana*. The Wisconsin specimen is undoubtedly a stray or accidental. *Zale* species sometimes roost in manmade structures during the day, so accidental transport by human activity is a possibility. In 2009 I found two individuals of *Zale lunata* roosting in a U-Haul truck in Gainesville, Florida.

***Allotria elonympha* (8721):** This species is a widespread habitat generalist of the southern Upper Austral and Lower Austral Zones, as reported for northern Florida in Kons and Borth (2006). Rings et al. (1992) consider it to be abundant in Ohio. I have collected one worn specimen from Wisconsin: Waukesha County: Ottawa Lake Campground, mesic hardwood forest/field, UV sheet, 25 July 1992. Rings et al. (1992) report that Franclemont found the larvae on hickory and walnut. These plants are widespread in the Southern Kettle Moraine State Forest, including at Ottawa Lake, as well as elsewhere in southern Wisconsin. However, as I have only seen one worn specimen from Wisconsin, it is probably a stray.

***Ptichodis herbarum* (8750):** This is a widespread generalist of the Lower Austral Zone, as reported for northern Florida in Kons and Borth (2006). It appears to stray northward on occasion. Rings et al. (1992) reported a single specimen from Ohio, and I have collected one worn specimen in Wisconsin: Waukesha County, sand prairie/oak savanna west of Highway S, UV sheet, 17 August 1993.

***Thysania zenobia* (8647):** This species was not recorded in Wisconsin to my knowledge during the years I studied Outagamie County, but Robert Borth collected a recent specimen in Milwaukee County: Fox Point, Poplar Drive, bait trap, 25 July 2010 (shown on BOLD Systems (2022), Sample ID Number: 9177-250710-WI). The specimen is in remarkably fresh condition except that a large portion of the right hindwing is missing. This is one of the few bait loving southern strays that has never shown up despite the massive baiting effort Outagamie County. It is a tropical

species that is probably a stray or migrant north of subtropical Texas. There is also a south Florida population that does not appear to be migratory, as I never encountered this species in northern Florida during the 1996-2016 study interval.

***Catocala angusi* (8783):** Until recently, the only Wisconsin specimen I was aware of is an old record from La Crosse County in the McGuire Center, from 10 August 1941. Recently, I collected a fresh male specimen in an MV Trap at Swamplovers Preserve: 17 August 2021. Given the fresh condition of the specimen it is possible this species is moving its range north and has colonized southwestern Wisconsin, although I only found the one specimen after running the MV trap from 14-24 August. Related *Catocala insolabilis*, *Catocala residua*, and *Catocala nebulosa* have expanded their range northward and recently colonized Outagamie County.

***Catocala dejecta* (8790):** This species occurs in hardwood forests in the Upper Austral and northern Lower Austral Zones, but it is a rare stray north to Wisconsin. Steve Bransky collected a specimen at MV light on an overlook in Crawford County: 19 July 2013.

***Tripudia rectangula* (9003.1):** This is a common and widespread habitat generalist of the Austral Zone, but I have only two Wisconsin specimens: Walworth County, Whitewater Lake Campground, mesic hardwood forest/grassy overlook, UV light, 9 August 1992; Dane County: Swamplovers Preserve, MV trap, 24 August 2021. Rings et al. (1992) report that this species (as *quadrifera*) is common in Ohio.

***Homophoberia cristata* (9056):** I do not know if this species is a poorly known resident or stray in Wisconsin. I have one somewhat worn Wisconsin specimen: Waukesha County: Ottawa Lake Fen, fen/sedge meadow/shrubby wetland/emergent wetland along lake margin, 25 July 1992. Rings et al. (1992) report the host to be yellow pond lily, but I do not know if this plant was present at Ottawa Lake. One species of yellow lily occurs in some open water areas in the Pike's Peak flowage wetlands at the Navarino Wildlife Area, but unfortunately these sites are along a busy road where there is no place to conceal a light trap.

***Schinia chrysellia* (11199):** I collected one fresh specimen in a UV trap in a sedge meadow at Schmeekle Reserve on 13 September 1993. Subsequently, Gerry Goth collected a specimen at Swamplovers Preserve in Dane County (Kyle Johnson, pers. comm. 2018). The core range of this species is the Austral/Sonoran Zone boundary region, but I do not know how far north resident populations occur.

***Polygrammate hebraicum* (9285):** This species is a common and widespread generalist of the Upper and Lower Austral Zones, as reported for Florida in Kons and Borth (2006) and North Carolina in Hall et al. (2022). It appears to be a rare stray where I have sampled in Wisconsin, as I have only two records. On 9 June 1992 I recovered a forewing out of a UV light trap from Portage County: Emmons Creek Public Hunting Area, oak-pine barrens. This was one of my first light trap attempts and I had not yet worked out the ethyl acetate wicking system, so insects were alive in the trap, and the rest of the specimen was likely eaten by large carabid beetles. The second record is a specimen in good condition: Waukesha County: sand prairie/oak savanna west of highway S, UV sheet, 13 August 1993. The reported host is *Nyssa sylvatica* (Rings et al. 1992), but the moth is common in many habitats lacking this plant. Hall et al. (2022) postulated the moth probably uses three species of *Nyssa* in North Carolina, based on the wide range of habitats where it occurs. USDA (2022) reports *Nyssa sylvatica* from Kenosha County, the southeastern most Wisconsin County.

***Plagiomimicus spumosum* (9748):** I am uncertain if this is a southern stray or poorly known resident in Wisconsin. I have two Wisconsin specimens in somewhat worn condition: Ozaukee County: Mequon: suburban yard with fields and forest in close proximity, MV trap, 7 September 2015; Dane County: Swamplovers Preserve: MV trap on overlook with dry-mesic-wet prairie planting or restoration/mesic hardwood forest/wetlands, MV trap, 24 August 2021.

***Phosphila turbulenta* (9618):** This species is widespread in the Upper and Lower Austral Zones, but it appears to be a rare stray in Wisconsin. I have one worn specimen: Waukesha County, Ottawa Lake Campground, mesic hardwood forest/field, UV sheet, 25 July 1992.

***Iodopepla u-album* (9522):** I have one specimen in good condition from Kenosha County: Chiswaukee Prairie, UV trap, 18 August 1993. I am uncertain if this is a southern stray or an uncommon resident of the extreme southern part of the state. This species is a common and widespread habitat generalist in the Lower Austral Zone as reported for

northern Florida in Kons and Borth (2006), and ranges north to at least the Upper Austral Zone. Rings et al. (1992) report it to be common in Ohio.

***Bellura gortynoides* (9523):** I am uncertain if this species is a stray or poorly known resident in Wisconsin. My only record is a somewhat worn specimen from Waukesha County: Ottawa Lake Fen: UV trap, 9 August 1992. Rings et al. (1992) report a hostplant is yellow water lily, but *gortynoides* was formerly lumped with *vulnifica*, a separate species, so host records could be confused. This species is widespread in northern Florida and frequently disperses to mesic hardwood forest habitats where there are no potential hostplants.

***Bellura species (anoa?)* (9525.1):** I am not clear on the application of the name *anoa*, even though the type is shown on MPG (2022). The type is a worn, dark reddish specimen, with little maculation discernible from the photograph. My best guess from this image is that the *anoa* type is a worn specimen of *densa*. I have two specimens from Ottawa Lake Fen (9 August 1992) that look similar to material from the Gulf Region and Atlantic Coastal Plain that is sometimes identified as *anoa*. I think this material represents a separate species from *densa*, but I doubt it is the same species as the actual *anoa* type. Both specimens are somewhat worn, and I am uncertain if they are strays or a poorly known resident. In northern Florida, similar phenotypes disperse to mesic hardwood forest habitat where there are no potential hostplants. Lafontaine and Schmidt (2010) state that *anoa* is a *Sagittaria* feeder (credit to Eric Quinter), and USDA (2022) shows *Sagittaria latifolia* is recorded from nearly every Wisconsin County. *Sagittaria* is common in the Wolf River floodplain at Mosquito Hill, but the only *Bellura* I have found at Mosquito Hill is typical *obliqua*. I do not know if *Sagittaria* was present at the Ottawa Lake site.

***Himella fidelis* (10502):** This is a common and widespread generalist of the Upper and Lower Austral Zones. I have one worn specimen from central Wisconsin: Portage County: Emmons Creek Public Hunting Area: oak-pine barrens, UV sheet, 11 May 1993.

***Abagrotis magnicupida* (11043.1):** I have one fresh specimen from Wisconsin confirmed with genitalic dissection: Walworth County: Whitewater Lake Recreation Area: west campground, southern mesic hardwood forest, UV light, 31 July 1992. I am uncertain if this record is a stray or a poorly known resident at the extreme northern limit of its range. I have a few other possible specimens from the Southern Kettle Moraine that have not been dissected.

RHOPALOCERA

***Nastra lherminier* (3993):** This is a widespread grassland species of the Upper and Lower Austral Zones, but it appears to be a rare stray north to Wisconsin. My only Wisconsin specimen is from Waukesha County: sand prairie/oak savanna along railroad tracks west of Highway S, 27 August 1994.

***Battus philenor* (4157):** Robert Borth has reared larvae of this species from Milwaukee County, and Ebner (1970) reported a breeding population in Waushara County during 1955. Ebner (1970) reports a stray as far north as Door County on 15 July 1930, and I saw a likely individual there on 19 August 2017, but unfortunately it was in a developed area with lots of people and I had no net with me.

***Pontia protodice* (4193):** This species almost certainly strays into Outagamie County on occasion, although I have no records as yet. It was found as close as the Oshkosh area (Winnebago County) by Clark Schultz in 1987, and in Portage County during 1992. Ebner (1970) reported it has been common in Oconto County during August, but did not give the year(s) it was found there. Most Wisconsin specimens I have examined or collected are from the southwest counties or extreme southeastern Wisconsin.

***Nathalis iole* (4248):** This ephemeral migrant is most often found in the southwest counties along the Mississippi and Wisconsin Rivers when it migrates into Wisconsin (Borth collection, Ebner 1970). However, Clark Schultz collected one specimen in Oshkosh (Winnebago County) during 1987, and Ebner (1970) reported a specimen from Door County. Thus, it may reach Outagamie County on occasion, although I have no records as yet. In the southern states this species can be common in low grassy areas with *Bidens*, and in the Gulf Region I most often found it in recently mowed areas rather than more natural habitats. I have observed oviposition numerous times on low growing plants of *Bidens alba* growing in recently mowed areas, but I have never seen oviposition on the larger plants in areas with taller vegetation.

PYRALIDAE

***Pyrausta tyralis* (5069):** I collected one somewhat worn specimen at the Swamplovers' Preserve in Dane County on 14 August 2021 in an MV trap. This is the only specimen I have seen from Wisconsin, and I ran the same MV trap from 14 to 24 August without finding any more. I suspect this is a stray, although my knowledge of the microlepidoptera fauna of southwestern Wisconsin is limited. This species is a conspicuous, common and widespread generalist of the Lower Austral southern Upper Austral Zones.

***Carectocultus perstrialis* (5307):** This distinctive species is a familiar site from my surveys of wetlands in the Gulf Region, but I was surprised to collect a specimen in boreal forest/wetlands in the Door County peninsula on 18 August 2017 at an MV sheet. MPG (2022) shows that most distribution records are from the Gulf Region and Atlantic Coastal Plain where I would expect them, but there are single scattered dots in Michigan, Ohio, and Indiana. Kyle Johnson (pers. comm. 2023) has collected this species in Upper Michigan. Either this species strays northward on occasion, or there is a Midwest disjunct that requires taxonomic evaluation. I have only seen the one specimen from Wisconsin, although it is from a locality poorly sampled for pyralids, and the specimen is in fresh condition.

PART II: RECENT COLONIZATIONS AND OTHER SPECIES NEWLY RECORDED FROM THE OUTAGAMIE COUNTY AREA

I hypothesize that at least 35 Macrolepidoptera and Rhopalocera species have colonized Outagamie County since the 1989-1996 study interval, including 8 Palearctic species and 27 Nearctic species. Twenty-two of the Nearctic species have expanded their ranges northward. Another 40 species have recently been recorded from Outagamie County from sites with extensive previous survey, but thus far there are few records and their status is unknown. I think an additional fifteen species newly recorded from Outagamie or northern Winnebago County do not represent recent colonizations, as discussed below. This section does not include microlepidoptera except for Palearctic species.

SECTION II.A: RECENT COLONIZATIONS OF PALEARCTIC SPECIES

Up to 22 Palearctic species have colonized Outagamie County since 1992, and nineteen of them since 1996 (*=colonized after 1996), including both Macrolepidoptera and microlepidoptera. In most cases I do not know specifically when these species colonized, as little survey was done from August 1996-June 2016, except for June 2012 and September 2015. The earliest date for which I have records appears in brackets: “[]”. All of these species have been recorded from suburban Appleton except for *Stigmella multispicata*. There are only one or two specimens recorded thus far for *Stigmella multispicata*, *Promalactis suzukiella*, *Lepidotarphius perornatella*, *Acleris comariana*, *Oaracorsia repandalis*, and *Hyles euphorbiae*, whereas the other species are more clearly established. Most of these species first became established in eastern North America and have been expanding their ranges westward, with exceptions noted below.

GEOMETRIDAE

Idaea dimidiata* (7126) [Appleton: MV trap, 7 July 2019]: I recorded this European species every year from 2019-2022, although it is uncommon, with only 16 individuals recorded through 2021 (most 2022 records have not yet been databased). I have records from Appleton, Fallen Timbers, Mosquito Hill, and the Navarino Wildlife Area. The local flight period is mid June through late July, but I have collected it in mid August in Door County, Wisconsin, northeast of the coverage area.

Pasiphila rectangula* (7625) [Appleton: UV light, 28 June 2009]: This European species is now common and widespread in the area, with over 2,000 individuals recorded from 2017-2022. It is common in many habitat types, including suburban yard. The local flight season is late May to late July with a peak in mid June.

SPHINGIDAE

Hyles euphorbiae* (7892) [Appleton: MV trap, 8 June 2017]: Only one specimen of this European species has shown up in Outagamie County; however, the specimen is in fresh condition. This species might now be established in western Wisconsin, based on recent collections by Kyle Johnson and Robert Borth. Unlike most exotic species that have colonized from the east coast, this species was first established in the western states and is moving its range east.

NOCTUIDAE

Lymantria dispar* (Gypsy Moth) (8318) [Appleton: July 2000, collected by Hugo Kons Sr.]: This notorious Eurasian species is widespread in many habitats, including suburban Appleton. I have not seen this species defoliating trees from 2016-2022, and I have not seen evidence that it is currently causing significant harm to the local ecosystems. Hugo & Sharon Kons Sr. reported that this species was much more abundant when it first appeared in the area, and in 2000 the larvae were swarming on the trunk of a blue spruce tree in the Appleton yard after causing significant defoliation. The males are both diurnal and nocturnal; I commonly see them flying during the day and they also come readily to lights at night. The local flight season is mid July through late August, with a peak in late July and early August.

Calophasia lunula* (10177) [Appleton: UV trap, 28 June 2012]: I have found this Eurasian species every year from 2016-2022, but thus far I only have 16 specimens from the area. The hostplant is *Linaria vulgaris*, and the moth was deliberately introduced in Ontario in 1968 in hopes of controlling this exotic plant (Rings et al. 1992). The moth occurs in many habitat types, and disperses to areas where the hostplant does not occur in the immediate vicinity. Based on the distribution of the hostplant, the breeding habitat is recently mowed low grassy areas, including suburban lawns and mowed margins of roads. I usually encounter it as one or two individuals at a time, although I have not sampled in areas where the hostplant is common. Areas where I have seen high density of the hostplant are along roads in areas with extensive light pollution and where light traps could not be concealed. The local flight is late May through late August, but the majority of records are from July.

***Apamea ophiogramma* (9362.1)** [Appleton: July 1999, collected by Hugo Kons Sr.]: This Eurasian species is widespread in many habitats, including suburban yard. I have databased records for over 165 individuals since 2016, and found it every season from 2016-2022. The local flight is early June through early August with a peak in mid July.

***Apamea unanimitis* (9362.2)** [Appleton: June 2003, collected by Hugo Kons Sr.]. This European species is widespread in many habitats, including suburban yard. I have databased records for over 200 individuals since 2017, and found it during every season from 2017-2022. The local flight season is late May through early July with a peak in early June.

***Hydraecia micacea* (9514)** [Fallen Timbers: UV light, 4 August 1992; first Appleton records in 1995]: While this European species is widespread in the area, it is uncommon. I recorded about 25 individuals from 2016-2022. Most were collected in suburban or grassland habitats. The local flight is mid July through mid August.

Rhizedra lutosa* (9447.2) [Appleton: MV trap, 5 October 2016]: Thus far I have collected six specimens of this European species in Outagamie County from late September to early October, from light traps from four locations in Appleton. The hostplant, exotic *Phragmites australis*, is an aggressive invasive species that has created dense monocultures in Appleton wetlands, including ditches in the vicinity of Fox Valley Technical College and along Highway 41. Based on the proliferation of the hostplant the moth might be common now, but I have not sampled right in the *Phragmites* habitat. The *Phragmites* habitats I have seen in Appleton are along roads in areas with extensive light pollution, where light traps could not be concealed. The four Appleton area locations where I have collected the moth are about 0.15, 0.25, 0.6, and 2.0 miles away from stands of *Phragmites*.

***Noctua pronuba* (11012.1)** [Appleton: bait trap, 17 August 1995]: This exotic species has become one of the most common and widespread species in the area. It comes readily to both lights and bait. It occurs in any habitat sampled, and is common in suburban Appleton. Thus far I have databased records for 5,350 individuals found from 2012 onward. Records span from late May to late October.

NEPTICULIDAE

***Etainia sericopeza* (38)**: This minute European species has been found in Appleton every year since 2017. The larval host, *Acer platanoides*, is common in suburban Appleton. The local flight is mid May-late August.

***Stigmella multispicata* (86.1)**: While most of my *Stigmella* specimens are unidentified, I first encountered one individual this distinctive species on 31 May 2023 at the Navarino Wildlife Area: sandy oak-pine barrens, MV sheet.

This Asian species is recorded from Siberian Elm (Nieukerken et al. 2018). At least one species of *Ulmus* occurs in mesic to hydric hardwood-pine forest near the collection site.

DEPRESSARIDAE

Depressaria depressana (924.1)* [Appleton: UV light, 10 July 2016]: This species is now common and widespread in the area. It occurs in a variety of habitats including suburban Appleton. Most records are from MV or UV lights. The local flight is early June through mid October.

OECOPHORIDAE

Promalactis suzukiella (1047.1)* [Appleton: UV trap, 2 October 2021]: Thus far, only one specimen has shown up in Outagamie County, but it is in fresh condition. This species is native to Korea, Japan, and Taiwan and first appeared in the northeastern U.S. around 2004 (Adamski et al. 2009).

GLYPHIPTERIGIDAE

Lepidotarphius perornatella (2346.5)* [Appleton: 2 August 2018, on Lilac leaf during the day]: Thus far, I only have the one record of this Asian species from Outagamie County. I have not found it at lights or bait. Austin et al. (2017) report this species was found in Iowa in 2017, and MPG (2022) shows records from Iowa, Wisconsin, Illinois, Missouri, Indiana, and Pennsylvania. Austin et al. (2017) report that the host is *Acorus*. *Acorus americanus* occurs in wetlands, and I have not seen this plant near the Appleton yard.

TORTRICIDAE

Epinotia nanana (3338) [Appleton: UV light, June 2012]: This Eurasian species was found in suburban Appleton in 2012 and every season from 2016 onward. Wikipedia (2022) reports the preferred host is Norway spruce, and this tree is common in suburban Appleton, with one example in the back yard next to the light trap site. I have also found this species at Mosquito Hill, Fallen Timbers, and the Navarino Wildlife Area. Some individuals have been found in areas with no spruce in the immediate vicinity, such as in the oak-pine barrens at Navarino, so perhaps it also utilizes pines as a larval host? The local flight is early June through late July, with a peak in late June.

Acleris comariana (3507)* [Appleton: UV light, 17 September 2022]: Thus far, I have only collected two fresh specimens in the area. The second record is from Shawano County: Navarino Wildlife Area: mesic-hydric hardwood-pine-hemlock forest, UV trap, 31 May 2023. This widespread Eurasian species is reported to use a variety of Rosaceae species as larval hosts (Gilligan and Epstein 2014).

PYRALIDAE

Paracorsia repandalis (4992.5)* [Appleton: UV light, 30 August 2021]: In addition to the suburban Appleton specimen, I have another fresh specimen from Dane County: Swamplovers Preserve: MV trap, 14 August 2021. MPG (2022) reports this is a recently introduced Eurasian species, first reported from Indiana by James Vargo. There are also many MPG (2022) distributional records from the east coast where Palearctic species typically are introduced, so perhaps this species was first detected after it had spread inland?

Sitochroa palealis (4986.1)* [Appleton: July 2006, collected by Hugo Kons Sr.]: This species is widespread in a variety of habitats within the coverage area, including hydric-upland hardwood forest, fields, prairie plantings, oak-pine uplands, sedge meadow, and bog. It occurs in suburban Appleton, although it is more common in better quality habitats. I found it during 2012 Appleton surveys and every year from 2016 onward. The local flight season ranges from late June to late August, with most records from early July to early August. I also found this species to be common in boreal forest/wetlands in the Canadian Zone of the Door County peninsula on 18-19 August 2017. Passoa et al. (2008) report that this species was first reported in the United States from Illinois, Indiana, Michigan, and Wisconsin, with the first specimen found in 2002.

Duponchelia fovealis (5156.5)* [Appleton, MV trap, 26 July 2016]: I have few records for this species, but it is probably established as I have found it during most recent seasons. Records include: Outagamie County: Appleton:

suburban yard, MV trap, 26 July, 14 September 2016; bait trail, 10 July 2018; Appleton: NW corner of N Bluemound Drive X Hwy 98, power line cut, UV Trap site 3, 26 August 2020, 15 September 2022; Mosquito Hill: UV sheet site 10, prairie planting near edge of floodplain forest, 16 September 2022; Fallen Timbers: UV trap site 19, hydric hardwood forest edge facing meadow/prairie planting, 19 September 2021; Shawano County: Navarino Wildlife Area: UV sheet site 22, sandy bracken grassland/shrubby-grassy wetland/hydric hardwood forest, 20 September 2022. Hayden et al. (2003) suggest this species has become broadly distributed in North America through the nursery trade; the native range is Southern Europe, the Middle East, and Africa.

Acentria ephemerella (5299)* [Appleton, UV light, June 2012]: This Eurasian species is now widespread in Outagamie County, and can be common in suburban Appleton. MPG (2022) reports that the females are wingless and aquatic, whereas Wikipedia (2022) reports most females are wingless but some have longer wings and fly. Winged females are common in Outagamie County. Wikipedia (2022) reports that all of the immature stages are aquatic. I have found this moth most common in suburban Appleton, where there is no aquatic habitat in the immediate vicinity. However, a pond where I have seen the moth landed on the surrounding vegetation is about 2 miles away on County Road Aa, and the Fox River is about 1.2 miles away. Some other species with aquatic larvae are also common in suburban Appleton, especially *Eulophia oblitalis*. The local flight season spans early June to mid September, with a peak in early July.

Anania hortulata (4952) [Appleton: UV light, 1995]: I have found this European species in a variety of habitats including suburban yard, mesic and hydric hardwood forest, field, and prairie planting. I have recorded it from Appleton, Fallen Timbers, and Mosquito Hill. The local flight season is early June to late July. Munroe (1976) reports that this species was introduced into Nova Scotia by 1907, and that it has a wide range in the northeast.

SECTION II.B: RECENT COLONIZATIONS OF NEARCTIC SPECIES

Northward Range Expansions of Southern Nearctic Species: At least 22 species have expanded their range north into Outagamie County since 1989-1996, and now appear to be permanent residents. For two additional species it is unclear if they are recently established residents or ephemeral migrants: *Renia discoloralis* and *Parahyphenodes quadralis*. Another ten more poorly known species that might have expanded their ranges northward into Outagamie County include *Cabera quadrifasciaria*, *Virbia nigricans*, *Grammia oithona*, *Catocala amestris*, *Heliothis ascecia*, *Psychomorpha epemini*, *Acronicta betulae*, *Apamea plutonia*, *Photodes near enervata*, and *Euxoa medialis*. However, thus far there are few records for these species and their status is unknown. These 32 species were either unrecorded from the Outagamie County area from 1989-1996 (*), or recorded only as isolated records and presumably strays. Many of these species occurred in Wisconsin's southern or southwestern counties as probable residents in the early and mid 1990s, as discussed below.

Alsophila pometaria (6258)*: I first recorded this species from the area in 2020, when I found it at three localities, all of which had been previously surveyed during the late October-November flight season. I found nine males on the Old Stone Bridge Trail between 28 October and 28 November. All were netted or found landed on branches. Wingless females were on oak tree trunks; however, I am unsure how to distinguish these from the females of *Opheroptera bruceata*, a more widespread species that flies with *Alsophila pometaria*. The other localities are: Mosquito Hill, netted on long trail up the hill just below the top, 4 November 2020; Appleton: UV light, 31 October 2020, 15 December 2021, 10 November 2022. I have not surveyed the Old Stone Bridge Trail at the appropriate time of year with good weather conditions since 2020, but the records from three consecutive seasons in suburban Appleton suggest it is established. I have also searched for this species unsuccessfully at Fallen Timbers and the Navarino Wildlife Area. Female dispersal must occur in the larval stage, as the wingless adult females crawl slowly on tree trunks, and I have never seen them moving across the ground.

Isturgia dislocaria (6419)*: There are few records for the area, but I found this species during three consecutive seasons at Mosquito Hill: MV trap, hilltop: 21 May 2020, 22 May 2021; south side of hill, UV trap, 6 June 2021; netted on hilltop, 20 May 2022. These areas were surveyed with lights on warm nights at the right time of year during 1992 and 1995 without finding this species. I also found one individual at the Navarino Wildlife Area during 2022: UV trap site 11, upland oak-pine hardwood forest, 29 May 2022. In the early and mid 1990s Borth and Barina recorded this species from Grant and Green Counties in southwestern Wisconsin, and I found it at Swamplovers Preserve in Dane County during 2011 (Kons and Borth 2014). The larval host is *Celtis* (Ferguson 2008), which

occurs at Mosquito Hill, along with the *Celtis* feeding nymphalids *Astereocampa celtis* and *Astereocampa clyton*. The *Celtis* feeders *Heterocampa subrotata* (7985) and *Isogona tenuis* (8493) have not been recorded from *Celtis* habitats in Outagamie County, although these species occur in southwestern Wisconsin.

***Anisota senatoria* (7719)*, *Anisota virginiensis?* (7723)*:** *Anisota senatoria* was common at Mosquito Hill from 2020-2022, but I had no Outagamie County records from 1989-1996. Jess Miller (pers. comm. 2023) reported that this species showed up at Mosquito Hill about five years ago. It is surely a new colonization as the adults and larvae are easy to find. The larvae have been defoliating *Quercus macrocarpa* and *Quercus velutina* on the prairie planting, edge of the prairie planting, and hilltop, but these oaks were not killed and resprouted the next year. Some adults lack black speckling on the forewings and resemble *Anisota virginiensis*, but I suspect these are extreme phenotypes of *Anisota senatoria* and that *A. virginiensis* does not really occur in Wisconsin.

***Virbia opella* (8118):** From 1989-1996 I recorded one worn specimen from the area, on 19 July 1991 at Mosquito Hill, presumably a stray. During the intensive 2016-2020 Appleton survey I found it at lights on: 15 & 29 July 2017; 6, 16, 17, 19 July 2018; 24 & 29 July 2019; 20 & 24 July 2020. Records from other localities include: Mosquito Hill: hilltop, mesic hardwood forest/grassland, MV trap, 10 July 2020; Fallen Timbers: hydric hardwood forest, MV trap, 27 July 2021; Navarino Wildlife Area: MV & UV lights, 22 June, 10 July, 5 August (10 individuals).

***Apantesis phalerata* (8169)*:** Recent and historical surveys (Kons, Borth, & Barina) found this species to be locally common in southwestern Wisconsin grasslands, but it has only recently shown up in Outagamie County. It is uncommon in the area, but I have found it during every year since 2016. Records include: Appleton: suburban yard, MV trap, 9 August 2016, 10 August 2017, 4 August 2018; Appleton: NW corner of N Bluemound Drive X Hwy 98: power line cut, UV Trap site 3, field/prairie planting, 6 May 2020; Appleton: Fox Cities Paper Trail by Fox Valley Tech.: prairie planting/field, UV trap, 21 August 2022; Mosquito Hill: south side of hill, mesic hardwood forest/upland prairie planting, UV trap site 6, 3 June 2020, 4 August 2021; UV trap site 20, prairie planting/hydric hardwood forest edge, 23 August 2022 (2); Shawano County: Navarino Wildlife Area: UV trap site 18, sedge meadow with bog elements, edge of oak-pine forest, 28 August 2022.

***Plusiodonta compressipalpis* (8534)*:** In the early and mid 1990s Jim Parkinson, Robert Borth, and Tom Barina collected numerous specimens in southwestern Wisconsin, including from Grant, Crawford, Richland, and Green Counties. Extensive surveys in southeastern Wisconsin and Outagamie County did not uncover it during this time. Since 2020 I have recorded this species numerous times in Outagamie and Shawano Counties, primarily on bait trails, including at Mosquito Hill (26), Fallen Timbers (4), and the Navarino Wildlife Area (2). The flight season ranges from early June to early September, with a peak in mid July. It occurs in hydric, mesic, and semi xeric hardwood forests.

***Catocala residua* (8785)*:** In the early and mid 1990s Robert Borth and Tom Barina recorded this species from southwestern Wisconsin, including Grant, Sauk, and Trempealeau Counties. However, it was not uncovered with extensive surveys in Outagamie County or the Southern Kettle Moraine State Forest in southeastern Wisconsin. I collected six individuals at Mosquito Hill from late July to early September from 2020-2022; some additional individuals may have been seen or photographed, but the diagnostic hindwing fringe was not examined to enable reliable identification. It is currently uncommon but was found for three consecutive seasons in mesic hardwood forest with hickories on the sides and top of the hill.

***Catocala insolabilis* (8791)*:** This species colonized Outagamie County in 2019 and has been found every year since. At least 23 individuals have been recorded between late July and mid August, including at suburban Appleton (9), Mosquito Hill (12), and Fallen Timbers (2). As the larval hosts are hickories (Rings et al. 1992) the suburban Appleton yard specimens are suspected dispersers from hardwood forests with hickory along the Fox River about 1.7 miles away; I have seen no hickories in the immediate vicinity of the yard. In the early and mid 1990s Kons, Borth, and Barina did not find this species in surveys of hickory habitats anywhere in Wisconsin, although Jim Parkinson collected a specimen in Grant County (the southwestern most county). On 7 August 2008 Robert Borth collected 5 specimens at the Whitewater Lake Recreational Area in Walworth County, a site we had surveyed multiple times in 1992 and 1993. Most of the Outagamie County specimens are from bait, although Kons and Borth have numerous records from MV lights from Walworth and Dane Counties. I photographed one individual nectaring on milkweed in Appleton on 27 July 2020.

***Catocala nebulosa* (8796):** From 1988-1996, I collected only one specimen in Outagamie County: Mosquito Hill, steep trail up south side of hill, mesic hardwood forest, UV sheet, 23 August 1992. It then showed up in 2018 and I have found it during every year since. This species is now established at Mosquito Hill (78 individuals recorded), Fallen Timbers (11 individuals), and Appleton (9 individuals). The larval host is bitternut hickory (*Carya cordiformis*) (Gall 1990). I have not seen the hostplant in the immediate vicinity of the suburban Appleton yard, but it occurs along the Fox River about 1.7 miles away. The recorded flight period is from late July to mid September, with the peak in late July. I photographed a mating pair landed on the side of my house on 19 August 2019 in suburban Appleton.

***Catocala connubialis* (8877):** From 1989-1996, the only record from Outagamie County was a single specimen Richard Merkhofer collected in a bait trap in his yard adjacent to Plamann Park. I have found this species in the area every year since 2018, and have recent records for Appleton (6), Mosquito Hill (8), Fallen Timbers (2), and the Navarino Wildlife Area (1). The local flight period is early July through mid August with a peak in late July.

***Lithacodia musta* (9051):** From 1989-1996, the only record from Outagamie County was one worn specimen from Fallen Timbers: 11 June 1990. It now appears to be established at Mosquito Hill where I have found it for three consecutive seasons. I collected three specimens on top of the hill at MV light on 10 July 2020. I found additional specimens at lights on the prairie planting on 18 July 2021 (1) 22 July (1) & 23 August 2022 (1).

***Psaphida grandis* (10013)*:** I found six individuals of this species on the hill at Mosquito Hill from late March to early April of 2021. Surveys on 18 April 2020 may have been too late in the season to find it, and I did not survey this area in April of 2022. Since this species is univoltine, does not feed as an adult, and some of the specimens are in fresh condition, these records likely represent a resident population. I am not aware of a reported hostplant, but localities where I have found this moth in Wisconsin and Florida are mesic hardwood forests with plentiful hickories. This species is common at Swamplovers Preserve in Dane County (southwestern Wisconsin).

***Oligia chlorostigma* (9402)*:** In the early and mid 1990s, Borth and Barina found this species in southwestern Wisconsin (Grant and Green Counties) but extensive surveys in southeastern Wisconsin and Outagamie County did not uncover it. Recently it has occurred irregularly in suburban Appleton, where specimens have been in fair to worn condition: MV trap, 16 July 2016, 10 July 2018, 20 & 23 July 2019. In 2022 I found fresh specimens at Mosquito Hill on the prairie planting on 5 and 22 July. I suspect it is now established in the county although the specimens from suburban Appleton may be dispersers from better quality habitats. All local records are from lights, although I did collect a specimen in a bait trap in the Florida panhandle.

***Papaipema baptisiae* (9485)*:** This species is now widespread in Outagamie County, including at localities that were extensively surveyed without finding it during the 1989-1995 interval. I have recorded at least 81 individuals since 2015, and found it during every season. Most specimens are from prairie plantings or fields, but I have collected a few individuals in suburban Appleton: MV trap, 14 September 2015, 2 September 2018, 12 September 2019, 4 September 2020. Other localities include the Highway 96 power line cut, the Fox Cities Paper Trail, Mosquito Hill, Fallen Timbers, and the Navarino Wildlife Area. Rings et al. (1992) report *Apocynum*, *Baptisia*, and *Arnoglossum atriplicifolium* as larval hosts, and the UW-Madison collection contains a large series of specimens reared from *Asclepias* by Andrew Williams. One to four of these plant genera are present at all of the collection localities.

***Papaipema silphii* (9498)*:** I have photographed this species at six localities in Outagamie County, five of which have one to four species of *Silphium*, the larval hosts (Rings et al. 1992). I first found it in the county in 2017 and have seen it every year since. The local flight season is late August through mid October, with a peak in mid September. This species differs from other similar species primarily by size and color, so using photographs without associated specimens for documentation is extremely poor procedure. However, unfortunately this species is listed as endangered by the Wisconsin DNR, meaning it would be expensive to apply for a field technician's collecting permit to document this species, and even if granted, I would be unable to retain the specimens for study. This species was originally only recorded in Wisconsin from native prairie remnants in the southeast counties. However, it is a prolific disperser that readily colonizes plantings of its hostplants, and it has a much more extensive range in the state than was known at the time it was listed. A listing of endangered or threatened is no longer justifiable. Furthermore, the misguided regulations associated with this listing are detrimental to research, even for basic documentation of the species' distribution. Charging hundreds of dollars to apply for a permit and excluding noninstitutional researchers from retaining specimens for study only serves to discourage research, proper

documentation, and reporting of data. This is detrimental to the study and conservation of any insect species, especially species which are difficult to identify.

***Papaipema nelita* species 1 (9502)*:** This species has colonized the prairie planting at Mosquito Hill, where I have found at least 19 individuals over three consecutive seasons from 2020-2022. The local flight period is early August through mid September, but most individuals were found from mid to late August. I also have a single specimen from a sedge meadow north of Allcan Road from 13 August 2020. Hessel (1954) reported *Rudbeckia grandiflora* as a larval host, and *Rudbeckia* species, including *R. Laciniata*, are common on the Mosquito Hill prairie planting. However, I have not seen *Rudbeckia* at the Allcan Road power line cut.

I think there is a second species that goes under this name, which has not been found in the Outagamie County area. This species flies later in the season, has a narrower reniform spot, and richer more contrasting forewing coloration. I have collected this species in fresh condition on 23 September 1994 at the Kettle Moraine Fen and Low Prairie in Waukesha County. I have also seen photographs of specimens from Ohio (Rings et al. 1992) and Minnesota (Kyle Johnson).

***Papaipema rigida* (9503)*:** I first found this species in Outagamie County in 2018, and have found it every year since. It is most common at prairie plantings along Highway 96 and on the Fox Cities Paper Trail by Fox Valley Tech., where 70 individuals have been found between these two sites. Other records include: Outagamie County: Appleton: suburban yard, MV trap, 2 September 2018, 15 September 2019, 25 August 2020; Mosquito Hill: prairie planting near edge of floodplain forest, MV and UV lights, 13 August 2020, 2 September 2020 (2), 2 September 2021, 5 October 2022; Fallen Timbers: prairie planting, MV trap, 6 September 2020, hydric hardwood forest edge near prairie planting, bait trail, 6 September 2020; Shawano County: Navarino Wildlife Area: sandy trail east of Highway K, edge of mesic to hydric hardwood-pine forest with *Helianthus*, netted at night, 22 October 2022. The local flight period is early August through late October, but most individuals have been recorded from late August through mid September. Reported larval hosts include a variety of composites (Rings et al. 1992).

***Papaipema sciata* (9506)*:** This species has colonized the prairie planting at Mosquito Hill. It was first found by Kyle Johnson on 25 September 2017. I found two individuals in 2021 and nine in 2022. The local flight period is mid September through mid October, with a peak in early October. The reported larval host is *Veronicastrum virginicum*, which occurs in the Mosquito Hill prairie planting.

***Lithophane franclemonti* (9887.1)*:** I have found at least 71 individuals at Mosquito Hill from late March-mid April and mid September-early November of 2020-2022. Most individuals were found at bait, and I have found it on bait trails on the sides and top of the hill and on along the edge of the floodplain. When this species was described in 1998, the only Wisconsin records reported were from the southwestern counties (Metzler 1998). The same areas where this species is now prevalent at Mosquito Hill were surveyed without finding it from 1992-1995.

***Epiglaea decliva* (9946)*:** All Wisconsin specimens I examined from 1989-1995 were from the southwestern Counties. Since 2018, I have found this species at Mosquito Hill (21), Fallen Timbers (10), the Old Stone Bridge Trail (5), suburban Appleton (1), and the Navarino Wildlife Area (477). It occurs in xeric oak-pine forest and uplands, xeric oak-pine barrens, mesic, hydric, and semi xeric hardwood forest. It appears to be a rare disperser to the suburban landscape. The local flight season is mid September through early November.

***Dardiga rubripennis* (10434)*:** During the early and mid 1990s, Kons and Borth had sporadic records of this species from Wisconsin's southern and western counties, including Grant, Trempealeau, and Waukesha Counties. However, the records all appeared to represent isolated strays. This species was common on the prairie planting and field at Mosquito Hill from 2020-2022, when at least 166 individuals were found, many in fresh condition. Other recent records from the Outagamie County area include: Appleton: bait trail, 5 August 2018, UV light, 25 July 2020, 23 July 2021; NW corner of N Bluemound Drive X Hwy 96, power line cut, UV Trap site 3, field/prairie planting, 1 August 2019, 7 August 2020; Fallen Timbers: field/prairie planting, UV trap site 19, 16 July 2020, 27 July 2021, MV trap site 20, 17 July 2020; Navarino Wildlife Area: sandy oak-pine barrens, MV sheet, 28 August 2022. The suburban Appleton records are isolated occurrences and it is probably a disperser in this locality, but a prairie planting where the moth occurs is only about 2.1 miles away. The local flight period is early July to late August, with a peak in early August.

***Protorthodes incincta* (10552)*:** On 2 September 2021, I collected one specimen at bait at Mosquito Hill, in mesic hardwood forest near the base of the hill. In 2022, I collected and photographed ten individuals, mostly around the edge of the prairie planting (including the south, east, north, and west sides), and saw some likely additional individuals not examined closely enough to reliably identify. 2020 surveys in the same areas where I found this species in 2021 and 2022 yielded no specimens, as is the case for night surveys from 1992-1995. Previously, the Wisconsin specimens I had examined were collected by Tom Barina from Lake Michigan sand dunes in Racine County (southeastern Wisconsin) and by Jim Parkinson in southwest Wisconsin. Mosquito Hill has some sandy uplands with prairie planting along the south side of the hill, but the individuals were not concentrated in this area. I also collected a specimen in sandy oak-pine barrens at the Navarino Wildlife Area at bait on 8 September 2022.

***Pompeius verna* (4048):** Prior to 1995, in Kons and Borth's experience this was an uncommon species in Wisconsin that occasionally showed up in the southern counties, except for a single male specimen from Fallen Timbers I collected on 19 June 1991. Ebner (1970) reported that it was first recorded from Wisconsin in 1960, when he found it in Waukesha County. It apparently colonized Mosquito Hill in 1995, when I found 6 individuals in grasslands on the hill from 8-9 July. These areas had previously been extensively searched for butterflies starting in 1989 without finding this species. Recent surveys show that this species is clearly established at Mosquito Hill, as I found at least 32 individuals from 2020-2022, not including many other possible individuals that were not examined closely enough to reliably identify. The best habitat there appears to be the unburned field east of the prairie planting and the adjoining grassland along the south side of the hill. The species also occurs on the prairie planting and occasionally in the butterfly garden by the parking lot. *Monarda* is the most frequently used nectar source, but *Asclepias* is also utilized regularly. Other recent records include: Outagamie County: Fallen Timbers: Goldenrod Lane, field/prairie planting, 25 June, 17 July 2020; Shawano County: Navarino Wildlife Area: sandy oak-pine barrens, 14 July 2022. The local flight season ranges from mid June to late July, with a peak in mid July.

Southward Range Expansions of Northern Nearctic Species:

***Coenonympha inornata* (4583)*:** This is the only clear case of a northern species that has expanded its range south into Outagamie County since 1989-1996, although *Apamea indocilis* is another possibility. *Coenonympha inornata* now occurs at Mosquito Hill (19 June 2020, prairie planting) and Fallen Timbers (9 June 2020, 2 July 2021, prairie planting/meadow), two localities that were extensively surveyed for butterflies from 1989-1995. I have also found it at Allcan Road in a sedge meadow (10 July 2020) and the Navarino Wildlife Area in oak-pine barrens (18 June 2022), two localities without historical survey data. In the early and mid 1990s, this species appeared to be restricted to the Canadian Zone, and in eastern Wisconsin I collected specimens from Langlade, Marinette, Forest, and Florence Counties.

Eastward Range Expansions of Western Nearctic Species: At least one species native to the western U.S. has expanded its range eastward into Outagamie County since 1989-1996, *Striacosta albicosta*. As discussed in the species accounts for western strays, the status of *Dargida procinctus* and *Parabagrotis exsertistigma* is unclear. Some of the specimens are in fresh condition, but thus far these species have not shown up at any locality consistently.

***Striacosta albicosta* (10878)*:** Numbers of individuals in fresh condition have been found during every year from 2016-2022, and I have databased records for 111 individuals from the Outagamie County area. It was already in the area by 2011 when Hugo Kons Sr. collected a specimen in Appleton. This is a widespread habitat generalist regularly found in suburban Appleton. The flight season is late June to late August with a peak in late July. I also have two fresh specimens collected in Appleton on 6 November 2016.

Westward Range Expansions of Eastern Nearctic Species:

***Oligia crytora* (9410)*:** This is the only species native to the eastern U.S. that has expanded its range westward into Outagamie County since 1989-1996. From 2020-2022 I recorded 30 individuals in hydric hardwood forest at Fallen Timbers. I also have single specimens from hydric hardwood forest at Mosquito Hill and the Navarino Wildlife Area. The local flight is period June, with a peak in mid June.

Other New Colonizations of Nearctic Species:

***Acasis viridata* (7635)*:** Outagamie County is within the historical range of this species, but I had no records from 1989-1996. During this interval, I recorded it from Boulder Lake Campground (Oconto County) to the north and the Southern Kettle Moraine State Forest (Waukesha County) to the south. Recent local records include: Outagamie County: Fallen Timbers: hydric hardwood forest, bait trail, 18 April 2021, netted, 2 May 2020, MV trap site 18, white cedar swamp, 1 May 2021 (4), UV trap site 11, field/immature aspen and birch, 14 May 2020; Appleton: MV trap, 5 August 2019; Shawano County: Navarino Wildlife Area: by UV trap site 13, mesic-hydric hardwood-pine-hemlock forest, 11 July 2022, UV trap site 6, oak-pine shrubby-grassy uplands south of Pikes Peak Flowage, 10 July 2022. The Appleton record is an isolated single disperser and there is no historical data for the Navarino Wildlife Area, but given the number of recent records for Fallen Timbers I suspect this species is a new colonization at least for that locality.

***Photodes panatela* (9436)*:** I recorded eleven specimens in hydric hardwood forest at Fallen Timbers from 2020-2022, but none during historical surveys. I also have a single specimen from suburban Appleton: MV trap, 15 June 2020. I have also found this species at two sites without historical surveys: Outagamie County: sedge meadow north of Allcan Road: UV trap, 18 June 2020; Shawano County: Navarino Wildlife Area: MV trap 15, sandy oak-pine barrens, 23 June 2022, UV trap site 13, hydric-mesic hardwood-pine-hemlock forest, 22 June 2022, UV trap site 3, emergent wetland/sedge meadow with bog elements, 23 June 2022, UV trap site 6, sandy oak-pine shrubby uplands just south of emergent wetland/sedge meadow with bog elements, 23 June 2022 (2). Thus far there are 18 local records from early to late June. Rings et al. (1992) hypothesized that this species was limited to wetlands although the host is unknown. I collected most local specimens in (or in close proximity to) wetlands. Rings et al. (1992) considered this species to be rare and reported they were only aware of one site in Ohio. Kons-Borth-Barina surveys did not find this species anywhere in Wisconsin from 1989-1995, despite many surveys in wetlands. I think this species has recently adapted in some way that has enabled it to expand its distribution.

SECTION II.C: NEWLY RECORDED SPECIES OF UNCERTAIN STATUS

The following 40 Nearctic species have been newly recorded from Outagamie County during recent surveys. Thus far there are few records and their status is unknown.

***Macaria transitaria* (6335)*:** Thus far, I have two records from Outagamie County: Appleton, MV trap, 20 August 2019; Mosquito Hill, mesic hardwood forest on hilltop, UV trap 9, 23 August 2022. I also have a specimen from the Navarino Wildlife Area: MV sheet, sandy oak-pine barrens, 28 August 2022. In the Austral Zone this species is widespread in pine habitats, but I have seldom encountered it in Wisconsin. Kons and Borth have collected a few specimens in xeric oak-pine forest with barrens openings in Jackson County, including on Kling Road on 6 July 1993.

***Cabera quadrifasciaria* (6680)*:** I collected two fresh specimens in a light trap facing the upland portion of the Mosquito Hill prairie planting on 3 June 2020. I did not find any more after the prairie was burned in the spring of 2021. This species has been reared on *Amorpha canescens* (BugGuide 2022 credited to Jim Sogaard). This plant occurs on the prairie planting in areas that were burned during 2021. It also occurs in grasslands on top of the hill that were not burned, but I have not found the moth on top of the hill. In the 1990s, *A. canescens* was much more common on the hill when the grasslands were at an earlier stage of succession. I have examined specimens of this species from dry prairie remnants in southwestern Wisconsin collected by Robert Borth and Jim Parkinson (Grant and Crawford Counties).

***Cingilia catenaria* (6898)*:** My only specimen from Outagamie County is from hydric hardwood forest at Fallen Timbers: MV trap, 17 September 2018. I did not find any more individuals during Fallen Timbers surveys during September of 2020-2022. Most Wisconsin specimens I have collected or examined are from central or northern Wisconsin. I collected one specimen at the Navarino Wildlife Area in 2022: UV sheet site 22, hydric hardwood forest/shrubby-grassy wetland/sandy xeric bracken grassland, 20 September. Larvae are reported to feed on a wide variety of shrubs and trees, many of which are common at some of the local study sites, so it is unclear why the moth appears to be local and uncommon in the area.

Nemoria rubrifrontaria (7047)*: My only specimen from Outagamie County is from mixed mesic hardwood forest and grassland on the top of Mosquito Hill: MV trap, 21 May 2020. Most of my Wisconsin material is from oak-pine barrens in northern Wisconsin.

Eupithecia cimicifugata (7524)*: On 3 June 2020 at Mosquito Hill, I netted two fresh specimens flying at night on the long trail up the west side of the hill. The habitat was mesic hardwood forest with some grassy-shrubby openings. This species may have been overlooked with previous surveys as it apparently does not come readily to lights.

Eupithecia assimilata (7528)*: I have at least one recent specimen: Fallen Timbers: white cedar/hardwood swamp, MV trap, 25 May 2021. There are likely other records in unprocessed/undetermined *Eupithecia* specimens.

Callizia amorata (7650)*: My only record for Outagamie County is Fallen Timbers: MV trap site 21, hydric hardwood forest, 10 June 2021. Most of my Wisconsin specimens are from uplands. I collected two specimens in a light trap at the Navarino Wildlife Area: sandy mesic to semi xeric oak-pine-hardwood forest east of Highway K, 22 June 2022.

Clostera inclusa complex (7896)*: This is an odd single specimen from Mosquito Hill: UV trap site 6, mesic hardwood forest edge facing prairie planting, 3 June 2020. Other *Clostera inclusa* specimens I have collected fall into two phenotypic groups. One is a smaller, darker phenotype that occurs primarily in the Austral Zone, although I have a specimen from Waukesha County. Another is a larger, pale phenotype that occurs in oak-pine barrens in the Canadian Zone. This specimen doesn't match either phenotype but is closer to these phenotypes than to any other *Clostera* species.

Notodonta scitipennis (7926)*: I have four recent specimens from Fallen Timbers but none from extensive historical surveys; however, three of the records are from the white cedar swamp which I did not survey with lights until recently. The Fallen Timbers records include: white cedar/hardwood swamp, MV and UV lights, 8 June 2020, 8 June 2021 (2), edge of hydric hardwood forest facing meadow, UV trap site 19, 27 July 2021. I also found this species at the Navarino Wildlife Area: UV trap site 17: hydric hardwood forest/sedge meadow, 9 June 2022; UV trap site 13, mesic to hydric hardwood-pine-hemlock forest, 5 August 2022. In the Canadian Zone I have found this species primarily in oak-pine barrens. The reported larval hosts are poplar and willow, but the moth appears to have a much more localized distribution than these plants.

Crambidia casta complex (8051)*: I collected one specimen in an MV trap in suburban Appleton on 30 August 2019. This species complex is locally common in oak-pine barrens with extensive lichens growing on the ground, and the Appleton record is the only time I have found it outside of this habitat. I have not seen any habitats in Outagamie County that look favorable for this species, although it is common in oak-pine barrens at the Navarino Wildlife Area. The Navarino records are from 22-23 June and 5 & 28 August 2022, and the size range of individuals is variable. At the Dunbar Barrens in Marinette County I found specimens on 28 August 1995, but none were recorded on warm nights in early and late June and early and late July. Also, only the larger sized individuals were found there.

Virbia nigricans (8119)*: I collected a male specimen of this poorly known species at Mosquito Hill: MV trap site 6, mesic hardwood forest edge facing into upland prairie planting, 3 July 2021. On 5 July 2022, I encountered a second male at a UV sheet in the prairie planting shelter. Unfortunately, the specimen flew off the sheet and I lost sight of it while attempting to photograph it. I only managed to obtain a poorly focused photograph, but the hindwings are exposed.

Grammia oithona (8195)*: My only area record is Outagamie County: Mosquito Hill: UV trap site 6, mesic hardwood forest edge facing upland prairie planting, 4 June 2021. All the other specimens I have collected or examined are from native prairie remnants from southern Wisconsin south to Missouri and Oklahoma. I consider this to be a separate species from *Grammia phyllira*, which I have found at the Navarino Wildlife Area. The two species have different distributions and habitat affiliations, although Robert Borth has collected both in sympatry at Spring Green Prairie (a sand prairie in Sauk County). *Grammia oithona* appears to be restricted to dry prairies (and perhaps prairie plantings) whereas *phyllira* is more broadly distributed in open sandy habitats. *Grammia phyllira* occurs in the Gulf Region, including the longleaf pine sandhill savannas in Florida and east Texas, but I have never seen *oithona* from the Gulf Region.

***Lophocampa maculata* (8214)*:** My only record for Outagamie County is Fallen Timbers: MV trap site 21, hydric hardwood forest, 10 June 2021. At the Navarino Wildlife Area, I have found this species from early to late June in sandy oak-pine barrens, oak-pine-hardwood forest, and bog habitats.

***Cycnia collaris* (8229):** Some taxonomists consider *Cycnia inopinatus* and *Cycnia collaris* to be the same species. In Wisconsin, I have collected the *inopinatus* phenotype from late May to mid June and the *collaris* phenotype from late July to early August. This is consistent with a hypothesis of a single species with different pattern phenotypes for the first and second brood. However, in northern Florida I have collected both phenotypes during June. Also, I have found the *inopinatus* phenotype exclusively in xeric grasslands where *Asclepias tuberosa* is present, whereas the *collaris* phenotype is more widespread. Therefore, I am treating the two phenotypes as separate species at this point. Until recently, I had only found the *inopinatus* phenotype in the Outagamie County area; it occurs on the Mosquito Hill prairie planting where *Asclepias tuberosa* is present.

I have five recent records of the *collaris* phenotype from Outagamie and Shawano Counties. Three are from the Mosquito Hill prairie planting where it is sympatric with *inopinatus*. I found two in a UV light trap on 24 July 2020, but could not find any the following year when most of the prairie was burned in the spring. However, another individual showed up at an MV light on 22 July 2022. I also collected one specimen in an MV trap in suburban Appleton on 23 July 2016. This is clearly a disperser, but I do not know the habitat of origin, as I have no other records of either *collaris* or *inopinatus* from the Appleton area. I flushed one specimen from the grass in sandy oak-pine barrens at the Navarino Wildlife Area on 30 July 2022. I have not found the *inopinatus* phenotype at Navarino, although I would expect it in two areas where I have not sampled at night where *Asclepias tuberosa* is present.

Cycnia collaris can be locally common in dry prairie remnants and plantings in southwestern Wisconsin, including Swamplovers Preserve in Dane County (Robert Borth collection). Kons and Borth found it to be common at the Wichita Mountains National Wildlife Refuge (Comanche County, southwestern Oklahoma), during early June. In north Florida, it is uncommon and local in my experience, and I have found it in longleaf pine-turkey oak sandhill scrub (Citrus County) and in herb bogs with pitcher plants (Liberty, Franklin, Okaloosa, and Escambia Counties), all localities where I did not see *Asclepias tuberosa*.

***Zanclognatha protumnusalis* complex species 2 (8349.2)*:** This species has more dark markings than nominotypical *protumnusalis* but averages smaller with less dark markings than *dentata*. It differs from both *dentata* and *protumnusalis* with COI 5' haplotypes, based on sequenced specimens from Door County, although there is a lot of haplotype overlap between *Zanclognatha* species so I am not sure if this would hold up with more extensive sampling or range wide. Most Wisconsin specimens I have collected/examined are from boreal forest/wetlands in Door County. However, I have two recent specimens from hydric hardwood forest at Fallen Timbers from 10 August 2019. One was taken in a UV trap and the other at bait.

***Zanclognatha martha* (8350)*:** I have single specimens from three different localities in Outagamie County: Mosquito Hill, MV trap site 6, mesic hardwood forest/upland prairie planting, 3 July 2021; Fallen Timbers: MV trap site 9, hydric hardwood forest, 16 July 2020; power line cut at northwest corner of Bluemound Drive X Highway 96: UV Trap, prairie planting/field/shrubs near hardwood forest, 12 July 2019. On 6 July 1993 I collected this species in xeric oak-pine forest with barrens openings on Kling Road in Jackson County (Central Sands biogeographic area). In 2022, I found seven specimens at the Navarino Wildlife Area on 23 June and 10 July. Six of the specimens were at MV light in sandy oak-pine barrens and one was from sandy oak-pine shrubby uplands.

***Zale aeruginosa* species 1 (8694)*:** I only have one specimen from Outagamie County: Mosquito Hill: bait trail on top of hill, mesic hardwood forest/grassland, 20 May 2022. At this time of year, bait has consistently worked poorly in Outagamie County, and this species is difficult to detect without bait. I suspect this is a resident species at Mosquito Hill, but that it is poorly documented due to bait attracting few moths during its flight season. It is undoubtedly a resident at the Navarino Wildlife Area, where I found at least 40 individuals at bait during 11, 14, and 15 May 2022. Most individuals were in xeric oak-pine uplands along a sand ridge, but I also found it in mesic-hydric hardwood forest.

***Catocala umbrosa* (8801.1)*:** I was unaware of this species as a possibility for Wisconsin when I conducted surveys from 1988-1996. The similar *Catocala ilia* is common and widespread in Outagamie County and throughout

Wisconsin, and at the time I thought it was a distinctive and easily recognized species. Thus, my series of voucher specimens is a small fraction of the individuals I encountered. While I found no *C. umbrosa* in my Wisconsin series from 1988-1996, I could have easily overlooked it with my limited sampling. Recent area records of *C. umbrosa* include: Outagamie County: Mosquito Hill: bait trail on hilltop, mesic hardwood forest/grassland, 4 August 2021 (1 female); Shawano County: Navarino Wildlife Area: hiking trail east of McDonald Road south of Pike's Peak Flowage, sandy oak-pine forest, bait trail, 5 August 2022 (1 male, genitalia examined; 1 probable female (worn). I also photographed, but then missed, another possible individual in fresh condition at a different part of the Navarino Wildlife Area; however, I cannot be certain of the identification without a specimen. This individual was found at bait in the sandy oak-pine barrens east of Highway K on the same date. The male genitalia enable identification by examination of the costal terminus without needing to do a KOH dissection, although dense hairs covering the costa need to be brushed away. Female genitalia can be readily separated, but only with KOH dissection. I have not done a KOH dissection of the Mosquito Hill female, but the pattern is a good match with the male from Navarino.

This species has a curious distribution. The core range is U-shaped; it occurs along the Atlantic Coastal Plain, in the Gulf Region, and in the Austral/Sonoran boundary region north as far as North Dakota. The species is common and widespread in the Gulf Region, as reported for northern Florida in Kohn and Borth (2006), and it is also common on the Edwards Plateau of Central Texas. Inside of the U this species appears to be uncommon and local, although it might be overlooked as *ilia* and underreported. A melanic form of *C. ilia* that occurs in the Midwest is misidentified as *umbrosa* in the paratype series. A curiosity is that *C. ilia* is highly variable and polymorphic in the Upper Midwest but exhibits little infraspecific variation in the Gulf Region.

***Catocala amestris* (8844)*:** I have three fresh specimens from Outagamie County, all from bait traps in suburban Appleton: 10 July 2018, 19 July 2019 (2). Larval hosts of this species are *Amorpha canescens* and *Amorpha fruticosa* (Kohn and Borth 2016). I have not seen these plants anywhere in Appleton, so the origin of these specimens is a mystery. Specimens I have collected or examined elsewhere in Wisconsin are from prairie remnants with *Amorpha canescens* in the southern counties. This plant occurs on the top of Mosquito Hill and on the prairie planting. I have made numerous unsuccessful attempts to find the adults in both of these areas during recent and historical surveys.

***Nycteola cinereana* (8977)*:** I have two recent records from Outagamie County, both during a week of unseasonably warm weather in early November 2020: Mosquito Hill, bait trail, mesic hardwood forest on west side of hill, 9 November 2020; Fallen Timbers: bait trail, white cedar-white pine-hardwood swamp, 8 November 2020. In Wisconsin, I have primarily seen this species from the Canadian Zone and Central Sands region.

***Heliopsis ascecius* (11072)*:** This species occurs in prairie remnants and prairie plantings and apparently is seldom attracted to lights. I found the first Outagamie County specimen on 5 August 2022 on the east side of the prairie planting at Mosquito Hill. The specimen is in fresh condition. Given the difficulty in detecting this species with surveys, it is not necessarily a recent colonization. I had previously collected a specimen during the day at a dry prairie planting at the Brilliance Nature Center (Calumet County) on 24 July 1990. Other Wisconsin specimens I have collected or examined are from prairie remnants in the southern counties, including Scuppernong Prairie in Waukesha County and Muralt Bluff Prairie in Green County (Robert Borth).

***Psychomorpha epimenis* (9309)*:** Thus far, I have two area records, both specimens in fresh condition: Outagamie County: Fallen Timbers, sipping moisture on mud on trail through hydric hardwood forest near open meadow, 15 May 2020; Shawano County: Navarino Wildlife Area: grassy ridge through sedge meadow and cattail marsh, 23 May 2022. This species rarely comes to light and never to bait, and in Florida I have mainly found it nectaring on flowering trees during the day in areas with mixed woodland and grassland. I have not been able to find it on flowering trees at the local sites where I collected it.

***Acrionicta betulae* (9208)*:** My only specimen from the area is from Appleton on 4 June 2020 in an MV trap. The specimen is in good condition. The only known hostplant is *Betula nigra* (Rings et al. 1992). To my knowledge, this plant is not native to the area, but it has been planted near the entrance to the Fox Cities Paper Trail near the Fox Valley Technical College, and probably elsewhere in the city. The hostplant grows naturally in floodplain forests along rivers in southwestern Wisconsin.

***Acrionicta falcata* (9214)*:** I have two recent specimens from the area: Outagamie County: Mosquito Hill: MV trap site 13, mesic hardwood forest on west side of hill, 17 May 2021; Shawano County: Navarino Wildlife Area: MV

trap site 10, sandy oak-pine barrens, 29 May 2022. In Wisconsin, most of my specimens are from the Canadian Zone and Central Sands. It typically occurs in xeric uplands, especially oak-pine barrens.

***Acronicta hamamelis* (9248)*:** The only area record is from suburban Appleton: UV trap, 15 July 2021. Rings et al. (1992) report that the larval host is witch hazel (*Hamamelis virginiana*). This species would be expected at the Navarino Wildlife Area and Mosquito Hill. Both of these sites have witch hazel, and I have recorded the same array of witch hazel feeding moths from both sites: *Caloptilia superbifrontella*, *Olethreutes hamameliana*, *Pseudexentera costumaculana*, *Nola triquetrana*, *Drasteria grandirena*, *Pyreferra hesperidago*, and *Pyreferra citromba*. I have not seen witch hazel in Appleton, and my only other Appleton record of a witch hazel feeding species is a single specimen of *Caloptilia superbifrontella*. I am aware of two other Wisconsin specimens of *Acronicta hamamelis*, collected by Kons and Borth at Boulder Lake Campground in Oconto County on 6 June 1992. This site contains mixed hardwood-conifer forest with witch hazel.

***Acronicta afflicta* (9254)*:** This species is a widespread generalist from the Lower Austral to Transition Zones, and I am perplexed that I have only collected three specimens in Outagamie County: Appleton: MV trap, 17 August 2018; bait trail, 25 August 2019; Mosquito Hill: MV trap, hilltop mesic hardwood forest/grassland, 1 July 2020. I found at least five individuals in sandy oak-pine barrens at the Navarino Wildlife Area during 2022 on 29 May, 23 June, and 11 July. Rings et al. (1992) report the larval host to be oak.

***Apamea vultuosa* (9341)*:** I have collected three recent specimens in Outagamie County: Mosquito Hill: mesic hardwood forest on west side of hill near base, 4 June 2021; Fallen Timbers: netted in hydric hardwood forest on Aspen Circle Trail, 8 June 2020; Appleton: bait trail, 25 July 2019. I also have two specimens from the Navarino Wildlife Area: UV trap site 6, shrubby oak-pine uplands on sand ridge south of Pikes Peak Flowage, 23 June 2022; landed in vegetation near MV light in early morning, sandy oak-pine barrens, 11 July 2022. This species apparently seldom comes to lights or bait and I lack a reliable means of detecting it with surveys. Most Wisconsin specimens I have collected or examined are from the Canadian Zone, but it has been found as far south as northern Ohio (Rings et al. 1992).

***Apamea plutonia* (9344)*:** In the early 1990s, Kons, Borth, and Barina occasionally encountered this species in the southern counties in sites with mixed hardwood forest and grassland (fields or dry prairie), including Grant, Green, and Waukesha Counties. I have five recent specimens from the Appleton bait trail, none of which are in good condition: 20, 25, 26 July, 3 August 2018, 10 August 2019. However, a 5 August 2022 specimen from the Navarino Wildlife Area is in good condition. This specimen was collected in oak-pine uplands with shrubby areas and grassy openings on the hiking trail south of Pikes Peak Flowage.

***Apamea impulsa* (9360)*:** This species seldom comes to lights or bait, and I suspect its apparent rarity is largely due to the difficulty in detecting it with these collecting techniques. I have one Outagamie County record: Appleton, bait trail, 10 July 2018. I also have one record from northern Winnebago County: Breezewood Lane, lighted sheet, mesic hardwood forest/field, 21-23 June 1989. Tom Barina has collected a specimen from Muralt Bluff prairie in Green County (southwestern Wisconsin) in an area with dry prairie and southern mesic hardwood forest.

***Apamea indocilis* (9362)*:** During Wisconsin surveys from the early and mid 1990s I only encountered this species in the Canadian Zone. Recently it has been recorded in Outagamie and Shawano Counties. Seven specimens in fair to worn condition came to the bait trail in Appleton during 2018: 11, 12, 17, 20, 21, 22, & 23 July. I also have one record from Mosquito Hill: MV trap site 6, mesic hardwood forest/upland prairie planting, 11 July 2021. I found two specimens at the Navarino Wildlife Area during 2022: UV trap site 3, hiking trail south of Pikes Peak Flowage, sandy oak-pine uplands south of sedge meadow with bog elements, 23 June; sandy oak-pine-hardwood forest/fields east of Highway K, netted, 10 July. Thus far, none of the specimens have been in fresh condition, and this species has not been found at any locality consistently.

***Oligia obtusa* (9418)*:** *Oligia obtusa* is seldom found at lights and it might have been undetected during the 1989-1996 surveys. However, it might be a recent colonization as it has been recorded from both Mosquito Hill and Fallen Timbers, two of the most intensively surveyed localities from 1992-1995. Records from the coverage area include: Outagamie County: Mosquito Hill: floodplain forest edge/wet-mesic prairie planting, UV trap site 7, 24 July 2020 (2); Fallen Timbers: hydric hardwood forest edge/prairie planting/field, UV trap site 19, 27 July 2021; Shawano County: Navarino Wildlife Area: UV sheet site 14, open tamarack bog adjacent to hardwood swamp and oak-pine

uplands, 5 August 2022. Hardwood swamp occurs in close proximity to all of the collection records, as well as where Kons and Borth collected this species in Posey County, Indiana.

***Photedes near enervata* (9441.1)*:** Two allopatric species go under this name, which differ by wing pattern and COI 5' mtDNA sequences. Nominotypical *enervata* occurs mainly on the Atlantic coastal plain in salt marsh habitats, but it has also been found in southern Louisiana by Vernon Brou (specimen photo examined). The second species occurs in the Midwest in wet-mesic prairie, prairie planting, and open wetland habitats. Rings et al. (1992) illustrate a specimen [called *enervata*] from Kenosha County (southeastern Wisconsin). Rings et al. (1992) report the host of *enervata* to be saltwater cord-grass (*Spartina alterniflora*) (credit to Ferguson) and suggest the Ohio host might be freshwater cord-grass (*Spartina pectinata*). USDA (2022) does not include Outagamie County in the distribution of this plant, although it shows it for three adjacent counties. *Aethes spartinana* occurs at Mosquito Hill, and to my knowledge *Spartina pectinata* is the only reported host for this moth (Ainslie 1917).

I think *Photedes near enervata* rarely comes to lights and I have never found it at bait. I know of no reliable way to survey for it. I have two recent records taken at MV light from wet-mesic prairie planting at Mosquito Hill near the edge of the floodplain forest: 24 July 2020 and 4 August 2021. I also have a specimen from wet-mesic prairie/fen/sedge meadow/varied wetlands from Scuppernong Prairie State Natural Area in Waukesha County (southeastern Wisconsin): UV trap, 11 August 1993.

***Papaipema harrisii* (9472)*:** My only record from the area is from Mosquito Hill: MV trap, wet-mesic prairie near edge of floodplain forest, 2 September 2020. Rings et al. (1992) list *Angelica* and *Heracleum lanatum* as larval hosts. I have not seen these plants at Mosquito Hill, but a species of Umbelliferae with large stems occurs in both the prairie planting and the floodplain. The only place I have found this moth in numbers in Wisconsin is at Swamplovers Preserve in Dane County (14-24 August 2021), which has a diverse assortment of prairie planting and open wetlands. I have single specimens from calcareous fen/sedge meadow at Nature Road in Walworth County (10 September 1994) and Armstrong Creek Bog in Forest County (28 August 1995).

***Papaipema circumlucens* (9491)*:** Two phenotypes go under this name, a uniform reddish phenotype shown in Rings et al. (1992), and a more contrasting phenotype with a lighter orange medial area.. Both phenotypes differ from numerous similar species by lacking a strongly contrasting lighter patch basal to the antemedial line. Kons and Borth have obtained COI 5' mtDNA sequences for both phenotypes, and they have the same haplotype. I have examined few specimens of either phenotype, but I have not seen intermediates.

On 23 August 2022, I collected a fresh female specimen of the contrasting phenotype at an MV sheet at Mosquito Hill. The sheet was near the shelter on wet-mesic prairie planting, near the edge of the floodplain forest. The pattern of this specimen is similar to a sequenced male collected by Kyle Johnson in a bog in Upper Michigan. Rings et al. (1992) report the hostplant to be hop vine (*Humulus lupulus*). Jess Miller (pers. comm. 2022) reports that this plant is not present at Mosquito Hill, and USDA (2022) shows no records for Outagamie County. BugGuide (2022) gives *Apocynum* as a larval host, but there is no citation, and Hessel (1954) reported that this plant is a host of *Papaipema baptisiae*, a species which is sometimes confused with *circumlucens*. However, *Apocynum* is present on the prairie planting at Mosquito Hill not far from where the *circumlucens* specimen was collected.

***Hydraecia stramentosa* (9516)*:** My only record for the area is one specimen from suburban Appleton: MV trap, 16 August 2019. In southwest Wisconsin, I found this species at Swamplovers Preserve where extensive upland prairie restoration and wet-mesic prairie planting is present, and Robert Borth has collected it in dry prairie at Muralt Bluff Prairie in Green County. I have surveyed four prairie plantings in Outagamie County during the flight season but did not find this species at any of them. In the Canadian Zone (Marinette and Forest Counties), I have collected this species in oak-pine barrens and bog, respectively, but did not find any in barrens or bog habitats at the Navarino Wildlife Area during my 2022 surveys. I found another specimen from suburban habitat from Wheaton, Illinois in 2022, but unsurveyed prairie plantings occur a few miles away. Rings et al. (1992) report a larval host to be *Scrophularia lanceolata*, which USDA (2022) shows occurring in most Wisconsin counties, including Outagamie.

***Bellura vulnifica* (9523.1)*:** I have two specimens from the area: Outagamie County: Fallen Timbers: hydric hardwood forest edge/wet-mesic prairie planting, UV trap, 16 July 2020; Shawano County: Navarino Wildlife Area: UV trap site 6, sandy oak-pine/shrubby uplands just south of emergent wetland/sedge meadow with bog elements, 10 July 2022. My other Wisconsin specimens are from early June to early July from barrens and bogs in Marinette,

Forest, and Jackson Counties. This species was formerly lumped with *gortynoides*, a species I have collected once in Waukesha County. *Bellura* have only wetland plants recorded as larval hosts, so records from uplands are likely dispersers.

***Conservula anodonta* (9548)*:** I collected two specimens in Outagamie County on 10 July 2020: Mosquito Hill: MV trap site 6, mesic hardwood forest/upland prairie planting; power line cut north of Allcan Road: sedge meadow, UV trap. This species was common at the Navarino Wildlife Area on 10 July 2022 in a variety of habitats, especially the oak-pine uplands along a sand ridge. I also found it in mesic-hydric hardwood-pine forest and bog. In the Canadian Zone, I have collected this species in oak-pine barrens (Marinette County), bog (Forest County), and xeric oak-pine forest (Florence County).

***Agrotis stigmosa* (10658)*:** I collected one fresh specimen on 20 May 2022 at Mosquito Hill. It was collected in a UV light trap in a poorly sampled area of the nature center, on the south side of the hill east of the prairie planting, in an area with oaks, white pine, hickories, sumac, and mesic to dry field. I found this species in numbers in sandy oak-pine barrens at the Navarino Wildlife Area during late May and early June 2022. In the early and mid 1990s most Wisconsin specimens I examined were from the southwest counties from areas with dry prairie, although I did collect a specimen in a bog in Douglas County along Highway T, with xeric oak-pine uplands in close proximity. All collection sites have some type of xeric grassland present.

***Euxoa medialis* (10813)*:** I collected one specimen at bait at Mosquito Hill on 2 September 2020. The habitat was mixed small trees and field between the building and the base of the hill, near the beginning of the trail up the hill. Previous Wisconsin specimens I have collected or examined were from prairie remnants in the southern counties. Two other specimens I collected are from mesic-wet prairie at Scuppernong Prairie State Natural Area, and a sand prairie/oak savanna west of Highway S; both of these sites are within the Southern Kettle Moraine State Forest in Waukesha County (southeastern Wisconsin). I have deployed lights and bait on the prairie planting at Mosquito Hill numerous times during the flight season, but found no more examples. I suspect this is a species that rarely comes to light or bait and is therefore difficult to detect with these methods.

***Ufeus satyricus* (11051):** My only record from the area is Fallen Timbers: white cedar swamp: MV trap, 8 November 2020. Lafontaine and Walsh (2013) report the hosts are poplar and cottonwood. I suspect this is a species that is rarely attracted to lights and difficult to detect with standard survey methods.

SECTION II.D: NEWLY RECORDED SPECIES THAT WERE PROBABLY OVERLOOKED BY PREVIOUS SURVEYS

Some Nearctic species were recorded in low numbers with recent spring or fall surveys in Outagamie County but were not recorded from 1989-1996. They cannot be reliably detected on individual survey nights during their flight season with lights or bait. I suspect they are resident species overlooked during the 1990s surveys. They fly during a time of year when I did more limited night survey in Outagamie County relative to other times of the year from 1992-1996, as I was attending UW-Stevens Point in Portage County during the spring and fall. Also, from 1989-1991 my night spring and fall surveys were mostly limited to the Appleton yard, where these species have not been found. These species include:

***Euthyatira pudens* (6240)*:** This univoltine spring species is usually encountered as single individuals in the Outagamie County area. It flies during a time of year when bait typically attracts few moths, and I suspect this is why it is difficult to detect with surveys. Local records include: Outagamie County: Old Stone Bridge Trail, mesic-hydric hardwood forest/fields, bait trail, 30 April 2020; Fallen Timbers: bait trail, hydric hardwood forest/grassland, 1 & 2 May 2020; MV trap site 18, white cedar swamp, 14 May 2020, 1 May 2021; MV trap site 8, hydric hardwood forest/grassland, 25 May 2019; Shawano County: Navarino Wildlife Area, UV trap site 9, mesic oak-pine hardwood forest, 15 May 2022.

***Hypenodes* species 1*:** In 1995 I collected this undescribed species in a Canadian Zone bog near Armstrong Creek in Forest County. Recent surveys have accumulated a number of specimens from the coverage area, including suburban Appleton (9), Fallen Timbers (12), Mosquito Hill (4), and the Navarino Wildlife Area (10). Habitats include bog, sedge meadow, hydric hardwood forest (floodplain and non floodplain), prairie planting near hydric hardwood forest edge, and suburban yard. This species is not found consistently in the suburban yard and these

specimens probably represent dispersers. All the other specimens were in (or in close proximity to) wetlands. The flight season ranges from early June to mid September. The size is similar to *Hypenodes caducus* and *H. sombrus*, but it has a plainer, less contrasting pattern than *caducus* and it is lighter tan than *H. sombrus*. I attempted to get a COI 5' sequence from an Appleton specimen but the sample yielded no results.

***Feralia jocosa* (10005)*:** My only Outagamie County record to date is from the white cedar swamp at Fallen Timbers: MV trap, 1 May 2020. Tamarack, one of the hostplants reported in Prentice (1962), is present in low density in this area. This part of Fallen Timbers was not surveyed with lights prior to 2020-2022, although there are scattered tamarack trees near areas that were surveyed previously. I collected a small series of this species at the Navarino Wildlife Area from 11-13 April 2023. Most of the specimens were collected in mesic to hydric hardwood-pine-hemlock forest, and are probably associated with hemlock, another one of the reported hosts.

***Feralia major* (10007)*:** This univoltine spring species has occasionally been encountered with recent surveys, usually as single individuals, except for 2023 records from Navarino. Records include: Outagamie County: Fallen Timbers: MV trap site 13, hydric hardwood forest, 8 April 2020; MV trap, white cedar/hardwood-pine swamp, 1 & 2 May 2020, 9 May 2022, 14 April 2023; Mosquito Hill: MV trap site 4, hilltop, mesic hardwood forest/grassland, 21 May 2020; MV trap site 13, mesic hardwood forest on west side of the hill, 4 April 2021 (2); Shawano County: Navarino Wildlife Area: MV trap site 7, sandy oak-pine-shrubby uplands south of Pikes Peak Flowage, 23 April 2022; sandy oak-pine barrens east of Highway K, mesic to hydric hardwood-pine-hemlock forest west of Highway K, MV and UV lights, 11-13 April 2023. Prentice (1962) reported larval hosts are pine and spruce. *Pinus strobus* is present at all three collection sites, and *Pinus resinosa* and *Pinus banksiana* are present among the Navarino sites.

***Feralia comstocki* (10008)*:** I collected two specimens in the white cedar/white pine/hardwood swamp at Fallen Timbers in an MV light trap on 1 May 2021. This part of Fallen Timbers was not surveyed with lights until 2020. I also collected a specimen in a UV light trap at the Navarino Wildlife Area in mesic hardwood/ pine/hemlock forest on 29 May 2022. None of the hostplants reported by Prentice (1962) occur at these collection sites, but Prentice (1962) included western white pine (*Pinus monticola*) and western hemlock (*Tsuga heterophylla*) as hosts. Eastern white pine (*Pinus strobus*) is a possible host present at both Fallen Timbers and Navarino, and *Tsuga canadensis* occurs by the Navarino light trap location. In central and northern Wisconsin this species occurs in xeric oak-pine barrens where *Pinus resinosa* and *P. banksiana* are the only conifers present.

***Papaipema speciosissima* or species near (9482)*:** This species (or species complex) has a disjunct distribution. It occurs along the Atlantic and Southeastern Coastal Plains, and disjunctly in the Upper Midwest. Reported hostplants are three species of *Osmunda* ferns, including royal fern, interrupted fern, and cinnamon fern (Hessell 1954).

From 1989-1995 I only collected one specimen from Wisconsin, a fresh specimen on 1 October 1992 at Schmeekle Reserve. I unsuccessfully attempted to find this species in a royal fern habitat at Fallen Timbers in late September and early October multiple times with recent and historical surveys. Recent records from the Navarino Wildlife Area in Shawano County (Kyle Johnson & the author) suggest that the October flight date of the fresh specimen from Schmeekle Reserve is atypical. My 2022 surveys at Navarino recorded this species from 8-21 September, and individuals found on 8 September were already not in fresh condition, so it apparently emerges even earlier. On 9 September 2022, I put a light trap in the royal fern habitat at Fallen Timbers and collected two specimens of *P. speciosissima*. My previous attempts at this location may have been too late in the season to have a good chance of finding this species. This species has also been found in Jackson County (central Wisconsin, collected by Tom Rochealeau) and Fond du Lac County (southeastern Wisconsin, collected by Steve Bransky, Kyle Johnson pers. comm. 2022).

***Xylena nupera* (9873)*:** Local records include: Outagamie County: Fallen Timbers, hydric hardwood forest, bait trail, 27 March 2019, 2 & 7 April 2020; Shawano County: Navarino Wildlife Area: hiking trail south of Pikes Peak Flowage, hydric-mesic hardwood-pine forest, 11, 21 & 23 April 2022. I have usually encountered this species in or near hydric hardwood forest, but Kons and Borth also have some specimens from oak-pine barrens in central and northern Wisconsin.

***Lithophane* species near *disposita* (9892.1)*:** I first encountered this species in Portage County, Wisconsin from 1992-1996 when I collected it at Schmeekle Reserve and Emmons Creek Public Hunting area, sympatric with *Lithophane disposita*. Specimens of these two species clearly segregate into two phenotypic groups. However,

unfortunately I did not include the records for near *disposita* in Kons (1996), as at the time another authority insisted they were the same species as typical *disposita* and should not be reported separately. Presently, I am convinced these are separate species. They have different distributions, and where they are sympatric I have seen no intermediate specimens.

This species is uncommon in the Outagamie County area and I have not recorded it on the majority of survey nights during the flight season, as was the case during the extensive surveys of Schmeckle Reserve. It is apparently widespread and not particular in habitat. With recent surveys I have found it at the Old Stone Bridge Trail (2), Fallen Timbers (2), Mosquito Hill (7), and the Navarino Wildlife Area (10). Habitats where I recorded it among these sites include floodplain and non riparian hydric hardwood forest, mesic hardwood forest, upland oak-pine forest, and oak-pine barrens. I have accumulated 21 specimens from Outagamie and southern Shawano Counties from mid April and early October to early November from 2020-2023. This species also occurs in Wisconsin's southwestern counties, including at Swamplovers Preserve in Dane County, where I did not find *disposita*.

***Lithophane baileyi* (9902)*:** I have rarely encountered this species in Outagamie County. It is easier to find in central Wisconsin, and it can be locally common in the Canadian Zone. Local records include: Outagamie County: Mosquito Hill: hill, bait trail, 12 March 2016 (Kyle Johnson); hilltop MV trap, mesic hardwood forest/grassland, 18 April 2020; Fallen Timbers: hydric hardwood forest, bait trail, 9 March 2021, 16 March 2022; Shawano County, Navarino Wildlife Area: hiking trail south of the Pikes Peak Flowage, 10 April 2022 (2), 10 November 2022; sandy trail through oak-pine forest east of Highway K, UV trap, 11 April 2023.

I consider *Lithophane vivida* to be a separate species from *L. baileyi*. The two phenotypes segregate with COI 5' mtDNA sequences, but thus far all of the sequenced specimens from the two haplotype/phenotype groups are allopatric. The nominotypical *vivida* phenotypes from the Pacific Northwest differ somewhat in pattern from specimens from the Upper Midwest and Appalachians (they tend to have more extensive silvery scaling), but Appalachian and Pacific Northwest specimens have the same COI 5' haplotypes (see public records from BOLD Systems (2022)). I tentatively refer to the Upper Midwest/Appalachian material as "*vivida* or species near". I recently found this species at the Navarino Wildlife Area: bait trail east of Highway K, sandy mesic to semi xeric oak-pine-hardwood forest/grassland, 22 October 2022; bait trail, sandy oak-pine barrens, 24 October 2022. This species is also sympatric with *Lithophane baileyi* at Schmeckle Reserve in Portage County, but there I only collected one specimen in four years of intensive survey.

SECTION ILE: NEWLY RECORDED SPECIES FROM PREVIOUSLY UNSURVEYED LOCALITIES

I recently collected five newly recorded species in Outagamie or northern Winnebago County at sites that I did not survey at night until recently. Outagamie and Winnebago Counties are within the range of these species and there is no reason to suspect they are recent colonizations. Accounts of these for species follow.

***Stamnodes gibbicostata* (7333)*:** Local records include: Outagamie County: Fox River Walk, UV trap, mesic-hydric hardwood forest, 21 September 2020, 11 September 2021 (2). I have seldom encountered this species and don't know why it appears to be local and uncommon. Other species recorded from the Fox River Walk are widespread in the area, except for *Papaipema cerina*, *Papaipema rutila*, and *Papaipema near pterisii*.

***Xanthorhoe* species 1 (7390.1)*:** I cannot place this phenotype with any recognized species. I only have one specimen from the Outagamie County area: power line cut north of Allcan Road, UV trap, sedge meadow, 10 July 2020. I have also collected this phenotype at a bog/hardwood-conifer forest in Forest County near Armstrong Creek. The Allcan Road specimen might originate from the extensive unsurveyed Hortonville Bog, about one mile north of the collection site.

***Orthonama evansi* (7415)*:** I recently found one specimen in Winnebago County, Wiouwash Trail just north of Outagamie Co. line, sedge meadow/shrubby wetland, UV trap, 2 August 2021. This is a local wetland species that occurs in fen and sedge meadow habitats, and I suspect future surveying at this site would reveal it is a resident there. Other Wisconsin localities where I have collected it include: Shawano County: Navarino Wildlife Area: Pikes Peak Flowage east of McDonald Road, emergent wetland/sedge meadow with bog elements, UV trap site 18, 2 August 2022; Dane County: Swamplovers Preserve: MV trap, overlook with mesic hardwood forest and upland prairie restoration, overlooking wet-mesic prairie planting and wetlands, 16 August 2021; Walworth County: Lulu Lake State Natural Area: sedge meadow/calcareous fen, UV trap, 11 August 1993 (2).

***Oligia brighami* (9415)*:** I have one specimen from Outagamie County: sedge meadow north of Allcan Road, UV trap, 13 August 2020. I suspect this specimen originated from the Hortonville Bog, an unsurveyed extensive bog about one mile north of the collection site. I have usually found this species in (or adjacent to) bogs or sedge meadows with bog elements. I also have a recent record from the Navarino Wildlife Area: MV sheet, hiking trail south of the Pikes Peak Flowage and east of McDonald Road, sandy oak-pine uplands just south of emergent wetland/sedge meadow with bog elements, 2 August 2022.

***Hillia iris* (9967)*:** I have two recent specimens from northern Winnebago County: Wiouwash Trail just north of Outagamie Co. Line: sedge meadow/shrubby wetland, UV trap, 18 September 2021, 17 September 2022. This species occurs in bog and sedge meadow habitats both north and south of the Wiouwash site, including at the Navarino Wildlife Area in southern Shawano County.

***Hemipachnobia monochromeata* (10993.1)*:** I have one record from Outagamie County: sedge meadow north of Allcan Road, UV trap, 10 July 2020. This species typically occurs in bogs, where it can be common, including at multiple locations within the Navarino Wildlife Area. At Navarino, during 2022 the flight ranged from early June to mid July with a peak in late June. I have found dispersers two miles or more from bog habitats in Jackson County. The Outagamie County specimen likely originates from the Hortonville Bog, an unsurveyed extensive bog about one mile north of the collection site.

SECTION II.F: SPECIES OMITTED FROM PREVIOUS CHECKLISTS

The following species were omitted (or reported under a provisional name) from the Kons (2014a) Outagamie County Checklist. However, they were collected during The 1989-1996 Interval:

***Hethemia pistaciaria* (7084):** This species was accidentally omitted from the Kons (2014a) list. While this species can be common in northern and central Wisconsin, especially in bogs, I only have two specimens from Outagamie County: Fallen Timbers: hydric hardwood forest, netted during day, 11 June 1990; Appleton: MV trap, 5 June 2020. Surprisingly I only found two specimens during my 2022 surveys of the Navarino Wildlife Area, and only one in a bog.

***Eupithecia columbiata* (7459):** This species was accidentally omitted from the Kons (2014a) list. I have specimens from mid and late May in Appleton, but there are likely additional records among unprocessed and undetermined *Eupithecia* specimens. Two Appleton specimens have been dissected.

***Eupithecia misturata* (7476):** This species is recorded from Mosquito Hill, Appleton, and the Navarino Wildlife Area. The local flight period is late July through early September. I have found it in mesic and hydric hardwood forest, mesic-hydric hardwood-pine-hemlock forest, prairie planting, and sandy oak-pine barrens. Exemplar specimens from Mosquito Hill and Appleton have been dissected. During its flight season, *Eupithecia miserulata* and *E. absinthiata* are usually the only other *Eupithecia* species present, and fresh specimens of these three species can be separated from each other by pattern.

***Hypenodes* species near *fractilinea* (8421.1):** In Kons (2014a) I lumped this under “*Hypenodes fractilinea* [complex]”. *Hypenodes* near *fractilinea* is common and widespread in the Outagamie County area, and much more common than nominotypical *fractilinea*. This species has a separate COI 5' haplotype from *H. fractilinea*, and I have sequenced one specimen from Appleton.

***Hypenodes palustris* (8422):** I have previously overlooked specimens from Fallen Timbers from 16 August 1994 and Appleton from 30 July 1995. This species has not been found regularly at any locality in Outagamie County. I have recent specimens from suburban Appleton (5), hydric hardwood forest at Fallen Timbers (1), and single specimens from floodplain forest and prairie planting at Mosquito Hill. This species was common at the Navarino Wildlife Area at a UV sheet on the bog boardwalk in 2022, and I have scattered specimens from other Navarino habitats including oak-pine barrens and hardwood-pine-hemlock forest. In the Canadian Zone I have found this species to be abundant in bogs, with lower numbers of specimens from oak-pine barrens and hardwood/conifer forest.

Hypenodes palustris has species specific COI 5' haplotypes, and I confirmed the identity of one of the suburban Appleton specimens with COI 5'. The size and pattern are similar to *Hypenodes* near *fractilinea*, a common

and widespread species in Outagamie County and Wisconsin, which also has species specific COI 5' haplotypes. *Hyphenodes palustris* is a darker greyish black whereas *Hyphenodes* near *fractililinea* is a lighter brown. *Hyphenodes caducus*, *Hyphenodes sombrus*, and *Hyphenodes* species 1 are distinctly larger.

***Hyphenodes franclemonti* (8424):** I have previously overlooked specimens from Fallen Timbers from 4 August 1992 and 16 August 1994. I also have at least five recent specimens from hydric hardwood forest at Fallen Timbers, and seven specimens from the Navarino Wildlife Area in 2022. Most are from wetlands including hydric hardwood forest, sedge meadow, and sedge meadow with bog elements, but there is one specimen from oak-pine barrens. The local flight period is late May through mid September. This minute species cannot be separated from more common similar species by the naked eye, but under magnification the notch in the postmedial line separates it from all other Wisconsin *Hyphenodes*. Nominotypical *franclemonti* occurs in the Canadian and Transition Zones, but there is a highly disjunct, undescribed sister species in the Gulf Region (Kons et al. 2017).

***Catocala orion* (8822.1):** I formerly lumped this species with *Catocala meskei*, but my studies of the three dimensional structure of the everted vesica have shown that it is clearly a separate species from *C. meskei*. The dorsal hindwing medial band is strongly bent medially at vein M2 in *C. orion* whereas it is fairly straight (although it may be constricted) in *C. meskei*. The local flight season of *C. meskei* spans early July to late August with a peak in late July, whereas the *C. orion* flight period spans mid August through early October with a peak in early September. I have not found the two species flying together during the same season, but if the flights were to overlap, I expect the *C. meskei* specimens would be worn when the *C. orion* are fresh.

***Papaipema aerata* (9468):** This species was reported as "*Papaipema* sp." and placed in the Hodges et al. (1983) checklist position for *aerata* in Kons (2014a). I currently assign the name *aerata* based on (1) comparison of the valvae of one dissected specimen to the drawing in Forbes (1948), and (2) comparison of the wing pattern to a photo of a paratype. Unfortunately none of the *aerata* paratype series specimens have been successfully sequenced for DNA. None of the Outagamie County specimens have been sequenced either. Up through 1996 I had collected a single specimen from Outagamie County: Fallen Timbers: hydric hardwood forest/meadow edge, UV trap, 1 September 1995. Unfortunately this specimen greased up, but the male genitalia are shown at: <http://www.lepidopterabiodiversity.com/Dissections/Noctuidae/Papaipema108.htm>. I have several recent records from Outagamie County. Most were collected in prairie planting but one was deep within hydric hardwood forest. Records include: Mosquito Hill: prairie planting near floodplain forest and mesic hardwood forest: MV trap, 15 September 2021; under leaf of sunflower, 15 September 2021; netted in flight, 16 September 2021; MV light, 1 October 2021 (2); UV trap, 16 September 2022; Fallen Timbers: hydric hardwood forest, 19 September 2021; NW corner of N Bluemound Drive X Hwy 96: power line cut, UV Trap site 3, field/prairie planting, 3 October 2018.

***Papaipema near pterisii* (9480):** In Kons (2014a), I lumped this species with *Papaipema pterisii*. I have confirmed the presence of near *pterisii* in Outagamie County with specimens sequenced for COI 5' mtDNA from Fallen Timbers and the Fox River Walk. Most Outagamie County specimens are near *pterisii*. *Papaipema* near *pterisii* occurs primarily in hydric hardwood forest, whereas *pterisii* occurs in association with bracken fern, often in xeric uplands. In the 1990s, there was some bracken fern in suburban Appleton, but I have not seen any recently and I have no recent records of *pterisii* for Outagamie County. However, *pterisii* and bracken fern are common at the Navarino Wildlife Area. Ostrich fern is the only fern I have seen in the vicinity of recent collections of near *pterisii* from suburban Appleton and the Fox River Walk, and this is also one of the ferns present at Fallen Timbers. *Papaipema* near *pterisii* is recorded from late August through late September, with most records from early-mid September.

***Chytonix rupertii* (9558):** This species was called "*Chytonix sensilis* complex species 1" in Kons (2014a). *Chytonix rupertii* and *Chytonix sensilis* are considered conspecific by some taxonomists. I have not found the phenotypes to be sympatric, but I have also seen no intermediates. The *ruperti* phenotype occurs at Mosquito Hill and the *sensilis* phenotype occurs at the Navarino Wildlife Area about 19 miles away. In Wisconsin, *Chytonix sensilis* inhabits oak-pine barrens of the Canadian Zone and Northern Transition Zone, whereas *ruperti* inhabits areas with xeric grasslands mixed with woodlands in the Southern Transition Zone. *Chytonix rupertii* is poorly documented in Outagamie County, but I have two specimens from mixed grassland/woodland habitat on the top of Mosquito Hill: UV sheet, 21 July 1992; MV light, 10 July 2020.

***Lithophane lanei* (9893.1):** I formerly lumped the *lanei* phenotype under *hemina*. These phenotypes are both common and fly together at every Outagamie County area locality that I surveyed for winter moths. I could not find

an explanation for why these phenotypes were considered separate species in the 2006 description. However, at this point I am treating them as separate species based on Kyle Johnson (pers. comm.) reporting that there are some Upper Midwest localities where only one of the phenotypes occurs. Both *hemina* and *lanei* have shaded and unshaded forms, but in Outagamie County the majority of *hemina* are shaded and the majority of *lanei* are unshaded.

***Eupsilia schweitzeri* (9934.1):** This recently described species was called “*Eupsilia sidus* [complex]” in Kons (2014a). Both *Eupsilia schweitzeri* and *E. sidus* occur in Portage County, but I can only confirm *E. schweitzeri* from Outagamie County, where during some years it is common at Mosquito Hill. Kyle Johnson discovered that these two species can be separated by examining forewing scales under magnification, and has examined numerous specimens from Mosquito Hill, all of which are *schweitzeri*.

PART III: FAUNAL COMPARISONS

SECTION III.A: OUTAGAMIE COUNTY VERSUS THE NAVARINO WILDLIFE AREA

In 2022 and the spring of 2023, I sampled a variety of habitats in the Navarino Wildlife Area in southern Shawano County at various times during the season. I recorded 822 species of Macrolepidoptera, 69 species of Rhopalocera, and over 541 species of microlepidoptera. The numbers of species of Macrolepidoptera, Rhopalocera, and microlepidoptera respectively, recorded and databased for the best studied sites in Outagamie County as of April 2023 are: suburban Appleton (720, 50, 539), Appleton+Grand Chute sites combined (736, 52, 583), Mosquito Hill Nature Center (844, 75, 656), Fallen Timbers Environmental Center (710, 74, 541), all of Outagamie County (999, 92, 889). The microlepidoptera lists are incomplete, as many specimens remain unidentified or unprocessed.

While the Navarino study area is only about 19 miles northeast of Mosquito Hill and 12 miles northwest of Fallen Timbers (Figure 66:B-C), the Navarino survey revealed a Lepidoptera fauna typical of the Central Sands Biogeographic Area of central Wisconsin (alternatively called “Central Plains” in Hole and Germain (1994)). Outagamie County survey localities have faunas typical of the Southeastern Ridges and Lowlands Biogeographical Area of southeastern Wisconsin.

My Navarino surveys recorded 60 species of Macrolepidoptera and Rhopalocera that I have not recorded from Outagamie County or my other sites from adjacent parts of Winnebago, Calumet, Brown, and Waupaca Counties. These species include: GEOMETRIDAE: *Speranza sulphurea* (6283), *Speranza abruptata* (6294), *Macaria signaria* (6344), *Eufidonia discospilata* (6639), *Selenia alcipheararia* (6817), *Selenia kentaria* (6818), *Metarranthis warneri* (6821), *Metarranthis amyrisaria* (6824), *Mesothea incertata* (7085), *Lobocleta plemyraria* (7097), *Hydriomena divisaria* (7235); MIMALLONIDAE: *Cicinnus melsheimeri* (7662); NOTODONTIDAE: *Heterocampa pulverea* (7990.1), *Schizura concinna* complex phenotype 2 [a northern Transition/Canadian Zone disjunct] (8010); NOCTUIDAE: *Phragmatobia assimilians* (8158), *Grammia margo* (8172.1), *Grammia phyllira* (8194) [I consider this a separate species from *Grammia oithona*, which has been found in Outagamie County], *Epantheria scribbonia* [a central Wisconsin disjunct] (8146), *Dasychira basiflava* or species near [a central Wisconsin disjunct] (8296), *Dasychira pinicola* (8305), *Mycterophora inexplicata* (8413), *Hypocala andremona* (8642), *Phoberia ingenua* (8591.1), *Drasteria graphica* (8618), *Zale helata* complex species 2 [occurs only in association with jack pine] (8704.1), *Zale* near *duplicata* [the pattern resembles *submediana* but the genitalia match *duplicata*, which it does not resemble in pattern; it flies later than *submediana* with little if any overlap in the flight season, and occurs exclusively in jack pine habitats], *Zale metatoides* (8707), *Chrysanympa formosa* (8904), *Syngrapha viridisigma* (8929), *Syngrapha microgramma* (8946), *Oruza albocostaliata* or species near (9025), *Psaphida thaxteriana* (10020), *Cerma cora* (9061), *Acronicta tritona* (9211), *Acronicta longa* (9264), *Sympistis riparia* (10135), *Photedes includens* (9434), *Bellura brehmei* (9524), *Bellura densa* complex phenotype 2 [a disjunct smaller phenotype] (9526), *Chytonix sensilis* [treated as separate from *ruperti*, which occurs at Mosquito Hill] (9557), *Fagitana littera* complex [a Midwest disjunct] (9629), *Caradrina meralis* (9654), *Fishia illocata* (9420), *Lithophane vivida* or species near [sympatric with *baileyi*] (9903), *Lithophane tepida* (9909), *Lithophane thaxteri* (9928), *Sericaglaea signata* (9941), *Sutyna privata* (9989), *Sideridis congermana* (10266), *Lacinipolia vicina* (10394), *Agrotis vetusta* (10641), *Eucloptocnemis fimbrialis* (10694), *Euxoa scandens* (10715), *Xestia praevia* (10968.1), *Xestia youngii* [sympatric with *dilucida*, which is more widespread and emerges earlier] (10970), *Cerastis fishii* (10997), *Aplectoides condita* (10999); HESPERIIDAE: *Hesperia leonardus* (4023); LYCAENIDAE: *Callophrys augustinus* (4322), *Callophrys niphon* (4328); NYMPHALIDAE: *Euphydryas phaeton* (4516).

Hypocala andremona, *Oruza albocostaliata*, and *Sericaglaea signata* are strays (or suspected strays) from the south, and *Mycterophora inexplicata* is a suspected stray from the north. These species are addressed in the species accounts for strays and ephemeral migrants. The author, Robert Borth, and Tom Barina collectively recorded all of the remaining species from the Central Sands Biogeographic Area in Portage and/or Jackson Counties from 1992-1996, except for *Schizura concinna* complex, *Photedes includens*, and *Bellura densa* phenotype 2. While some of these species are recorded elsewhere in the Eastern Ridges and Lowlands region, they appear to be more localized and/or uncommon in this region relative to the Central Sands. An exception is *Euphydryas phaeton*, which is common and widespread in sedge meadows in southeastern Wisconsin.

Furthermore, numerous species that are rare or uncommon in Outagamie County are more common at both the Navarino Wildlife Area and in the traditional Central Sands. These species include: GEOMETRIDAE: *Speranza evagaria* (6278), *Speranza brunneata* (6286), *Speranza loricaria* (6290), *Speranza exhausticata* (6292), *Epelis truncataria* (6321), *Iridopsis vellivollata* (6582), *Iridopsis larvaria* (6588), *Euchalena effecta* (6728), *Euchalena irraria* (6739); *Eulithis explanata* (7206), *Mesoleuca ruficillata* (7307); EIPLEMIDAE: *Callizia amorata* (7650); APATELODIDAE: *Olceclostera angelica* (7665); SPHINGIDAE: *Sphinx gordius* complex [I think records of *poecila* and *gordius* from the Upper Midwest are a single species; however, material from Florida and the Atlantic coastal plain may represent a different allopatric species] (7810); NOTODONTIDAE: *Symmerista* species; NOCTUIDAE: *Crambidia casta* complex (8051), *Virbia laeta* (8114), *Lophocampa maculata* (8214), *Dasychira vagans* (8294), *Idia dimminuendis* (8329), *Zanclognatha martha* (8350), *Hyphenodes* species 1, *Zale aeruginosa* species 1 (8694), *Zale phaeocapna* (8698), *Zale submediana* (8702), *Catocala antinympa* (8775), *Lithacodia bellicula* (9046), *Callopietria cordata* (9633), *Acronicta tristis* (9247), *Acronicta afflicta* (9254), *Acronicta noctivaga* (9259), *Papaipema pterisii* (9480), *Papaipema speciosissima* or species near (9482), *Conservula anodonta* (9548), *Homoglaea hircina* (9881), *Lithophane baileyi* (9902), *Lithophane fagina* (9917), *Chaetoglaea sericea* (9950), *Eucirroedia pampina* (9952), *Melanchra assimilis* (10295), *Spirameter grandis* (10300), *Spirameter lutra* (10301), *Lacinipolia lustralis* (10370), *Lacinipolia anguina* (10372), *Agrotis stigmata* (10658), *Trichosilia geniculata* (10680), *Euagrotis forbesi* (10902), *Diarsia rubifera* (10917), *Xestia badicollis* (10968), *Xestia dilucida* (10969), *Coenophila opacifrons* (10988), *Euretagrotis attenta* (11009), *Lycophota phyllophora* (11010); HESPERIIDAE: *Erynnis brizo* (3946); LYCAENIDAE: *Callophrys henrici* (4326).

More limited surveys I have conducted in northern Shawano, southeastern Oconto, and southern Menominee (Legend Lake Area) Counties have also revealed a fauna typical of the Central Sands. Some additional species Kohn and Borth have recorded from these areas include: GEOMETRIDAE: *Eraetria coloraria* (Oconto & Menominee Counties), *Apodrepanulatrix liberaria* (Menominee County), SPHINGIDAE: *Hemaris gracilis* (Menominee County), NOCTUIDAE: *Schinia indiana* (Menominee, Oconto, & Shawano Counties), HESPERIIDAE: *Erynnis persius* (Menominee County), and LYCAENIDAE: *Lycaeides melissa samuelis* (Menominee County).

Comparison of microlepidoptera lists is preliminary, as I have an extensive number of microlepidoptera specimens from Outagamie County and elsewhere that have yet to be sorted, identified, and recorded. However, I collected the following microlepidoptera species at the Navarino Wildlife Area that are not represented on my current list for Outagamie County [*=species I have also collected in the traditional Central Sands (Portage and/or Jackson Counties); #=species I have also collected in the Canadian Zone of Wisconsin; @=species I have also collected in southeastern Wisconsin]: TINEIDAE: *Isocorypha mediostratella* (299), *Scardia anatomella* (311); GRACILLARIDAE: *Caloptilia triadicae* (644.1), MOMPIDAE: *Mompha passerella* (1450); COSMOPTERIGIDAE: *Triclonella determinatella* (1527); GELECHIIDAE: *Isophrictis magnella* (1694), *Exotelia pinifoliella* (1840), *Chionodes continuella* (2069)*, *Chionodes formosella* (2077), *Anacamptis conclusella* (2233), *Dichomeris* species; TORTRICIDAE: *Zomaria interruptolineana* (2750)*#, *Apotomis funerea* (2755)#, *Olethreutes malana* (2820)*, *Hedya separatana* (2860)*, *Rhyacionia* species, *Retinia gemistrigulana* (2898)*, *Eucosma spiculana* (2971), *Eucosma striatana* (2973)*, *Eucosma pallidacostana* (2980)*, *Pelochrista lathamii* (3036), *Pelochrista palabundana* (3079), *Pseudexentera kalmiana* (3255)*#, *Gretchena semialba* (3267), *Rhopobota dietziana* (3277), *Ancylis comptana* (3374), *Ancylis albocostana* (3387)*#, *Cydia toreuta* (3486)*#, *Acleris pulverosana* complex species 1 (3531)*#@, *Acleris maculidorsana* (3543)*#, *Acleris minuta* (3545)*#, *Acleris maccana* (3549)*#, *Acleris bomonana* (3553)*#, *Acleris lipsiana?* (3555), *Acleris busckana* (3558)*, *Choristineura obsoletana* (3631) [disjunct?], *Pandemis canadana* (3595), *Archips myricana* (3652)*#, *Archips strianus* (3664)#, *Sparganothis tristriata* (3699)#, *Amorbia humerosana* (3748)*, *Neocochylys dubitana* (3774); LIMACODIDAE: *Packardia elegans* (4661)*#; PYRALIDAE: *Elophila ekthlipsis* (4747)*#, *Petrophila canadensis* (4779)#, *Xanthophysa psychicalis*

(4879)*@, *Pyrausta pythialis* (5035), *Donacula albicostellus* (5316.2)*, *Crambus hamella* (5340)*#, *Xubida panalope* (5500), *Dioryctria banksiella* and/or *resinosella* (5858/5861.1)*#.

The major Outagamie County study sites have been surveyed more thoroughly than the Navarino Wildlife Area, so it is more meaningful to note which species recorded from Navarino have not been found at these Outagamie County sites than vice versa. However, one assemblage of species completely lacking from the Navarino samples is the fauna associated with southern hardwood forests, including many species recorded exclusively from Juglandaceae for larval hosts. The major Outagamie County study sites have some combination of the following southern hardwood forest affiliated species, none of which have been found at Navarino: NOTODONTIDAE: *Datana angusii* (7903), *Datana contractata* (7906), *Datana integerrima* (7907); NOCTUIDAE: *Baileya dormitans* (8971), *Panopoda carneicosta* (8588), *Catocala innubens* (8770), *Catocala habilis* (8778), *Catocala serena* (8779), *Catocala judith* (8781), *Catocala obscura* (8784), *Catocala residua* (8785), *Catocala resecta* (8788), *Catocala insolabilis* (8791), *Catocala palaeogama* (8795), *Catocala nebulosa* (8796), *Catocala subnata* (8797), *Catocala neogama* (8798), *Catocala communis* (8798.1), *Catocala mira* (8863), *Abrostola ovalis* (8880), *Lithacodia musta* (9051), *Psaphida electilis* (10012), *Psaphida grandis* (10013), *Phosphila miselioides* (9619), *Lithophane franclemonti* (9887.1); LYCAENIDAE: *Satyrrium caryaevorum* (4283); TORTRICIDAE: *Pseudexentera cressonia* (3246), *Cydia caryana* (3471), *Argyrotaenia juglandana* (3622); PYRALIDAE: *Acrobasis palliolella* (5659), *Acrobasis caryalbella* (5660), *Acrobasis juglandis* (5661), *Acrobasis caryae* (5664), *Acrobasis tumidulella* (5663), *Acrobasis demotella* (5674).

SECTION III.B: FAUNAL CHANGE GRADIENTS IN EASTERN WISCONSIN FOR MACROLEPIDOPTERA AND RHOPALOCERA

Current evidence suggests that two steep Lepidoptera faunal change gradients occur in eastern Wisconsin. One is discussed above and occurs somewhere in the 12-19 miles between Fallen Timbers-Mosquito Hill and the Navarino Wildlife Area, where the Lepidoptera fauna changes from the Southeastern Ridges and Lowlands of the southern Transition Zone to the Central Sands fauna of the Northern Transition Zone (Figure 66:B). Another occurs where the Lepidoptera fauna changes from the Northern Transition Zone to the Canadian Zone. Boulder Lake Campground in southern Oconto County (just north of the Menominee County border) and the Navarino Wildlife Area (in southern Shawano County) have Northern Transition Zone/Central Sands type faunas, whereas the Door County peninsula (near Baileys Harbor) and Summit Lake (Langlade County) have Canadian Zone faunas. A second faunal change gradient must occur somewhere between Boulder Lake and Summit Lake, and disjunctly somewhere south of Baileys Harbor (Figure 66:B). The Summit Lake study site is about 28 miles northwest of Boulder Lake, but only about 14 miles farther north. The Baileys Harbor study site is a little farther south than Boulder Lake, but it has a colder climate due to its location on a narrow peninsula in Lake Michigan (Figure 66:B-C).

In eastern Wisconsin, the following species have been recorded exclusively in the Canadian Zone among specimens I have collected and examined: GEOMETRIDAE: *Speranza occiduaria* (6279), *Speranza argillacearia* (6282), *Speranza anataria* (6287), *Speranza boreata* (6287.1), *Speranza bitactata* (6304), *Macaria marmorata* (6349), *Orthofidonia tinctaria* (6428), *Euchlaena madusaria* species 1 (6731, see Kons et al. (2017) page 100), *Tacparia atropunctata* (6806), *Idaea rotundopennata* (7125), *Scopula ancellata* (7162), *Leptostales ferruminaria* species 2 (7180; species 1 occurs in the Upper Austral Zone south of Wisconsin), *Dysstroma walkerata* (7188), *Eulithis destinata* (7204), *Eulithis serrataria* (7208), *Ecliptopera silaceata* (7213), *Hydria undulata* (7291), *Rheumaptera subhastata* (7294), *Perizoma basaliata* (7316), *Xanthorhoe iduata* (7371), *Xanthorhoe decoloraria* (7384), *Hydrelia condensata* (7420), *Eupithecia regina* (7483), *Eupithecia nimbicolor* (7522), *Eupithecia bowmani* (7565), *Eupithecia anticaria* (7594); NOTODONTIDAE: *Clostera near inclusa* (7896.1), *Clostera brucei* (7900); NOCTUIDAE: *Virbia lamae* (8120), *Spilosoma dubia* species 1 (8136, species 2 occurs in the Lower Austral Zone), *Platarctia parthenos* (8162), *Arctia caja* (8166), *Grammia speciosa* (8172.1), *Dasychira plagiata* (8304), *Zanclognatha deceptricalis* (8341.1), *Catocala badia* (8776, the *coelebes* form), *Catocala semirelictata* (8821), *Autographa rubida* (8909), *Autographa bimaculata* (8911), *Autographa mappa* (8912), *Syngrapha alias* (8939), *Syngrapha cryptica* (8941), *Syngrapha montana* (8945), *Alypia langtoni* (9318), *Acronicta quadrata* (9224), *Sympistis dinalda* (10066), *Apamea commoda* (9359), *Apamea near sordens* (9364.1), *Apamea scoparia* (9365), *Apamea cogitata* (9367.1), *Eremobina claudens* (9396), *Oligia minuscula* (9416), *Chortodes basistriga* (9439), *Hyppa* species 1 (9578.1), *Litholomia napaea* (9884), *Lithophane lepida* complex (9925), *Psectraglaea carnosata* (9951) *Brachylomia discinigrata* (9999), *Discestra trifolii* species 2 (10223.1), *Sideridis maryx* (10268), *Melanchnra*

pulverulenta (10294), *Lacanobia nevadae* (10296), *Lacanobia radix* (10298), *Trichordestra rugosa* (10302), *Trichordestra tacoma* (10303), *Papestra quadrata* (10310), *Papestra biren* (10311), *Orthodes obscura* (10290), *Trichosilia mollis* (10644), *Euxoa divergens* (10702), *Euxoa sinelinea* (10703), *Diarsia rosaria* (10921), *Erois stricta* (10930), *Xestia oblata* (10947), *Paradiarsia littoralis* (10992), *Protolampra rufipectus* (11004); HESPERIIDAE: *Hesperia comma* (4020); LYCAENIDAE: *Epidemia dorcas* (4261), *Lycaeides idas* (4374), *Plebejus saepiolus* (4376); NYMPHALIDAE: *Polygonia satyrus* (4422), *Polygonia faunus* (4423), *Boloria eunomia* (4463), *Boloria frigga* (4466), *Boloria freija* (4471), *Erebia discoidalis* (4596), and *Oeneis chryxus* (4606). There are several additional species that I think are residents only in the Canadian Zone, but which have occasionally strayed south and were recorded outside of the Canadian Zone as isolated occurrences. These species include: *Eupithecia mutata* (7575), *Hyles gallii* (7893), *Manulea bicolor* (8043), *Zanclognatha inconspicualis* (8344), *Mycterophora inexplicata* (8413), and *Euxoa perpolita* (10865).

Boulder Lake Campground is about 32 miles north of the Navarino Wildlife Area, and contains mesic to hydric hardwood-conifer forest and bog in the areas I sampled. Kons and Borth surveys there in late May and early June recorded 201 Macrolepidoptera species. All of these species have been recorded at the Navarino Wildlife Area and in the Central Sands with the exception of *Acronicta hamamelis*, a witch hazel feeder recorded both south and north of Navarino. No species particular to the Canadian Zone are represented in this sample.

I surveyed a bog bordered by hardwood-conifer forest near Summit Lake (Langlade County) primarily during June of 1995, and recorded 138 Macrolepidoptera and Rhopalocera species. Even with this small sample I found numerous species particular to the Canadian Zone, including: *Speranza argillacearia* (6282), *Virbia lamae* (8120), *Spilosoma dubia* complex species 1 (8136), *Autographa rubida* (8909), *Alypia langtoni* (9318), *Apamea* new species near *sordens* (9364.1), *Melanchnra pulverulenta* (10294), *Lacanobia nevadae* (10296), *Lacanobia radix* (10298), *Trichordestra rugosa* (10302), *Trichordestra tacoma* (10303), *Papaestra biren* (10311), *Diarsia rosaria* (10921), *Xestia oblata* (10947), *Boloria eunomia* (4463), *Boloria frigga* (4466), *Boloria freija* (4471), and *Erebia discoidalis* (4596). Kons and Borth conducted a survey on Sunset Drive near Baileys Harbor during mid August. The habitat includes mesic to hydric boreal forest (trees include white spruce, balsam fir, white cedar, pine, birch, balsam poplar, and aspen), sedge meadow, and shrubby wetlands. Canadian Zone species we recorded include: *Idea rotundopennata* (7125), *Hydria undulata* (7291), *Perizoma basaliata* (7316), *Dasychira plagiata* (8305), *Zanclognatha inconspicualis* (8344), *Zanclognatha deceptricalis* (8341.1), *Catocala badia* (8776), *Catocala semirelictica* (8821), *Syngrapha alias* (8939), *Syngrapha cryptica* (8941), *Apamea cogitata* (9367.1), *Eremobina claudens* (9396), *Brachylomia discinigra* (9999), and *Trichosilia mollis* (10644). I expect numerous other Canadian Zone species would be found in these areas if surveys were conducted at other times of the year and/or in upland habitats (the Baileys Harbor and Summit Lake survey localities lack uplands in the immediate vicinity). What is apparent from even these limited samples is that numerous species particular to the Canadian Zone in eastern Wisconsin range near the southern limit of the Canadian Zone.

The change in the Macrolepidoptera fauna between the Southern Kettle Moraine State Forest (SKM) in southeastern Wisconsin and the Outagamie County study sites is apparently less than the change between Fallen Timbers-Mosquito Hill and the Navarino Wildlife Area. This is despite the distance between Appleton and the SKM being about 98 miles, versus 12-19 miles between Fallen Timbers-Mosquito Hill and the Navarino Wildlife Area (Figure 66:B-C). While the SKM has not been surveyed nearly as thoroughly as Outagamie County (most surveys were from July to September), Kons, Borth, and Barina have collectively recorded 746 species of Macrolepidoptera and Rhopalocera from there, 744 of which are reported in Kons et al. (2014).

The SKM species list includes 37 species of Macrolepidoptera not recorded from Outagamie County. However, 25 of these species are recorded from one or two specimens, and many of these are likely strays to the SKM rather than resident species. These species include: *Hypomecis umbrosaria* complex (6439), *Tornos scolopacinarius* (6486), *Epimecis hortaria* (6599), *Euchlaena deductaria* (6735), *Patalene olyzonaria* (6974), *Timandra amaturaria* (7147), *Lacasoma chiridota* (7659), *Eacles imperialis* (7704), *Erinnyis ello* (7834), *Eumorpha achemon* (7861), *Symmerista albifrons* (7951), *Virbia immaculata* (8124), *Renia salusalis* species 2 (8378) *Phytometria* species (formerly misidentified as *rhodarialis*, for which the type is a tropical species not present in the U.S.) [specimen in Milwaukee Public Museum], *Zale bethunei* (8705), *Ptichodis herbarum* (8750), *Nycteola metaspilella* (8978), *Baileyi australis* complex (8973), *Tripudia rectangula* (9003.1), *Homophoberia cristata* (9056), *Heliothis subflexus* (11070), *Phosphila turbulenta* (9618), *Bellura gortynoides* (9523), *Bellura anoa* or species near (9525.1), and *Abagrotis magnicupida* (11043.1). Only twelve of the SKM Macrolepidoptera species that are more clearly residents have not

been found in Outagamie County: *Apodrepanulatrix liberaria* (6693), *Lobocleta plemyraria* (9079), *Eulithis molliculata* (7203), *Cicinnus melsheimeri* (7662), *Apatelodes torrefacta* (7663), *Anisota stigma* (7716), *Hemileuca maia* (7730), *Phragmatobia lineata* (8157), *Phytometra ernestinana* (8480), *Tarachidia tortricina* (9101), *Schinia grandimedia* (11148.1) [reported as *oleagina* in Kons et al. (2014)], and *Tricholita notata* (10628). Four of these species appear to be more widespread in the Central Sands than in southeastern Wisconsin (*Apodrepanulatrix liberaria*, *Lobocleta plemyraria*, *Cicinnus melsheimeri*, and *Hemileuca maia*), whereas the remainder are not known to range as far north as Outagamie County in eastern Wisconsin. Three additional species are recorded from single specimens in Outagamie County but are regularly found in numbers in the SKM: *Catocala epione* (8773), *Spartiniphaga inops* (9435), and *Papaipema beeriana* (9508). I have also collected five species or phenotypes from the SKM that cannot be confidently placed with current taxonomy, and which have not been found in the Outagamie County area: *Papaipema nelita* species 2, *Papaipema unimoda* phenotype 2, *Sutyna* species (*profunda?*), *Agrotis* species, and *Agnorisma bugrai* phenotype 2.

The SKM has eight Rhopalocera species not recorded from Outagamie County, including one stray: *Nastra lherminier* (3993); one ephemeral migrant: *Pontia protodice* (4193); one stray or uncommon resident: *Thorybes bathyllus* (3909); one historical resident: *Calephelis muticum* (4391); and four residents: *Oarisma powesheik* (4006), *Polites origenes* (4042), *Tharsalea helleoides* (4262), and *Euphydryas phaeton* (4516). *Calephelis muticum*, *Tharsalea helleoides*, and *Euphydryas phaeton* occur both south and north of Outagamie County. Thus, the SKM has only two clear cases of resident Rhopalocera species that do not range as far north as Outagamie County.

Hole and Germain (1994) considered Fallen Timbers, Mosquito Hill, Navarino, southern Menominee and Oconto Counties, and the Door County peninsula to occur in a proposed biogeographic area that they called the Lake Michigan Shoreland (LMS), whereas Appleton but not Fallen Timbers and Mosquito Hill were included in the Southeastern Ridges and Lowlands (SRL) (Figure 66:C). As demonstrated above, this proposed delimitation of biogeographic areas strongly contradicts Lepidoptera distribution patterns. Both of the sharp faunal change gradients in eastern Wisconsin occur within Hole and Germain's (1994) concept of the LMS. Hole and Germain's (1994) proposed Lake Michigan Shoreland includes areas with a Southern Transition Zone/SRL fauna, (Mosquito Hill and Fallen Timbers), a Northern Transition Zone/Central Sands fauna (Navarino Wildlife Area, southern Menominee and Oconto Counties), and a Canadian Zone fauna (Door County peninsula near Baileys Harbor) (Figure 66:B versus C). The LMS is actually a mixing of portions of the Canadian, Northern Transition, and Southern Transition Zones, and thus is an extremely misleading concept of a biogeographic area. Likewise, classifying Appleton in a separate biogeographic area from Fallen Timbers and Mosquito Hill strongly clashes with available data. With the exception of some strays, ephemeral migrants, and recent Palearctic colonizations, nearly all Macrolepidoptera and Rhopalocera species recorded among the Appleton-Grand Chute area localities (the suburban yard, Old Stone Bridge Trail, Bluemound Drive power line cut, Fox River Walk, Fox Cities Paper Trail, Prairie Hill Park) are species also recorded from Mosquito Hill and/or Fallen Timbers. The few exceptions are *Stamnodes gibbicostata* and *Catocala luciana*. Unlike the LMS, I think the SRL is a valid biogeographic area; however, Hole and Germain's (1994) boundary should be moved north to include Mosquito Hill and Fallen Timbers, rather than between these sites and Appleton. Likewise, the Central Sands is a meaningful biogeographic area, but the boundary should be expanded eastward to include Shawano, Menominee, and southern Oconto Counties at a minimum.

These comparisons between life zones/biogeographic areas are based on the collective faunas of a range of different habitats. Within the same biogeographic area or life zone, there are substantial differences between individual localities with different types of habitat, such as between a grassland and a woodland or a hydric versus a xeric habitat. These differences are difficult to quantify, since many sites have multiple habitat types in close proximity, and many Lepidoptera species routinely disperse outside of their habitat of origin.

Based on the Lepidoptera faunal assessments presented above, I think eastern Wisconsin has three life zones, the Southern Transition Zone (including the area between the Southern Kettle Moraine State Forest and Fallen Timbers-Mosquito Hill), the Northern Transition Zone (including the area between the Navarino Wildlife Area and Boulder Lake), and the Canadian Life Zone (including the area from Summit Lake northward, plus a disjunct area in the Door County peninsula) (Figure 66:B). I consider the "Transition Zone" to actually be comprised of two zones, due to the steep faunal change gradient within it. Figure 66:B maps the location of study sites mentioned herein and color codes them by each zone, whereas Figure 66:C color codes the same set of sites according to the Hole and Germain (1994) biogeographic areas.

Table 7 lists Macrolepidoptera and Rhopalocera species that I hypothesize are residents in only one or two of the three life zones in eastern Wisconsin. This is based primarily on my own field work, but I also included some specimens examined from the collections of Robert Borth and Tom Barina when creating this table. For the Canadian and Northern Transition Zones I included only species that occur from Stevens Point eastward, although for these species I included data from anywhere in the Central Sands biogeographic area for determining which species are resident in the Northern Transition Zone. For the Southern Transition Zone I included only species that occur east of Dane County (just west of Madison there appears to be an east/west faunal change gradient within the Southern Transition Zone, which will be addressed in a subsequent paper).

Within this coverage area, I have collected or examined specimens of 1397 Macrolepidoptera and Rhopalocera species. Of these, 769 species are recorded from all three life zones as probable residents or annual migrants. All of the annual migrants that occur in Outagamie County (Tables 1-2) are broadly distributed in eastern Wisconsin and occur in all three life zones. Strays or ephemeral migrants comprise 171 of the species, and are excluded since they are nonresidents in the coverage area. I also excluded 41 species recorded from few specimens, either because I was unsure of their status (stray or rare resident) or because there are inadequate data to hypothesize about their distribution by life zone. The remaining 417 species (29.9%) are responsible for the faunal differences between Life Zones (Table 7). I hypothesize that in eastern Wisconsin, 95 species are residents only in the Canadian Zone, 99 only in the Canadian + Northern Transition Zone, at most six only in the Northern Transition Zone, 122 only in the Northern + Southern Transition Zones, and 94 only in the Southern Transition Zone (Table 7). This suggests that species richness might be similar within each zone. To my knowledge Mosquito Hill has the longest species list for Macrolepidoptera+Rhopalocera in eastern Wisconsin with 919 species (850 species if strays and ephemeral migrants are excluded), and no locality in the Northern Transition Zone or Canadian Zone has been surveyed as extensively as Mosquito Hill. My longest species list for a locality in the Northern Transition Zone is from the Navarino Wildlife Area, with 891 species of Macrolepidoptera+Rhopalocera (853 species if strays and ephemeral migrants are excluded). Thus, the Macrolepidoptera+Rhopalocera species totals are quite similar between these two localities if strays and ephemeral migrants are excluded.

I think the Lepidoptera fauna of an area can be thought of in terms of a “landscape set” and “locality sets” of species. The landscape set is comprised of the species that range into the area, and the locality sets are the subsets of the landscape set comprised of residents at specific localities. The locality sets change greatly among specific localities within a life zone based on the quality and types of habitat present. I hypothesize that in eastern Wisconsin, the landscape set changes over a highly non-uniform gradient, with much of the change occurring over a small area between the zones, while changing relatively slightly within the zones. However, I stress that thus far this hypothesis is derived from a limited number of comparisons, and the seasonal coverage for some of the areas compared is incomplete.

Acknowledgments

Hugo and Sharon Kons Sr. have been supportive of this research in numerous ways, and Sharon Kons assisted with many collecting trips. The cooperation of local nature center or Wildlife Area managers has been essential to this research. Nature Center or Wildlife Area managers who encouraged and/or authorized Lepidoptera research include (alphabetically): Jim Anderson (Mosquito Hill, 1989-1996), Libby Dorn (Fallen Timbers 1988-1996), Gerry Goth (Swamplovers Preserve), Matthew Gottfredsen (Fallen Timbers 2018-present), Paul Matthiae (Wisconsin State Natural Areas, 1994), Mike Hibbard and Jess Miller (Mosquito Hill 2020-present), James Robaidek (Navarino Wildlife Area, 2021-present, via correspondence with Kyle Johnson), and Ron Zimmerman (Schmeeckle Reserve, 1992-1996). Tribal Headquarters of the Menominee Nation provided permission to collect in the Legend Lake Area of Menominee County. Sylvia Barbarich, Robert Borth, Kyle Johnson, Richard Merkhofer, and Tom Rochealeau provided additional records of Outagamie County Lepidoptera. Tom Barina, Robert Borth, Steve Bransky, and Kyle Johnson shared additional Wisconsin Lepidoptera data. Hugo and Sharon Kons Sr. collected some specimens in Appleton, particularly during years I was living in Florida. George Balogh, Terry Harrison, Michael Sabourin, and Jim Vargo assisted with some microlepidoptera determinations, and George Balogh assisted with geometrid determinations in the early years of my Wisconsin study. Jim Bartz, Joanne Bartz, David Fritsch, Merlin & Marie Kons, and Tony & Sally Zuleger hosted collecting trips on their private property. J. Donald Lafontaine and Chris Schmidt provided photos of certain type specimens. John Douglass and Gerry Goth contributed funding for this research. John Douglass and Lance Durden provided careful and thoughtful reviews of this manuscript. The editor J. Barry Lombardini formatted and combined my numerous files for publication in this issue.

References

Adamski, D., G. Hevel & A. Pultyniewicz. 2009. Redescription and immature stages of *Promalactis Suzukiella* (Matsumura) (Gelechioidea: Oecophoridae), a new introduction into the United States. *Proceedings of the Entomological Society of Washington* 111(1): 204–214.

Ainslie, C. N. 1917. A few notes on the life history of *Phalonia spartinana*. *The Canadian Entomologist* 49:93-96.

Austin, K.A., V. Nazari, J. Landry, & S. R. Johnson. 2017. "*Lepidotarphius perornatella* (Walker, 1864) (Lepidoptera: Glyphipterigidae) new to North America". *News of The Lepidopterists' Society*, 59(4): 182-184.

BOLDSystems. 2022. <https://v3.boldsystems.org>

Brou, Vernon A. Jr. 2009. *Utetheisa ornatix* (L., 1758) and *Utetheisa bella* (L., 1758) (Lepidoptera: Arctiidae) in Louisiana. *Southern Lepidopterists News*.

Brou, Vernon A. Jr. 2010. *Micrathetis triplex* (Walker, 1857) (Lepidoptera: Noctuidae) in Louisiana. *Southern Lepidopterists News*.

Covell, Charles V. Jr. 1984. *A Field Guide to the Moths of Eastern North America*. Houghton Mifflin Co. Boston, Massachusetts.

Devitt, Terry. 2016. Tropical moth alights in UW's Botany Garden, a Wisconsin first. *University of Wisconsin-Madison News*.

<https://news.wisc.edu/tropical-moth-alights-in-uws-botany-garden-a-wisconsin-first/>

Ebner, James A. 1970. *The butterflies of Wisconsin*. Board of Trustees, Milwaukee Public Museum.

Ferguson, Douglas C. 2008. *The moths of North America Fascicle 17.2, Geometroidea, Geometridae (part)*. The Wedge Entomological Research Foundation.

Forbes, William T. M. 1948. *Lepidoptera of New York and Neighboring States Part II*. Cornell University Agricultural Experiment Station Memoir 274.

Gall, Lawrence F. 1990. Evolutionary ecology of sympatric *Catocala* moths (Lepidoptera: Noctuidae). I. Experiments on larval foodplant specificity. *Journal of Research on Lepidoptera* 29(3): 173-194.

Gilligan, Todd M. and Marc E. Epstein. 2014. *Tortricids of Agricultural Importance*. TortAI.

https://idtools.org/id/leps/tortai/Acleris_comariana.htm

Hall, S.P.; Sullivan, J.B.; Petranks, J.W.; George, D.; Backstrom, P.; and Howard, T. 2022. *The Moths of North Carolina* [Internet]. Raleigh (NC): North Carolina Biodiversity Project and North Carolina State Parks.

<https://auth1.dpr.ncparks.gov/moths/index.php>.

Hayden, James E., S. Lee, S. C. Passoa, J. Young, J.-F. Landry, V. Nazari, R. Mally, L.A. Somma, and K. M. Ahlmark. 2013. Digital identification of Microlepidoptera on Solanaceae. USDA-APHIS-PPQ Identification Technology Program (ITP). Fort Collins, CO.

Hessel, Sidney A. 1954. A guide to collecting the plant boring larvae of the genus *Papaipema* (Noctuidae). *Lepidopterists' News* 8:57-63.

Hodges, Ronald W., Tatiana Dominick, Donald R. Davis, Douglas C. Ferguson, John G. Franclemont, Eugene G. Munroe, and Jerry A. Powell. 1983. *Check list of the Lepidoptera of America north of Mexico*. E. W. Classey, Ltd., London, England.

Hole, Francis D. and Clifford E. Germain. 1994. *Natural Divisions of Wisconsin*. Wisconsin Department of Natural Resources.

Kimball, Charles P. 1965. The Lepidoptera of Florida, An Annotated Checklist. Division of Plant Industry, Florida Department of Agriculture. Gainesville, FL.

Kons, Hugo L. Jr. 1996. Moth study of Schmeekle Reserve. University of Wisconsin-Stevens Point.
https://www3.uwsp.edu/cnrap/schmeekle/Documents/Research/wildlife_studies/Schmeekle_moths.pdf

Kons, Hugo L. Jr. 1998. Check list of the butterflies of Outagamie County, Wisconsin (Lepidoptera: Papilionoidea & Hesperioidea). 1998 update. Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/CL/OutagamieCoButterflies.htm>

Kons, Hugo L. Jr. 2001. Contributions to a Macrolepidoptera biodiversity inventory of the Kettle Moraine Fen and Low Prairie State Natural Area in Waukesha County, Wisconsin, 2001 Draft. Lepidoptera Biodiversity LLC.
http://www.lepidopterabiodiversity.com/Bioblitz/KFLP_files/KFLP.pdf

Kons, Hugo L. Jr. 2013. Comparison of male genitalia images for exemplar dissection voucher specimens of four species in the *Paectes pygmaea* complex (Noctuidae: Euteliinae). Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/Dissections/Euteliinae/PaectesPygmaeaComplex.htm>

Kons, Hugo L. Jr. 2014a. Contributions to a check list of the Lepidoptera of Outagamie County, Wisconsin. 2014 update. Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/CL/OutagamieCoList.htm>

Kons, Hugo L. Jr. 2014b. Contributions to a check list of the Lepidoptera of Fallen Timbers Environmental Center in Outagamie County, Wisconsin. 2014 update. Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/CL/FTECList.htm>

Kons, Hugo L. Jr. 2014c. Contributions to a check list of the Lepidoptera of Mosquito Hill Nature Center in Outagamie County, Wisconsin, 2014 update. Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/CL/MHNCList.htm>

Kons, Hugo L. Jr. 2016. Cannon PowerShot SX50 HS Photos of live Lepidoptera and other arthropods: West Summer Street: A Suburban Yard with Trees, Gardens, and Lawns in Appleton, Wisconsin (Outagamie County) in October 2016. Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/CannonPS/Appleton/Oct2016.htm>

Kons, Hugo L. Jr. 2019. Photos of Lepidoptera from suburban Appleton in 2017. Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/CannonPS/Appleton/Appleton2017.htm>

Kons, Hugo L. Jr. and Robert J. Borth. 2006. Contributions to a study of the diversity, distribution, habitat association, and phenology of the Lepidoptera of northern Florida. North American Journal of Lepidoptera Biodiversity. Volume I: 1-231.
http://www.lepidopterabiodiversity.com/VolIpdfs_files/North%20American%20Journal%20of%20Lepidoptera%20Biodiversity%20Volume%20I.pdf

Kons, Hugo L. Jr. and Robert J. Borth. 2007. Lepidoptera survey methods utilized in North American Journal of Lepidoptera Biodiversity publications. Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/SurveyMethods.htm>

Kons, Hugo L. Jr. and Robert J. Borth. 2012. Contributions to a biodiversity inventory of the late summer Lepidoptera species of Twin Swamps Nature Preserve in Posey County, Indiana. Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/Bioblitz/TSList.htm>

Kons, Hugo L. Jr. and Robert J. Borth. 2014. Lepidoptera recorded from the Swamp Lover's Preserve in Dane County, Wisconsin in late April and mid May of 2011. Lepidoptera Biodiversity LLC.
http://www.lepidopterabiodiversity.com/Bioblitz/SwampLovers_files/SwampLoversSpringLeps2011.pdf

- Kons, Hugo L. Jr. and Robert J. Borth.** 2016. A new species of *Catocala* (Lepidoptera: Noctuidae) from the Gulf Coast of the Florida Panhandle. *Bulletin of the Peabody Museum of Natural History* 57(2): 229-239.
- Kons, Hugo L. Jr. and Robert J. Borth.** 2021. A Lepidoptera biodiversity blitz at the Otter Slough Conservation Area (Stoddard County, Missouri). *Southern Lepidopterists' News* 43(2): 159-196.
<http://www.lepidopterabiodiversity.com/Bioblitz/OtterSlough.pdf>
- Kons, Hugo L. Jr. and Robert J. Borth.** 2022. Mitochondrial genetics of Ophiderini, with a new species from the *Eudocima phalonia* species group (Lepidoptera: Noctuidae: Calpinae). *Zootaxa* 5148(1): 1-151.
<file:///C:/Users/slk/Downloads/75626-Article%20Text-271845-293008-10-20220602.pdf>
- Kons, Hugo L. Jr., Robert J. Borth, and Thomas S. Barina.** 2014. Contributions to a check list of the Lepidoptera of the Southern Kettle Moraine State Forest in Southeastern Wisconsin. 2014 update. Lepidoptera Biodiversity LLC.
<http://www.lepidopterabiodiversity.com/CL/SKMList.htm>
- Kons, Hugo L. Jr., Robert J. Borth, James T. Vargo, Lance A. Durden, & Jeffrey R. Slotten.** 2017. A Lepidoptera biodiversity blitz at the Nature Conservancy's Splinter Hill Bog Preserve in Baldwin County, Alabama. *Southern Lepidopterists' News* 39(2): 93-143.
<http://www.lepidopterabiodiversity.com/Bioblitz/SplinterHill.pdf>
- Lafontaine, J. Donald.** 1998. Moths of America North of Mexico, Fascicle 27.3., Noctuoidea, Noctuidae (Part). The Wedge Entomological Foundation.
- Lafontaine, J. Donald & J. B. Walsh.** 2013. A revision of the genus *Ufeus* Grote with the description of a new species from Arizona (Lepidoptera, Noctuidae, Noctuinae, Xylenini, Ufeina). *ZooKeys* 264: 193-207.
- Lingren, P.D. and G. L. Green.** 1984. Suppression and management of Cabbage Looper populations. U.S. Department of Agriculture Technical Bulletin 1684.
- Metzler, Eric H.** 1998. Presidential address 1997: a new species of *Lithophane* (Noctuidae) from the Midwestern United States, dedicated to the purpose of the Lepidopterists' Society. *Journal of the Lepidopterists' Society* 52(1): 1-8.
- Mitchell, Andrew, Charles Mitter, and Jerome C. Regier.** 2006. Systematics and evolution of the cutworm moths (Lepidoptera: Noctuidae): evidence from two protein-coding nuclear genes. *Systematic Entomology*, 31: 21-46.
- Moth Photographers Group.** 2022. Mississippi State University. <http://mothphotographersgroup.msstate.edu/>
Note: This reference is cited as MPG (2022).
- Munroe, Eugene.** 1976. Moths of America North of Mexico, Fascicle 13.2a, Pyraloidea, Pyralidae (Part). The Wedge Entomological Foundation.
- Nieukerken, E.J. van, D.O. Gilrein & C.S. Eiseman.** 2018. *Stigmella multispicata* Rociene & Stonis, an Asian leafminer on Siberian elm now widespread in eastern North America. *ZooKeys* 784: 95-125.
- Passoa, Steven, George Balogh, & M. Alma Solis.** 2008. *Sitochroa palealis*: A Palearctic pyraustine Moth (Lepidoptera: Pyraloidea) newly introduced to North America. *Proceedings of the Entomological Society of Washington*, 110(2): 504-515.
- Prentice, Richard M.** 1962. Forest Lepidoptera of Canada. Nycteolidae, Noctuidae, Notodontidae, Liparidae. Canadian Department of Forestry Bulletin 128: 77-281.
- Rings, Roy W., Eric H. Metzler, Fred J. Arnold, and David H. Harris.** 1992. The Owlet Moths of Ohio Order Lepidoptera Family Noctuidae. *Ohio Biological Survey Bulletin New Series Vol.9 No. 2*.
-

Rockburne, Eric W. and J. Donald Lafontaine. 1976. The cutworm moths of Ontario and Quebec. Canada Department of Agriculture Publication 1593.

USDA. 2022. USDA Plants Database. Accessed Dec. 2022.

<https://plants.usda.gov/>

Wagner, David L. 2009. Ode to *Alabama*: The meteoric fall of a once extraordinarily abundant moth. *American Entomologist* 55(3): 170-173.

Zahiri, Reza, Ian J. Kitching, J. Donald Lafontaine, Marko Mutanen, Lauri Kaila, Jeremy Holloway & Niklas Wahlberg. 2011. A new molecular phylogeny offers hope for a stable family level classification of the Noctuoidea (Lepidoptera). *Zoologica Scripta* 40, 158-173.

Zahiri, Reza, Jeremy Holloway, Ian J. Kitching, J. Donald Lafontaine, Marko Mutanen, & Niklas Wahlberg. 2012a. Molecular phylogenetics of Erebidae (Lepidoptera: Noctuoidea). *Systematic Entomology*, 37: 102-124.

Zahiri, Reza, J. Donald Lafontaine, Jeremy Holloway, Ian J. Kitching, B. Christian Schmidt, Lauri Kaila, & Niklas Wahlberg. 2012b. Major lineages of Nolidae (Lepidoptera, Noctuoidea) elucidated by molecular phylogenetics. *Cladistics* 1 (2012): 1-23.

Zahiri, Reza, J. Donald Lafontaine, Christian Schmidt, Jeremy Holloway, Ian J. Kitching, Marko Mutanen, & Niklas Wahlberg. 2013. Relationships among the basal lineages of Noctuidae (Lepidoptera, Noctuoidea) based on eight gene regions. *Zoologica Scripta* 42(5): 488-507.

APPENDIX A: SURVEY LOCALITIES

The number of Lepidoptera species databased from each site as of February 2023 appears in [], and the location of these sites in Wisconsin is mapped on Figure 66:B. Four sites have been surveyed throughout much of the field season with lights, bait, and diurnal searching: suburban Appleton, Fallen Timbers, Mosquito Hill, and the Navarino Wildlife Area. For other sites the length of species lists is primarily due to the amount of survey effort. I include general GPS coordinates to two decimal places below, but surveys from 2012 onward have more precise coordinates on individual voucher specimen labels, usually to five decimal places for specimens found at lights and/or in traps.

OUTAGAMIE COUNTY

Fallen Timbers Environmental Center N 44.84° W 88.41° [1325 species]: This primary study site was surveyed during the day from 1988-1991 and day and night from 1992-1996 and 2018-2022. Survey methods include lighted sheets, light traps, bait trail, bait traps, and diurnal searching. I conducted surveys from late March through early November. An extensive hydric hardwood forest is present, part of which is seasonally flooded. The canopy cover ranges from dense to open, and there are several sedge meadow openings. Common trees include maples, aspen, ash, birch, oaks, and basswood. Bitternut hickory and cottonwood are also present in places. An extensive mesic to hydric grassland is present west of the forest. Part of the grassland is a prairie planting started in 1995. The remainder is field and meadow, with areas of plentiful goldenrod and aster. Some ephemeral streams occur within the grassland with shrubby to forested corridors, including dense willow stands. Tamarack grows in some areas within the field or along the edge. A pond is present with cattail marsh, willows and cottonwoods. The north side of the property contains a white cedar-hardwood swamp with white pine and tamarack. This white cedar area was not surveyed at night until 2020-2022.

Mosquito Hill Nature Center N 44.38° W 88.70° [1575 species]: This primary study site was surveyed during the day and with bait traps from 1989-1991 and surveyed day and night from 1992-1995 and 2020-2022. Numerous habitat types have been sampled throughout much of the season with lighted sheets, light traps, bait trail, bait traps, and diurnal searching. A 216 foot high hill is present. The top of the hill is mixed southern mesic hardwood forest

and mesic to xeric grassland with some prairie and barrens vegetation, including lead plant and columbine. Sandstone cliffs are present. Trees include oaks, hickories, sumac, poplars, hawthorn, red cedar, and white pine. The south and west sides of the hill contain southern mesic hardwood forest including hickories, walnuts, aspen, oaks, basswood, maple, elm, ash, red cedar, witch hazel, and hackberry. Grasslands on the top, south and west sides of the hill were more extensive from 1989-1995 than at present, with some areas that were formerly grassland now second growth hardwood forest. The north side of the hill is dominated by red maple forest with birch and white pine. South of the hill is a prairie planting with a diverse array of planted tall grass prairie plants. The prairie planting slopes down to a floodplain and ranges from sandy xeric conditions to mesic to hydric along the edge of the floodplain. The Wolf River Floodplain includes southern mesic hardwood forest along the edge and seasonally flooded silver maple dominated forest. The silver maple forest has openings with emergent wetland, sedge meadow, and button bush. The floodplain also contains oxbow ponds where wild rice is abundant. East of the prairie planting is a mesic to semi xeric field with sumac, shagbark hickory, oaks, and white pines. Bee balm and milkweeds are common in this field. This part of the property has been sparsely investigated for nocturnal species to date. West of the hill is an area with mixed woodland and field. A spring fed wet meadow is present, which is currently dominated by shrubby growth, but was open with calcareous fen and sedge meadow vegetation in the early and mid 1990s.

Power Lines North of Allcan Road N 44.39° W 88.68° [210 species]: The area surveyed includes field and sedge meadow. North of the study area are extensive areas of swamp forest, tamarack swamp, and an extensive bog about 1 mile away, part of the Hortonville Bog State Natural Area. I have not sampled in these habitats, and accessing the bog for diurnal survey let alone with night collecting equipment would be a formidable hike through difficult terrain with no trail. I conducted surveys during 2020, and obtained UV trap samples from sedge meadow on 7 April, 21 May, 18 June, 10 July, 13 August, and 15 September. I also did diurnal survey at these same times of year in both field and sedge meadow.

Bubolz Nature Center N 44.31° W 88.45° [145 species]: I surveyed this site primarily during the day, but also included some bait trap samples. From 1991-1992 I did diurnal surveys in late April, mid-late May, early and late June, late July, and late September. Habitat types include white cedar swamp, mesic to hydric hardwood forest, fields, open to shrubby wetlands, streams, ditches, and ponds.

Plamann County Park 44.32° W 88.38° [157 species]: I surveyed this site during the day and with a few bait trap samples. Richard Merkhofer's yard is adjacent to this park, and I included some unusual records from his yard with Plamann Park. Habitat types include southern mesic to hydric hardwood forest, fields, open to shrubby wetlands including some sedge meadow, and streams. The sedge meadows were formerly more extensive; when I revisited the area in 2021 some areas of former sedge meadow are now dense willows or other woody growth. From 1989-1991 I conducted surveys during the day during late May, mid June, July, early August, and early October. I have one recent diurnal survey from 1 August 2021.

APPLETON/GRAND CHUTE STUDY SITES (6) [1371 species]

Suburban Appleton Yard on West Summer Street [1309 species]: This suburban yard is the most intensively collected site in the Outagamie County area, and was my backyard for much of my life, except from August 1996 to June 2016 when I lived in Florida. I did a little bit of collecting there from 1981-1987. In 1988 I started running bait traps and lights, initially focusing on butterflies, *Catocala*, and some of the other larger moths. From 1989 onward I collected the broad spectrum of Lepidoptera except for minute species (species needing minuten sized pins), which I did not start collecting much until 2018. From 1989-early August of 1996 I regularly ran multiple bait traps of the minnow trap and inverted cone designs, as well as a lighted sheet with 150 watt spotlights and an 80 watt UV light. During 1991 I collected at least one representative of each Macrolepidoptera species I encountered every night of the season except for 28-29 June and 22-24 August. From 2016-2020 I did quantitative sampling with MV traps, and to the extent possible with bait, as described in the methods section below. From 2021-2022 I scaled back the Appleton survey, but still ran UV lights and bait traps throughout the season, and ran MV lights and bait trails irregularly.

Power Line Cut at Northwest Corner of Bluemound Drive X Highway 96 N 44.27° W 88.46° [578 species]: This site is a mix of field and prairie planting. Mesic hardwood forest and suburban habitat occur in close proximity. Planted prairie plants include cup plant, compass plant, purple coneflower, and various other composites. The field

portion includes goldenrod, New England aster, and dogbane. Invasive buckthorn is a serious problem, and a significant portion of the prairie planting has already been replaced by dense buckthorn growth, and the situation grows worse every year. Some of the buckthorn is covered by dense grapevine, which further crowds out the prairie plants. I did surveys here from 2018-2022. I primarily surveyed with a UV trap, but light pollution is significant due to proximity to Highway 96, the Fox Valley Technical College, and other lights. I obtained light trap samples from early May through mid October except for mid May and late July. I did one bait trail in early October, and searched flowers with a flashlight several times in September. I did short daytime surveys from late August through early October.

Old Stone Bridge Trail N 44.28° W 88.46° [260 species]: This site is in close proximity to the preceding site, but has quite different habitat. There are two trails, one paved and another unpaved. The trails go through mesic to hydric hardwood forest. Boxelder is a dominate tree, and other trees include maples, oaks, aspen, cottonwood, and dense willows in a swampy ditch at the end of the paved trail. Invasive buckthorn is a severe problem, and in many parts of the trail the entire understory is dense buckthorn. Recently some of the buckthorn has been cleared out in a few areas, but in most areas the buckthorn problem is getting worse. One field is present along the paved trail, and fields are also present on the access road, which I include as part of this site. Some small wetlands are present along the access road, but they are getting filled in with invasive *Phragmites*. Two streams bisect the paved trail. Plants present along the edge of the woods include goldenrod, jewelweed, and joe pye weed. Part of the field along the access road has plentiful milkweed, which creates a large nectar bank when it is in bloom. I surveyed this site with bait trails, nighttime searches with a flashlight, and daytime searching. I ran bait trails from late February through mid May, mid June, early September through late November, and late December. I did surveys here from 2020-2022.

Fox Cities Paper Trail by Fox Valley Technical College N 44.29° W 88.46° [174 species]: From 2021-2022 I obtained 15 watt light trap samples from a single location from late August to early October and late October. I have also done a little bit of day survey during these same times of year. The habitat by the light trap is mixed field and prairie planting with cup plant, sunflowers, aster, and goldenrod. Compass plant is also present in another part of the site. Several ponds and cattail marshes are present in other areas. Areas with mesic to hydric hardwood forest have been extensively invaded by buckthorn and have not been sampled, but the fields and prairie planting remain largely free of buckthorn thus far. Invasive thistles are starting to crowd out prairie plants by a hill, but they are not present in the immediate vicinity of the light trap site.

Prairie Hill Park N 44.32° W 88.38° [72 species]: I have sparsely investigated this site, but include it in this paper due to some notable records of ephemeral migrants. All my survey has been during the day from late September to late October 2022 except for one bait trail sample on a cool night on 21 October 2022. Habitats include mesic prairie planting with cup plant, prairie dock, and sunflowers, mesic fields, open to shrubby wetland, and some forested margin with hardwoods and white pine. In the fall New England Aster is abundant in the fields. The site closes shortly after dark and is heavily used by the public, so leaving unattended light traps would be risky. The site also borders highway 41 and there is extensive light pollution, which would further complicate sampling with lights.

Fox River Walk by Riverside Cemetery N 44.27° W 88.38° [167 species]: This site contains a trail through southern mesic to hydric hardwood forest on a slope along the Fox River. I conducted surveys with a 15 UV trap in a single location, and searched during the day along the trail. The canopy is partially open in some areas with a rich understory flora including goldenrod, asters, joe pye-weed, phlox, and sunflowers. There is a large concentration of mayapple around the UV trap site. Unfortunately part of the site has been extensively invaded by exotic buckthorn, and in places the understory vegetation has been replaced with dense buckthorn. From 2020-2022 I obtained UV trap samples from late April, early June, late August, and mid September to early October. Day searches were also conducted in mid and late June and mid July.

OUTAGAMIE/WINNEBAGO COUNTY

Wiouwash Trail N 44.23° W 88.62° [239 species]: The area I investigated is between Medina and Medina Junction Road. Habitats include sedge meadow, shrubby wetland, grassy wetland, cattail marsh, hydric to mesic hardwood forest, fields, and agricultural fields. Most of the daytime searches ranged from Medina Junction Road in northern Winnebago County to just beyond the Outagamie County border. For 1990 surveys I started at Medina and walked

south. Beginning in 2020 I obtained some light trap samples from a sedge meadow/shrubby wetland just north of Medina Junction Road at N 44.23431° W 88.62284°. Season coverage for light trap samples included mid July, early August, late August, mid September, and early October. I did recent diurnal surveys in early July, early August, late August, mid September, and mid October, and during early July and late September in 1990.

WINNEBAGO COUNTY

Breezewood Lane N 44.15510° W 88.66345°, 5286 West Breezewood Lane (Winneconnie) [269 species]: This site was a private yard with southern mesic hardwood forest and fields. The property was taken by eminent domain for a highway expansion, and the habitats surveyed are now gone. I conducted surveys with lighted sheets, bait traps, and daytime searching. Dates I did both night and day surveys include 21-23 June 1989, 23-25 August 1990, 28-29 June 1991, and 22-24 August 1991. I also did a little daytime survey in late April, mid May, and early July.

CALUMET COUNTY

Brillion Nature Center N 44.16° W 88.10° [57 species]: This is a minor study site that I surveyed during the day only, on 24 July 1990 and 23 July 1991. Habitats include southern mesic hardwood forest, fields, prairie planting, and sedge meadow.

BROWN COUNTY

Village of Howard N 44.61° W 88.11° [154 species]: I did day and night surveys with a lighted sheet and bait traps from 15-17 August 1991, and a day survey on 14 July 1991. The habitat was hardwood forest with a mesic field in close proximity.

WAUPACA COUNTY

Vicinity of Roland Lake Near Ogdensburg N 44.45° W 88.99° [115 species]: I have one UV sheet sample from 21 June 1993, and I collected around an electric bug zapper on 16 August 1989. I also have a little bit of day survey data from 1988-1990 from early to late August and late September. Habitat included fields, mesic hardwood forest, and some wetland along the margin of Roland Lake. The UV sheet sample was from near the edge of the Lake.

SHAWANO COUNTY

Navarino Wildlife Management Area N 44.62° W 88.52° [1432 species]: While I primarily surveyed this site during 2022 and the spring of 2023, I made an extensive survey effort covering much of the field season. Initially I did some fall bait trails on 19-20 November 2020, 27-29 October, 7-8 and 10 November 2021. During 2022 I surveyed with MV lights, UV light traps, and bait trails in mid and late April, mid May-early June, late June and early July, late July and early August, late August, early and mid September, late October, and early November. I conducted daytime surveys in late May, early June, mid June, mid July, and briefly in early September. A wide variety of habitat types are present, including xeric sandy oak-pine barrens (with white pine, red pine, and jack pine), sandy oak-pine shrubby to grassy uplands, mesic hardwood-pine forest, mesic to hydric hardwood-pine-hemlock forest, sedge meadow, bog, and emergent wetlands.

Addendum (November 2023)

As of November 2023, I have recorded 1,006 Macrolepidoptera species from Outagamie County, including 748 species recorded from both 1989-1996 (historical) and 2015-2023 (recent) surveys, 69 species recorded from historical but not recent surveys, and 189 species recorded from recent but not historical surveys. Of the 189 species added with recent surveys, 101 are strays or ephemeral migrants outside of their permanent range, including 88 species of southern origin, 5 of western origin, and 8 of northern origin. Twenty-four of the newly recorded species are new colonizations of Nearctic species, 19 of which are southern species that have expanded their ranges northward into the area since 1989-1996. Of the remaining newly recorded species, 8 are new colonizations of Palearctic species, 41 are known from few specimens and their status is unknown, 9 were likely overlooked by historical surveys due to insufficient seasonal coverage in their habitats, and 6 are from localities with no historical surveys. Only nine southern strays were found with historical but not recent surveys: *Erinnyis obscura* (7837), *Aellopos titan* (7849), *Alabama argillacea* (8554), *Catocala epione* (8773), *Catocala maestosa* (8793), *Tarachidia semiflava* (9085), *Acrionicta impleta* species 2 (9257b), and *Papaipema beeriana* (9508).

The species diversity recorded of resident Macrolepidoptera species was higher among Outagamie County study sites with recent surveys than with historical surveys. Only seven of the 69 species found with historical but not recent surveys were recorded from more than two specimens. These species, with the number of specimens in “()” include: *Datana perspicua* (9), *Apamea alia* (8), **Speranza loricaria* (7), **Sphinx gordius* (including *poecile*) (7), *Catocala luciana* (7), *Euxoa servita* (6), and **Ematurga amitaria* (3). Seventeen additional species were recorded from two specimens, and 45 from one specimen. These records were all from well surveyed localities, thus most or all of these species were likely strays or dispersers at the localities where they were found. These species include (*=recently recorded from southern Shawano County): *Homochlodes lactispargaria* (2), **Anagoga pulveraria* (2), *Caripeta divisata* (2), **Olceclostera angelica* (2), *Datana contractata* (2), *Datana integerrima* (2), **Dasychira vagans* (2), **Zale phaeocapna* (2), Eustrotiinae species (2), *Syngrapha epigaea* (2), *Tarachidia semiflava* (2), *Acrionicta fragilis* (2), **Papaipema pterisii* (2), **Melanchra assimilis* (2), *Euxoa redimicula* (2), **Euagrotis forbesi* (2), **Euretagrotis attentata* (2), **Archieris infans* (1), **Macaria fissinotata* (1), *Digrammia ordinata* (1), **Euchlaena irraria* (1), **Epirranthis substriataria* (1), **Probole amicaria* (1), **Hydriomena perfracta* (1), *Rheumaptera hastata* (1), *Spargania magnoliata* (1), *Sphinx drupiferarum* (1), *Erinnyis obscura* (1), *Aellopos titan* (1), *Datana angusii* (1), *Dasylophia anguina* (1), *Manuela bicolor* (1), **Dasychira dorsipennata* (1), **Dasychira obliquata* (1), **Hypena palparia* (1), *Alabama argillacea* (1), **Zale obliqua* (1), **Zale submediana* (1), *Catocala epione* (1), *Catocala maestosa* (1), **Lithacodia bellicula* (1), *Autographa ampla* (1), **Syngrapha abstrusa* (1), **Callopietria cordata* (1), *Schinia trifascia* (1), *Schinia lucens* (1), *Calocasia flavicornis* (1), *Acrionicta radcliffei* (1), *Acrionicta funeralis* (1), **Acrionicta laetifica* (1), **Acrionicta tristis* (1), *Acrionicta impleta* species 2 (1), *Apamea lutosa* (1), *Papaipema beeriana* (1), *Neoligia* species (1), *Caradrina multifera* (1), **Xystocheila rufago* (1), **Euxoa declarata* (1), *Euxoa comosa* (1), *Euxoa perpolita* (1), *Diarsia jucunda* (1), and *Ufeus plicatus* (1). Twenty-nine of the species not recorded from recent surveys in Outagamie County have recent records from the Navarino Wildlife Area in southern Shawano County.

In contrast, recorded species diversity of resident butterfly species was higher historically among Outagamie County study sites. Four historical residents were not found with recent surveys: *Erynnis lucilius*, *Erynnis brizo*, *Thorybes pylades*, and *Aglais milberti*. The one Outagamie County locality where *Erynnis lucilius* and *E. brizo* were found has undergone significant plant community succession, but I currently have no explanation for the absence of the other two species. Also, *Polites themistocles* was formerly common but is seldom encountered now. *Speyeria aphrodite* colonized a prairie planting in 1994, was found again in 1995, but has not been found with recent surveys. The only butterfly species which appears to have colonized Outagamie County since 1996 is *Coenonympha inornata*.

Macrolepidoptera Species Newly Recorded in Outagamie County During the 2023 Season.

***Prochoerodes lineola* species 2 (6982):** Mosquito Hill: prairie planting, MV trap site 24, 24 August, one worn specimen. This is likely a short distance stray from slightly farther north. See pages 18 & 238-239.

***Haploa clymene* (8107):** Mosquito Hill: prairie planting near floodplain forest edge, MV sheet, 24 August. Prior to 2023 I had only collected or examined one Wisconsin specimen (Figure 83.3). Kyle Johnson and Steve Bransky collected multiple specimens in Manitowoc County during August 2023 (Kyle Johnson, pers. com. 2023).

Arugisa lutea (8509) [Figure 84.18, page 171]: Appleton: UV lights, 26 June 2023. This is a rare southern stray or accidental (see page 48).

Bulia deducta (8614) [Figure 85.3, page 173]: Mosquito Hill: upland prairie planting/mesic hardwood forest along south side of hill, MV sheet, 9 June. This is an abundant and widespread generalist of the southwestern United States that occasionally occurs eastward as a rare stray or accidental. This is the first specimen I have seen from Wisconsin.

Catocala junctura (8829): Appleton: bait trap, 3 October. This specimen is a rare stray or accidental from south or southwest of the area, and to my knowledge there are only a few records of *C. junctura* from Wisconsin. During the latter half of September 2023, I collected a small series of *C. junctura* in Wheaton, Illinois (DuPage County). Most were in worn condition but one was fresh, raising the possibility that the species is now established in that area. These specimens are a different phenotype than the Appleton specimen, with brownish mottling and a purplish sheen. The Appleton specimen is a plainer, greyer phenotype, and perhaps originates from southwestern populations rather than those in northern Illinois?

Some Southern Strays and Ephemeral Migrant Records Recorded During 2023

I conducted less survey in the area during 2023 than with other recent seasons, particularly late in the season when southern strays and ephemeral migrants are most likely to be found. I conducted no survey in the area from 11 September-2 October and from 8-22 October. Local surveys combined with surveys I conducted in Ludington, Michigan and Wheaton, Illinois suggest it was a good year for migrants in the Upper Midwest. The following are some notable 2023 records of strays and ephemeral migrants from Outagamie County or the Navarino Wildlife Area in southern Shawano County. This is not comprehensive, and many 2023 records have not been databased.

SPHINGIDAE

Manduca quinquemaculata (7776): Mosquito Hill: MV trap site 24, prairie planting, 5 September. The specimen is in fairly fresh condition, but with scales rubbed off of the thorax. This is the first season I rerecorded this species in the area during the 2016-2023 interval. There were multiple large tomato plants in the Appleton yard during 2023, but no larvae were found.

Ceratonia amyntor (7786): Mosquito Hill, prairie planting near floodplain forest edge, MV sheet, 18 July (2 somewhat worn specimens). These records are from a similar time of year and in close proximity to where a specimen in good condition was collected during 2022. More survey is needed to investigate the possibility that this species has become established, although thus far there are still only four specimens recorded from Outagamie County and three from Mosquito Hill.

Sphinx eremitus (7796): Mosquito Hill: mesic hardwood forest along sandstone cliffs near top of hill, UV trap, 9 June; prairie planting near floodplain forest edge, MV sheet, 18 July (3), 5 August (1).

Sphinx chersis (7802): Mosquito Hill, prairie planting near floodplain forest edge, MV sheet, 18 July, 1 somewhat worn specimen. This record is from a similar time of year and near the location of a 2022 Mosquito Hill record. More survey is needed to investigate the possibility that this species may have become established. While thus far there are just two recent records and only one is in fresh condition, I suspect this species is difficult to detect with the survey methods I have been using.

Hyles lineata (7894): Mosquito Hill: MV lights, prairie planting, 24 August (20), 5 September (8); Bluemound Drive power line cut: UV trap, 4 September.

NOCTUIDAE

***Zanclognatha pedipilalis* species B (8348b):** Mosquito Hill: prairie planting near floodplain forest edge, MV sheet, 5 August.

***Tetanolita* near *palligera* (8367.1):** Appleton: MV trap, 4 October. This was the first season I rerecorded this species in the area during the 2015-2023 interval. It apparently underwent a significant northward migration into the Upper Midwest during 2023. I collected series of this species in Ludington, Michigan and Wheaton, Illinois in the latter half of September, and Steve Bransky (pers. com. 2023) found it in numbers in southeastern Wisconsin.

***Renia discoloralis* (8381):** Appleton: nectaring on butterfly bush, 12 August. I searched for this species on 26 July at the Navarino Wildlife Area along the same bait trail where I found this species in numbers during 2022, but did not find it. This is consistent with the hypothesis that this species is still an ephemeral migrant from the south and not established in the area. However, bait was attracting few moths during the 26 July 2023 survey, despite high numbers of moths at lights. Since most area records of *Renia discoloralis* are from bait rather than lights, it might have gone undetected during the 2023 Navarino survey if it was present in the area.

***Garella nilotica* (8974):** Mosquito Hill: MV sheet, prairie planting, 24 August.

***Hyperstrotia pervertens* (9037):** Navarino Wildlife Area: sandy oak-pine barrens, MV sheet, 23 June. This is the second record for the area.

***Amyna stricta* (9070), *Ctenoplusia oxygramma* (8889), *Pseudoplusia includens* (8890), *Anicla infecta* (10911):** Appleton: MV trap, 3 October. I also found all of these species in Ludington, Michigan and Wheaton, Illinois during the latter half of September.

***Trichoplusia ni* (8887):** Mosquito Hill: MV sheet, prairie planting, 24 August.

***Rachiplusia ou* (8895):** Prairie Hill Park: netted at night, 3 September; Fox Cities Paper Trail: UV trap, 3 September; Appleton: MV trap, 3 October.

***Oruza albocostaliata* or species near (9025):** On 26 July I collected a small series at the Navarino Wildlife Area, the second consecutive season I found it here with no records from Outagamie County. This is more evidence favoring the hypothesis that there is a disjunct population or second species in the Central Sands biogeographic area, as opposed to the hypothesis that this material is from a northward migration from the Austral Zone. However, most of the specimens were worn, and future survey is needed earlier in the flight of this species in order to confirm that there is a resident population.

***Heliothis subflexus* (11070):** Navarino Wildlife Area: sandy oak-pine barrens, MV sheet, 23 June (Figure 79.14, page 161). This specimen is in fairly fresh condition and is the first record for the area. Most Wisconsin specimens I have examined are from the southwestern Counties (Grant, Green, La Crosse), including a small series of fresh specimens collected by Tom Barina in the early 1990s.

***Heliothis virescens* (11071):** Appleton: MV trap, 3 October. This is the second record of this southern stray for the area. I also found this species in Ludington, Michigan and Wheaton, Illinois during the latter half of September during 2023.

***Schinia gaurae* (11168):** Mosquito Hill: upland prairie planting/mesic hardwood forest edge along south side of hill, MV sheet 6, 9 June 2023. This is the second specimen from this locality, and it is in remarkably fresh condition.

***Parabagrotis exsertistigma* (11047):** Mosquito Hill, mesic hardwood forest on south side of hill, beginning of steep trail up hill, UV trap, 5 September (1 worn specimen).

HESPERIIDAE

Hylephila phyleus (4013): Mosquito Hill: butterfly garden by parking lot, late afternoon, 5 September (1 male).

DEPRESSARIDAE

Gonioterma mistrella (1032): Mosquito Hill: MV trap site 24, prairie planting, 5 September; Appleton: UV sheet, 9 September. This is the second consecutive season fresh specimens have been found in the area, including in the Appleton yard during both seasons, so it may be established now.

PLUTELLIDAE

Plutella porrectella (2363): Appleton: UV lights, 14 July 2023 (Figure 86.5, page 175). This is the second area record of this species, which was first recorded on 24 June 2022 (Figure 86.8, page 175).

YPSOLOPHIDAE

Ypsolopha barberella (2370): Navarino Wildlife Area: sandy oak-pine barrens, UV trap site 27, 23 May.

PYRALIDAE

Uresphita reversalis (4992): Mosquito Hill: prairie planting, MV trap site 24, 24 August.

Hymenia perspectalis (5169): Appleton: MV trap, 26 October (1).

Herpetogramma bipunctalis (5272): Appleton: MV trap, 26 October (1).

Hypsopygia nostralis (5531): Appleton, UV lights on front porch, 22 May (1 worn specimen) (Figure 90.9, page 183). Other than this specimen, I have not seen this species north of the Gulf Region. This record is undoubtedly a rare stray or accidental.

I found the following species in southeastern Wisconsin on 3 October.

Choeophora fungorum (NOCTUIDAE) (10998): Kenosha County: Visitor's Center on northbound Interstate I94 just over the state line (N 42.52146° W 87.94927°): I flushed one slightly worn specimen walking through a field. In late September and early October 2023 I was regularly encountering this species in a variety of habitats in Wheaton, Illinois, but I was not aware of any Wisconsin records. There are several possibilities for the Kenosha County record: it might be a southern species expanding its range northward, it might be a stray (I don't know if this species is prone to straying outside of its permanent range), or it might be an accidental which potentially hitched a ride in someone's vehicle. In Wheaton some individuals of this species were in fresh condition during mid and late September, but mostly worn by early October.

Hylephila phyleus (HESPERIIDAE) (4013): Kenosha County: Visitor's Center on northbound Interstate I94 just over the state line (N 42.52146° W 87.94927°): nectaring on New England Aster (1 male); Ozaukee County: Mequon, nectaring on butterfly bush (1 female).

PALEARCTIC SPECIES

Stigmella multispicata (NEPTICULUDAE) (86.1): Thus far I have only one specimen from the area: Navarino Wildlife Area: sandy oak-pine barrens, MV sheet site 8, 31 May 2023 (1 fresh specimen) (Figure 95.1, page 193).

Hedya salicella (TORTRICIDAE) (2864.1): Thus far I have only one specimen from the area: Mosquito Hill: prairie planting near floodplain forest edge, UV sheet, 5 July 2022. The specimen had been unidentified until recently. MPG (2023) states this species is introduced from Europe, and Wikipedia (2023) reports the larvae feed on willow and poplar.

Paracorsia repandalis (PYRALIDAE) (4992.5): One additional record was obtained in 2023: Mosquito Hill: prairie planting, MV trap site 24, 5 September (1 fresh specimen).

Some Microlepidoptera Species Newly Recorded in Outagamie County During the 2023 Season.

TINEIDAE

Oenoe hydromella (283): Mosquito Hill: mesic hardwood forest along sandstone cliffs near top of hill, UV trap, 18 July (1).

DEPRESSARIDAE

Depressaria cinereocostella (921): Mosquito Hill: upland prairie planting/mesic hardwood forest edge, MV sheet site 6, 9 June (1); Navarino Wildlife Area: sandy oak-pine barrens, MV trap 10, 11 May (1).

OECOPHORIDAE

Mathildana newmanella (1059): Mosquito Hill: 9 June: upland prairie planting/mesic hardwood forest edge, MV sheet site 6 (1); mesic hardwood forest by sandstone cliffs near hill top, UV trap site 28 (1).

TORTRICIDAE

Bactra maiorina (2708): Mosquito Hill: prairie planting near floodplain forest edge, MV sheet, 24 August. This species appears to be associated with wetlands. Other local records are from Navarino Wildlife Area sedge meadows on 23 June. I also have specimens from sedge meadows in Portage and Jackson Counties in central Wisconsin.

Endothenia heinrichi (2733): Mosquito Hill: wet-mesic prairie planting near floodplain forest edge, netted in flight (not flushed) in late afternoon, 9 June (1).

Barbara mappana (2905): Fallen Timbers: white cedar-hardwood swamp, MV trap site 18, 14 April (1 specimen in fresh condition). I also collected one specimen in fair condition at the Navarino Wildlife Area: Pike's Peak Flowage, sedge meadow with bog elements/oak-pine forest edge, UV trap site 18, 11 May. The MPG (2023) distribution map shows records only from the northeast and west coast. This distribution pattern, followed by subsequent records from the Upper Midwest, is consistent with a Palearctic species that first colonizes the coastal areas and then moves its range inland. However, the type locality is British Columbia from 1941, and I am not aware of reports of this species from the Palearctic region.

Notocelia culminana (3211): Fox River Walk: mesic hardwood forest along Fox River, UV trap, 23 August.

Proteoteras moffatiana (3235): Appleton: UV lights on front porch, 1 July 2023 (1). The specimen is tattered, and may represent a stray from the south?

Proteoteras obnigrana (3237): Appleton: UV lights on front porch, 1 July 2023 (1). I wonder if I might have overlooked this species in the past due to similarity with the abundant *Proteoteras aesculana*, although this individual did stand out as being something unusual. It might represent a stray from the south.

PYRALIDAE

Thaumatopsis pexellus (5439): I found five specimens at three localities during early September: Mosquito Hill: prairie planting, MV trap 24, 5 September (2); mesic hardwood forest on steep trail on south side of hill, UV trap, 5 September; Bluemound Drive power line cut: prairie planting/field, UV trap, 4 September; Appleton: UV sheet, 9 September. I am uncertain if this species is an ephemeral migrant, disperser, or recent colonization.

***Eoreuma crawfordi* (5498):** Appleton: UV lights on front porch, 14 July (Figure 117.13, Pages 236-237); Mosquito Hill: prairie planting, MV sheet, 18 July. Prior to these records, all Wisconsin specimens I collected or examined were from prairie remnants in the southern counties. Since the Outagamie County specimens are in fresh condition, it appears that this species has expanded its range northward and is able to colonize prairie plantings. I suspect the Appleton specimen is a short distance disperser from one of the prairie plantings in the area, such as the Bluemound Drive power line cut, Fox Cities Paper Trail, or Prairie Hill Park, but additional survey at these localities is needed to confirm this.

***Teletuscia ovalis* (5812):** Mosquito Hill: prairie planting/floodplain forest edge, MV sheet, 18 July.

Some Lepidoptera Species Newly Recorded from the Outagamie County Area During the 2023 Season.

The following species recorded from the Navarino Wildlife Area (southern Shawano County) in 2023 represent new records for the Outagamie County area:

GEOMETRIDAE

***Metarranthis warneri* (6821):** mesic hardwood-pine-hemlock forest near hardwood swamp and open wetlands, UV trap 12, 23 May (1 male). This species is typically found in barrens in central and northern Wisconsin, thus this specimen may represent a disperser from the nearby sandy oak-pine barrens, although as yet I have not found this species there.

***Metarranthis amyrisaria* (6824):** sandy oak-pine barrens, MV sheet site 8, 31 May 2023 (2, Figure 100.6, page 203). This species is typically found in barrens in central and northern Wisconsin, and might be dependent on this habitat.

NOCTUIDAE

***Zanclognatha deceptricalis* (8341.1):** sedge meadow with bog elements in the Pike's Peak Flowage/oak-pine forest edge, UV trap site 18, 26 July (1) (Figure 120.5, page 243).

***Zale near duplicata* (8703.1):** sandy oak-pine barrens, 23 May 2023, bait trail & MV sheet (1 female each, Figures 125.8 & 125.9, page 253). See page 252 for an explanation of this taxon. An additional likely specimen was photographed in oak-pine forest adjacent to the sand barrens on 29 May 2022, but I missed the specimen and cannot be certain of the identification.

***Heliothis subflexus* (11070):** See 2023 records for strays and ephemeral migrants (above).

***Bellura brehmei* (9524):** mesic hardwood-pine-hemlock forest near hardwood swamp and open wetlands, UV trap 12, 31 May (1 male, 1 female) (Figures 128.4 & 128.5, page 259).

HEPIALIDAE

***Sthenopsis thule* (0021):** sandy oak-pine uplands just south of the Pike's Peak Flowage wetlands, MV sheet, 26 July (1) (Figure 110.10, page 223). This is a local and uncommon wetland species. It surely originates from the sedge meadow with bog elements to the south rather than the uplands. I have also found it in calcareous fen habitat around Ottawa Lake in Waukesha County, southeastern Wisconsin.

TINEIDAE

***Scardia anatomella* (311):** mesic hardwood-pine-hemlock forest, UV trap 12, 31 May (1).

GELECHIIDAE

Exotelia pinifoliella (1840): sandy oak-pine barrens: MV sheet site 8, 31 May (1); UV trap 10, 26 July (1).

TORTRICIDAE:

Rhyacionia species: sandy oak-pine barrens, MV sheet site 8, 31 May (1 fresh specimen). The closest match I have found is the western species *Rhyacionia salmonicolor*, although it is clearly not this species.

Pelochrista pallidipalana (3153): sandy oak-pine barrens, UV trap site 10, 26 July (1).

Rhopobota dietziana (3277): mesic hardwood-pine-hemlock forest, UV trap 12, 23 May (1).

Ancylis comptana (3374): sandy oak-pine barrens, MV trap site 10, 11 May (1).

Neocochyliis dubitana (3774): sandy oak-pine barrens, MV sheet site 8, 31 May (1 fresh specimen).

PYRALIDAE

Eoparargyractis plevie (4787): MV sheet, sandy oak-pine barrens, 23 June (1). This specimen must be a disperser from one of the wetlands in the vicinity, as all members of this subfamily (Nymphulinae) have aquatic larvae.

Pediasia abnaki (5416): sedge meadow with bog elements in the Pike's Peak Flowage/oak-pine forest edge, UV trap site 18, 23 June (2). My other Wisconsin specimens are from prairie/wetland complexes in southeastern Wisconsin, including the Scuppernong Prairie State Natural Area in Waukesha County.

Acrobasis vaccinii (5653): sedge meadow with bog elements in the Pike's Peak Flowage/oak-pine forest edge, UV trap site 18, 23 June (1). Larvae of this species are reported on various species of *Vaccinium*, and both blueberries and cranberries occur near the collection site.
