

A Survey of Moths of the Delaware Water Gap National Recreation Area

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Abstract

The Delaware Water Gap National Recreation Area (DEWA) consists of ~70,000 acres of diverse habitat along the Delaware River in eastern Pennsylvania and western New Jersey. There have been a few invertebrate studies done in the park but no comprehensive moth list has been developed. For this study, we conducted surveys at various points in the Delaware Water Gap to develop an evidence-based moth list for the park from April-November 2014. Surveys were conducted using a combination of 1000 Watt and 400 Watt metal halide lights, a UV blacklight, and baiting. Approximately 89 hours were spent conducting 28 surveys at 9 locations within the park, yielding 617 species of moths from 37 families, and over 2,277 specimens. Of the 37 families observed, Noctuidae was the most species rich family followed by Erebidae, Geometridae, Tortricidae, and Crambidae. The Speckled Green Fruitworm, *Petrophila fulicalis*, Painted Lichen Moth, Elegant Grass-veneer, and Hickory Tussock Moth were

the five most abundant species found on our surveys respectively. Of the 617 species identified, 289 were only documented on one of the 28 surveys and 235 species were represented by only one individual.

The Delaware Water Gap National Recreation Area (DEWA) covers ~70,000 acres along the Middle Delaware National Scenic and Recreational River in Pennsylvania and New Jersey, along the Delaware River with parts in Monroe and Pike County, PA and Warren and Sussex County, NJ. A fundamental objective of the National Park Service is to protect and maintain biological diversity within parks. Park managers, rangers, planners, and scientists need basic information on species occurring in parks as a basis for making management decisions, and for working with the public, other agencies, and the scientific community (NPS 2014B).

The DEWA landscape comprises a mosaic of mature deciduous and coniferous forests such as oak and hemlock and early-succession habitats, including several thousand acres of ponds and wetlands. Surrounding the Delaware River there are many additional riparian areas within the park. Some areas are used for agriculture. Much of the biodiversity in the park comes in the form of insects and other invertebrates, many of which go unnoticed because of their small size, excellent camouflage, secretive behavior, or the time of day they are active.

Various studies have been conducted within DEWA and comprehensive, evidence-based species lists have been compiled for DEWA's vertebrate wildlife and plants, but relatively little is known about the occurrence and distribution of insects and other invertebrates, other than comprehensive butterfly (Lepidoptera), treehopper

(Hemiptera), and dragonfly and damselfly (Odonata) lists. There were only 68 moth species documented as being present in DEWA (NPS 2014A) based on a study conducted in 1998-1999 (Shreiner pers. comm).

Wallace (2008) focused on treehopper (Hemiptera: Membracidae: Smiliinae) occurrence on oaks and used yellow sticky card traps to collect treehoppers, which were suspended from members of either the “red oak” or “white oak” group. Thirty trees were used in the study selected from three sites in Pennsylvania that were chosen as the best places to collect treehoppers. The study found 27 species in 8 genera over the three year period with the number of specimens taken in 2006 three times higher than 2004 and 2005 combined. The most commonly collected genera were *Cyrtolobus*, *Ophiderma*, *Glossonotus*, and *Telamona*. Most of the species and specimens collected were *Cyrtolobus* and *Ophiderma* (Wallace 2008).

Wander Ecological Consultants (2008) constructed an evidence-based checklist of the butterfly species found within DEWA based on 79 field trips completed from 1993-2008. They found 88 species, 87 of which are native. Based on their categorical system, they ranked 6 species as abundant, 47 as common, 12 as uncommon, 9 as rare, and 14 as occasional. There were a few species not found during the surveys that may still occur or have occurred in DEWA. Thirty-three of the 88 species were represented by digital photographs (Wander 2008).

An Odonate checklist was developed for DEWA by Olson et al. (2010) from surveys completed between 2007 and 2010. They found 122 species present within the park, including 60 which are ranked as rare or imperiled by either Pennsylvania’s or New Jersey’s Natural Heritage Program (or both in some instances). Nineteen species

on the checklist are considered rare in PA and NJ and 3 species are considered globally rare or imperiled. DEWA was found to have a rich diversity of Odonate fauna due to its diverse array of aquatic habitats and riparian areas, from large rivers to sphagnum wetlands. It was determined that more field work would be needed on the PA side of DEWA to map species' distributions and better estimate species' abundance (Olson, 2010).

DEWA's moth list consists of 68 species (NPS 2014A), only a fraction of the taxa that potentially occur there. There are likely 2,000 moth species found between PA and NJ since 1889 species have been recorded in PA and over 661 recorded in NJ according to Butterflies and Moths of North America (BAMONA) (MSU 2014). Given that over 400 species have been recorded in Plainfield Township, PA in a residential 4 acre yard over a period of 3 years (Kloiber pers. obsv.), it is likely that at least a thousand species should be present within the park borders given the diverse array of habitats it contains. A more comprehensive moth list for DEWA would greatly increase the number of species documented within the park and add to the knowledge of species biodiversity that can be found in its many habitats.

Objectives:

The main purpose of this study was to develop an evidence-based checklist of the park's common moth taxa, documenting species' occurrence in various habitats with voucher photographs and, in a few cases, preserved specimens. This would increase the number total of species documented within DEWA and add to its overall known biodiversity.

Study Area:

The area studied was south of the Dingmans Ferry bridge just to keep a relatively more manageable area. Survey locations were chosen for habitat variation as well as ease of access and the general openness of the area so the light could reach as far as possible to draw in the most species of moths. The area surveyed consisted of DEWA lands in Pennsylvania and New Jersey south of the Dingmans Ferry Bridge but not including Worthington State Forest. On the Pennsylvania side of the Delaware River, surveys were conducted at nine sites: Pocono Environmental Education Center (PEEC) as the northernmost survey point, Bushkill Access (BA), Delaware Water Gap Headquarters Building (HQ), and Hialeah Picnic Area (HPA). Areas surveyed on the NJ side of the river included New Jersey Rangers Station (RS), Watergate Recreation Area (WRA), Mohican Outdoor Center (MOC), and Turtle Beach (TB). The 9 sites surveyed were chosen mostly for convenience, ease of access, and habitat variability. The amount of equipment needed to conduct the surveys limited our access to relatively open areas near the vehicles.

The site in Blirstown is located just outside the park but species documented there by us on 9 surveys from 2012-2013 were added to the list as “probably present within DEWA” due to its proximity to the park boundary. The species added from this site were denoted on the annotated species list (Appendix II) with a different font color. All areas surveyed were easily accessible by car and an attempt was made to try and include a variety of habitats to document the greatest number of species possible. All of the sites surveyed are shown in the table below with a brief description of the habitat and are arranged from North to South in their respective states.

Table 1. Sites surveyed within DEWA in 2014, including the site in Blairstown, NJ. Sites are listed in north-south orientation in each state.

Site Name	State	Lat.	Long.	Habitat Description
Pocono Environmental Ed. Center (PEEC)	PA	N 41° 10' 14.0383"	W 74° 54' 49.8251"	Small grassy area surrounded by large spruce trees, small shrubs, and other plants. A small pond and wetland area close by.
Bushkill Access (BA)	PA	N 41° 6' 24.3713"	W 74° 59' 4.9353"	Parking lot adjacent to Delaware River surrounded by goldenrod patches and purple loosestrife with a few scattered deciduous trees.
DEWA Headquarters (DEWA HQ or HQ)	PA	N 41° 4' 12.3692"	W 75° 1' 1.9751"	Open cattail marsh with flooded white pine snags. Marsh edges comprised of alder, multiflora rose, blackberry, highbush blueberry, and wineberry; scattered trees present around the edges of the marsh and surrounding the parking lot.
Hialeah Picnic Area (HPA)	PA	N 41° 1' 2.4571"	W 75° 5' 3.5574"	Patchy mixed deciduous forest with a few coniferous trees and an herbaceous understory adjacent to agricultural fields; close to the Delaware River.
Ranger's Station (RS)	NJ	N 41° 9' 20.2376"	W 74° 53' 2.0453"	Within 10 m of survey site sod-grass surrounds ranger station. Within 20m west of survey light a mesic hillside edge borders the ranger station - hemlock and white pine edge, multiflora rose, and morrows honeysuckle. Japanese barberry dominates the understory of deciduous uplands. Approximately 100m to the east a large +/- .5 acre pond feature with emergent/submergent hydric vegetation dominates the feature. This pond is surrounded by hemlock, spruce, and bottomland deciduous trees
Watergate Recreation Area (WRA)	NJ	N 41° 4' 9.4573"	W 74° 58' 22.1498"	Ponds surrounded by grassy vegetation; small patches of mixed forest; maintained grassy area; scrubby field behind row of spruce trees.
Blairstown Site	NJ			Site located just outside the DEWA boundary consisting of managed meadow habitat with various deciduous and evergreen trees including many cedars; small creek runs along one end of the property along with two small ponds; small planted vegetable garden present as well.

Mohican Outdoor Center (MOC)	NJ	N 41° 2' 6.2369"	W 75° 0' 5.2078"	Parking area surrounded by deciduous forest near a large wetland habitat. (based on satellite imagery)
Turtle Beach (TB)	NJ	N 41° 1' 59.5214"	W 75° 2' 13.2843"	Small maintained grassy area near the Delaware River surrounded by deciduous forest edges and meadow containing Queen Anne's Lace, Goldenrod, and other herbaceous plants.

Materials and Methods:

Survey Methods:

To document the highest number of species possible in DEWA during the study, different survey methods were utilized: point surveys, driving surveys, and incidental observations. Baiting was used on some nights to supplement the nights' species list by attracting species that may not have come into the light. The bait was a mixture of stale beer or wine, old bananas and/or other fruit, and brown sugar which was then painted on trees or other surfaces such as fences. Bait stations were set up within 100 m of light station in order to attract species not inclined to fly to survey lamp.

Point surveys were conducted using a 1000 watt Sanyo Metal Halide bulb mounted on a Gitzo tripod adapted for a light bulb. The light was connected to a ballast rated for 1000W and run by either a Briggs and Stratton generator or through an electric outlet when available via use of extension cords. For the



Figure 1. Photograph of the light setup used for point surveys.

sheet, a white plastic tarp with ~2mm square weave was placed over a study vehicle to reflect the light which was placed about 3-4 feet from the tarp (Figure 1). Sometimes a drop cloth was placed under the light to try to avoid excessive stepping on of insects depending on location. A bendable arm was clamped onto one tripod leg to hold vegetation to be used as substrate for photodocumentation. On two nights (HQ 8/25 and 9/29), a Model 7020 BL Lights of America fluorescent black light was also used in addition to the primary light. A 400 watt self-ballasted metal halide light unit was used one night at PEEC (8/9) when the 1000 watt light was unavailable and in addition to the primary light at DEWA HQ on 6/24. A small bed sheet was used in place of the tarp for the blacklight and 400 watt lights. Multiple point surveys were performed at the DEWA Headquarters building, Turtle Beach, Watergate Recreation Area, and PEEC while a single survey was performed at the NJ Ranger Station, Hialeah Picnic Area, and Mohican Outdoor Center. Point surveys usually began around dusk in an attempt to catch pre-dusk emergent species along with allowing for set-up to take place using ambient light. Surveys lasted for a few hours depending on activity levels around the light and ended at the discretion of the surveyors.

Driving surveys were performed using a personal vehicle and stopping at various points to check for moths around pre-existing sodium parking and street lights. The DEWA Headquarters building and the Bushkill Access were surveyed almost exclusively during the driving surveys. Most of the driving surveys were performed on some nights when there was no point survey being conducted. On the occasions when point surveys were performed at PEEC, stops were made at the Bushkill Access and

the DEWA HQ on the way south along US Hwy. 209. Driving surveys usually took place between 9-11pm and lasted as long as it took to thoroughly survey the locations.

A datasheet (Appendix I) was filled out at each location for both survey types. Insect species found via incidental attraction to survey light or observed in the vicinity were added to margins of data sheet. These ancillary sightings of interest are submitted as Appendix II.

Species found by incidental observations were added to the list of species but a data sheet was not filled out for them. This was the case when surveying for moths was not the primary focus for being in the park. Some of these instances included conducting bird surveys, helping with research on Louisiana Waterthrush (*Parkesia motacilla*) and Acadian Flycatcher (*Empidonax vireescens*), or targeting one or two individual species within the park such as Hummingbird Clearwing (*Hemaris thysbe*) and Snowberry Clearwing (*H. diffinis*), which could be found nectaring at flowers just about anywhere. Species seen by incidental observations were added to the list along with the date and location only if they were previously unrecorded.

Photographs:

Where logistically possible, photographs were taken of all species attendant at the survey lamp (including adult moths and any caterpillars). Photos were taken with a Nikon D800 camera body and a 105mm Nikor lens. A SB 800 macro ring light was also used for even exposure and detail. Some images were processed using Nikon NX v.2 image software. Post processing of images included: cropping of the photo, sharpening of the image, application of various levels of noise blocking, mainly in the background, adjustment of light levels when necessary, erasing of unwanted background items, use

of Gaussian blur to blur unwanted backgrounds, adjusting the color saturation, adjustment of the images' white balance, and removal of dust particles from the sensor. The majority of photographs were unaltered aside from cropping. An attempt was made to take most photos on a natural substrate, but often they were taken wherever the moth was at the time. Photos were taken of all species possible and each photo was labeled using the following park service file-naming system:

Genus_species_location_date. Thus, photos are useful as voucher specimens as long as diagnostic features are visible. Most species can be identified from photos but not all; some can only be identified to family or genus level. Species such as *Eulithis diversilineata*, *Eulithis gracilineata*, *Xanthotype sospeta*, and *Xanthotype urticaria*, for example, cannot be reliably separated from photos.

Species Identification:

Since the majority of moth species can be identified from photos based on observable characteristics, many of the identifications made were based on prior experience but many others required consultation with other resources. The Peterson guide to Moths of Northeastern North America was used as an identification resource in the field while conducting the surveys (Beadle 2012). The Moth Photographers Group website was used extensively to confirm identifications and to compare photos of similar species (MPG 2015). Some individuals also required identification from other experts. Species common names came from the Peterson guide or Moth Photographers Group depending on which was more widely used, although many species can have many common names. Some individuals could only be identified to a species pair, in which an individual could be one of two species but not identifiable to species based on the photo

or without dissection. Species pairs were included in the annotated species list (Appendix II).

Specimens:

A small sample of insect specimens were collected using a glass killing jar with a layer of Plaster of Paris in the bottom soaked with ethyl acetate. They were then pinned on either size 0 or 3 black enameled Bioquip[®] pins and spread on a green foam insulation spreading board and allowed to dry. The dried and spread specimens were then labeled with the state and county they were collected in, latitude and longitude of where it was collected, the date, and the name of the collector. The second label has the study number, permit number, and names of the persons on the permit. Specimens were then stored in Bioquip[®] Cornell drawers with a plastofoam bottom.

Data Management:

The datasheet in Appendix I was filled out for each survey night. Each site was given a name and the state, county, and coordinates for the location were recorded. A brief description of the habitat in the immediate area were taken along with the general location of the site. Other data like cloud cover, moon phase, and temperature were recorded along with the observers' names and sampling method(s). The date and start and end time of each survey were also recorded. In the species list below the general survey data, the genus and species, common name, and the number of individuals were recorded for every species found during the survey. All of the survey sheets were typed into an Excel spreadsheet and a scanned PDF was made of the datasheets. The Hodges number for each species was used to organize the DEWA list in Appendix II. Hodges numbers are a classification system introduced by R.W. Hodges in his 1983

book “Checklist of the Lepidoptera of America North of Mexico” in which every species was designated a number. Hodges numbers allow for an easy method of organization and many collections are sorted using them.

Results:

We conducted 28 surveys between April and November which yielded approximately 2,278 observed and examined individuals of 618 moth species. 63 additional specimens could only be identified to genus or family level. An attempt was made to photograph as many species of moths observed as possible and 353 photos were taken of 281 identified and 62 unidentified specimens. An additional 91 species were added to the DEWA park list from the Blirstown site as “probably present within the park.” For the purposes of this study, only those species found within DEWA during the study period were included in the data analysis. The results of the surveys are shown in Table 2 below.

Table 2. The results of each survey separated by location including date, and number of species found.

	DEWA HQ	TB	PEEC	WRA	BA	DEWA RS	HPA	MOC	SB
April 10	32								
April 19			29						
May 2								9	
May 11	59								
June 6				113					
June 24	151								
July 5			111						
July 6	33				11				
July 16		237							
July 18									6
July 19	44				12				
July 29	29				6				
August 6	36				7				
August 9			53						
August 10	17				5				
August 13		162							
August 25	122								
August 27				167					
August 29						85			
September 14		37							
September 21							47		
September 29	63								
November 12	5								

We documented 37 families within the park during the study as shown in Figure 2 (Psychidae was only found in Blairstown). Most of the species observed were in the families Noctuidae (169) and Erebidae (107). Speckled Green Fruitworm (Noctuidae), *Petrophila fulicalis* (Crambidae), Painted Lichen Moth (Erebidae), Elegant Grass-veneer (Crambidae), and Hickory Tussock Moth (Erebidae) were the five most abundant species respectively. We also found 289 species that were only represented from one survey (one site on one night). Additionally, 235 species consisted of one observed individual. According to Anthony McBride, our observation of *Papaipema speciosissima*

at the Headquarters building may constitute a new Monroe County record for the species.

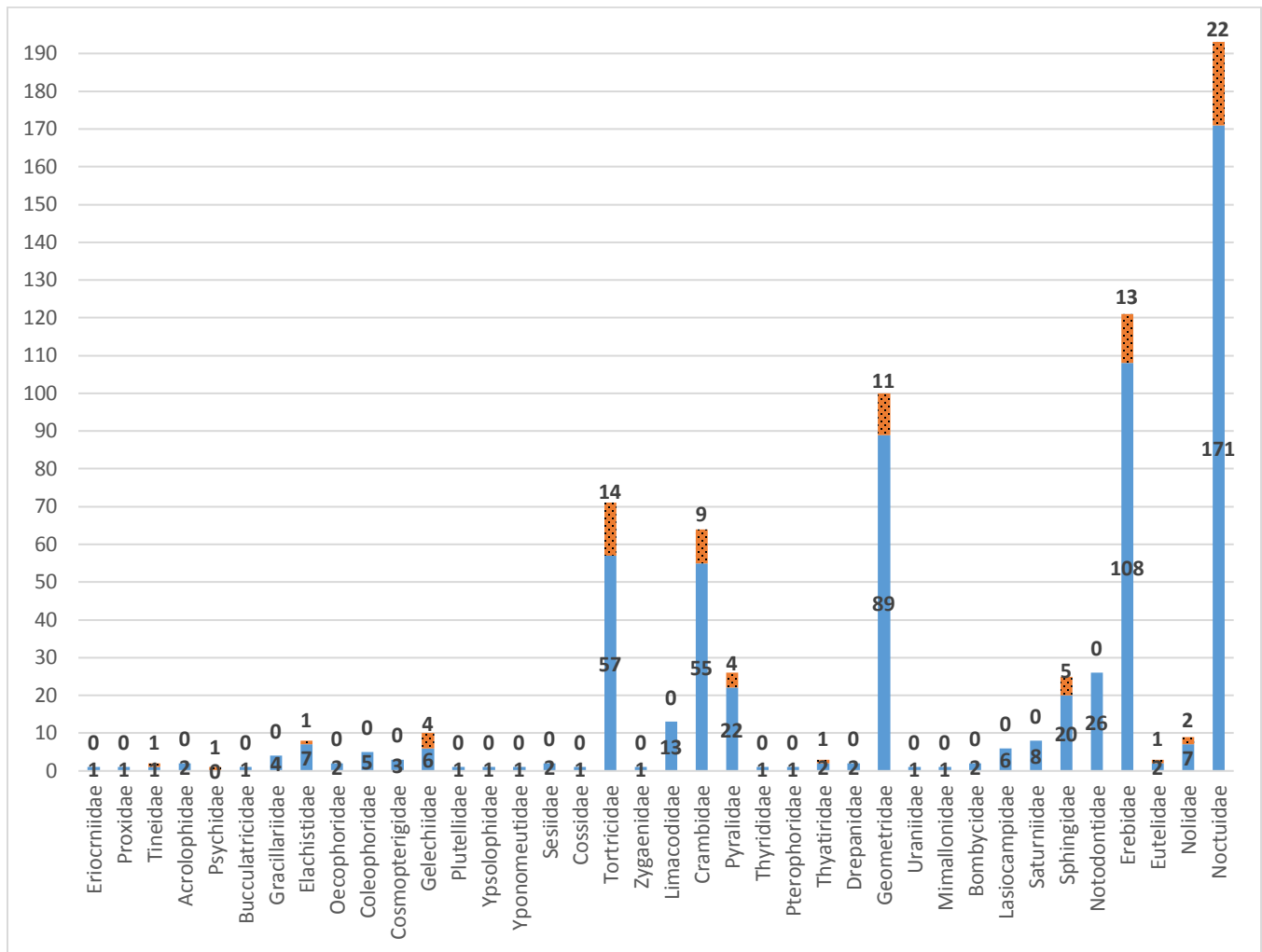


Figure 2. Stacked column graph showing the number of species in each family found within the park in blue (lower number), with additional species not found during the study but present at the Blairstown site, but which are likely present within the park in orange (upper number) giving the total number of species in each family on the DEWA moth list. The numbers only account for moths that were identified to species level or species pair so some numbers would be slightly higher if including unidentified individuals.

The number of species found in each month is presented in Figure 3. August had the highest species richness followed by July and June while October had the lowest number of observed species (2), both being represented by incidental observations.

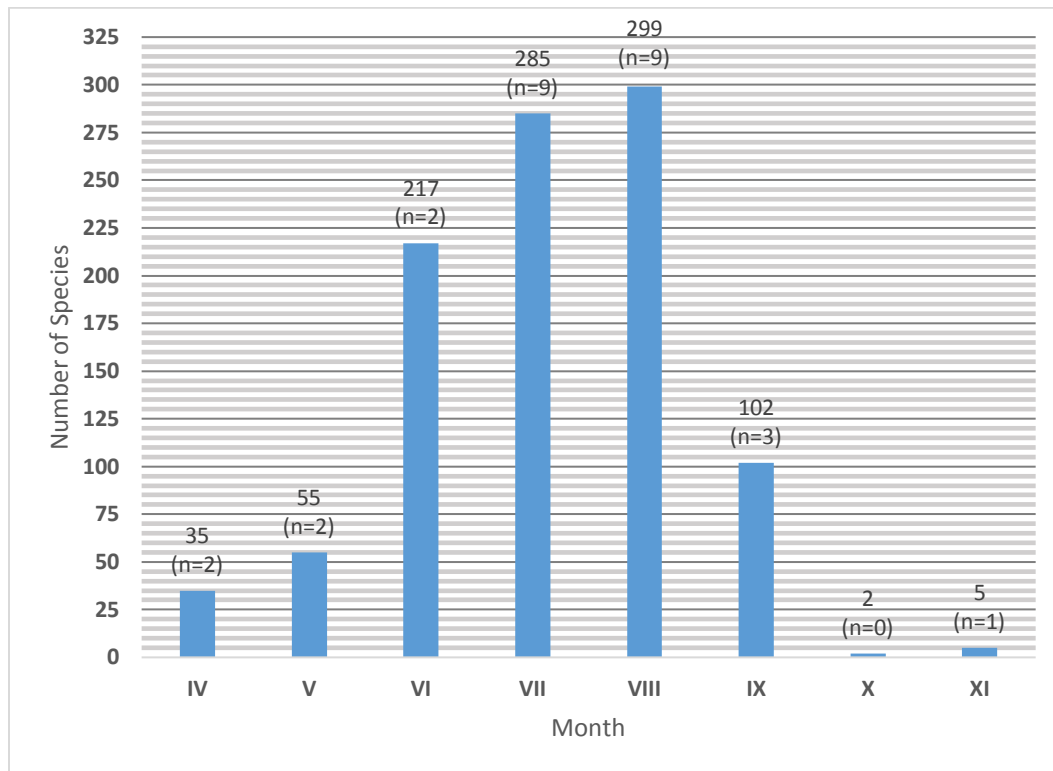


Figure 3. Graph showing the monthly species richness found within DEWA over the study period, only accounting for moths that were identified to species level or species pair so some numbers would be slightly higher if including unidentified individuals. n represents the number of surveys at each location.

Figure 4 shows the species richness at each site surveyed along with the number of surveys. The DEWA Headquarters building was our most species rich site with 360 species followed by Turtle Beach with 319 species. Both Smithfield Beach and Mohican Outdoor Center sites were only surveyed once giving them lower species totals.

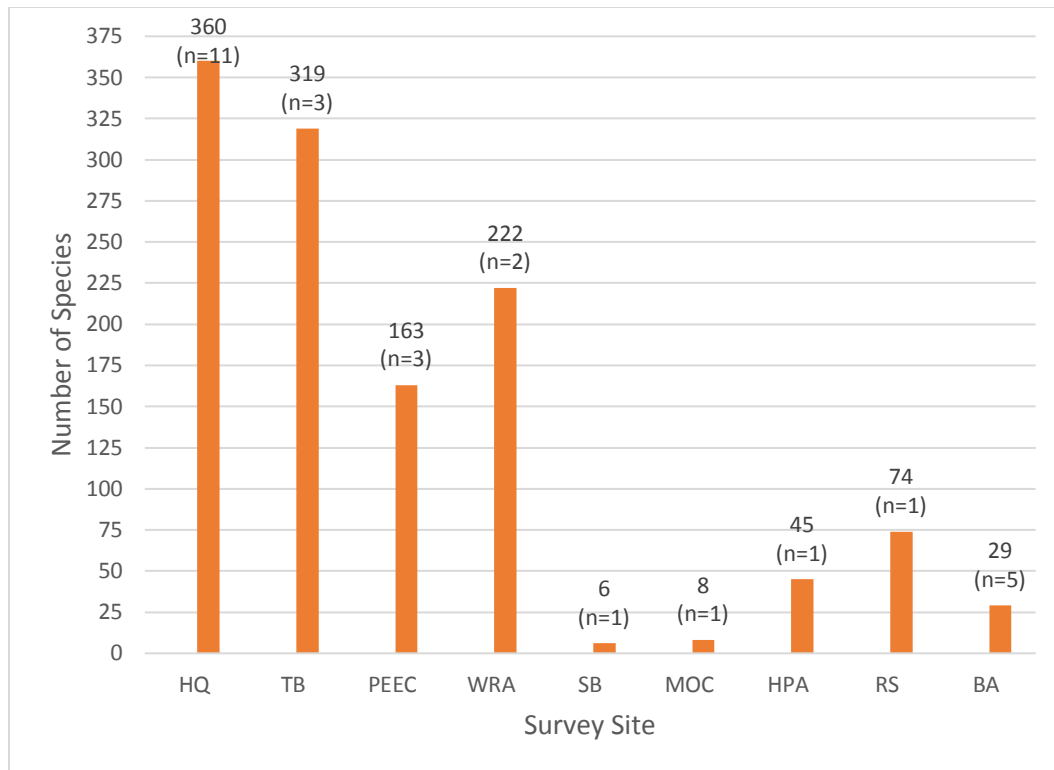


Figure 4. A comparison of the species richness found at each site based on surveys conducted during the study. The numbers only account for moths that were identified to species level or species pair so some numbers would be slightly higher if including unidentified individuals. n represents the number of surveys at each location.

Table 3 shows the number of surveys at each location, the number of species found at each location, and the number of species unique to each site, or species not found at any other site. The Headquarters building and Turtle Beach had the two highest total number of species, and they had the highest number of unique species respectively. A total of 89.23 hours were spent conducting the surveys. Of the four most species rich sites (HQ, TB, PEEC, WRA), Watergate Recreation Area had the highest number of species per survey hour (17.9) followed by Turtle Beach (14.7), Pocono Env. Ed. Center (12.4), and the Headquarters Building (12.3).

Table 3. Table showing the number of total and unique species found at each site. The numbers only account for moths that were identified to species level or species pair so some numbers would be slightly higher if including unidentified individuals. Also shows the number of surveys, total survey hours, and species per survey hour for each location.

Site Name	Total Species	Unique Species	Number of Surveys	Survey Hours	Species per Survey Hour
HQ	360	113	11	28.83	12.4
TB	319	88	3	21.75	14.7
PEEC	163	31	3	13.08	12.5
WRA	222	54	2	12.41	17.9
SB	6	1	1	0.08	75
MOC	8	2	1	3.5	2.3
HPA	45	7	1	3.33	13.2
RS	74	6	1	5.25	14.1
BA	29	3	5	1.00	29
		Total:	28	89.23	

Figure 5 shows a comparison of the five most numerous species found on our surveys. Speckled Green Fruitworm (*Orthosia hibisci*) flies in early spring and none were observed after the end of April. The largest peak comes from an estimated 100 individuals seen at the headquarters building on the first survey. Elegant Grass-veneer (*Microcrambus elegans*) was present on 12 surveys from June through September. *Petrophila fulcalis* was most prevalent in July and the highest number of individuals were seen at the Bushkill Access. *Petrophila* can be a difficult genus to identify individuals to species and our identification of the *P. fulcalis* is based on comparing to images on Moth Photographers Group, an online identification resource containing photographs of thousands of moth species. Hickory Tussock Moth (*Lophocampa caryae*) has two peaks as seen in the graph, one in early summer and one in late summer-early fall. The peak in July represents a high number of adults (30) that were present while the peak in September represents caterpillars (8) found getting ready to overwinter.

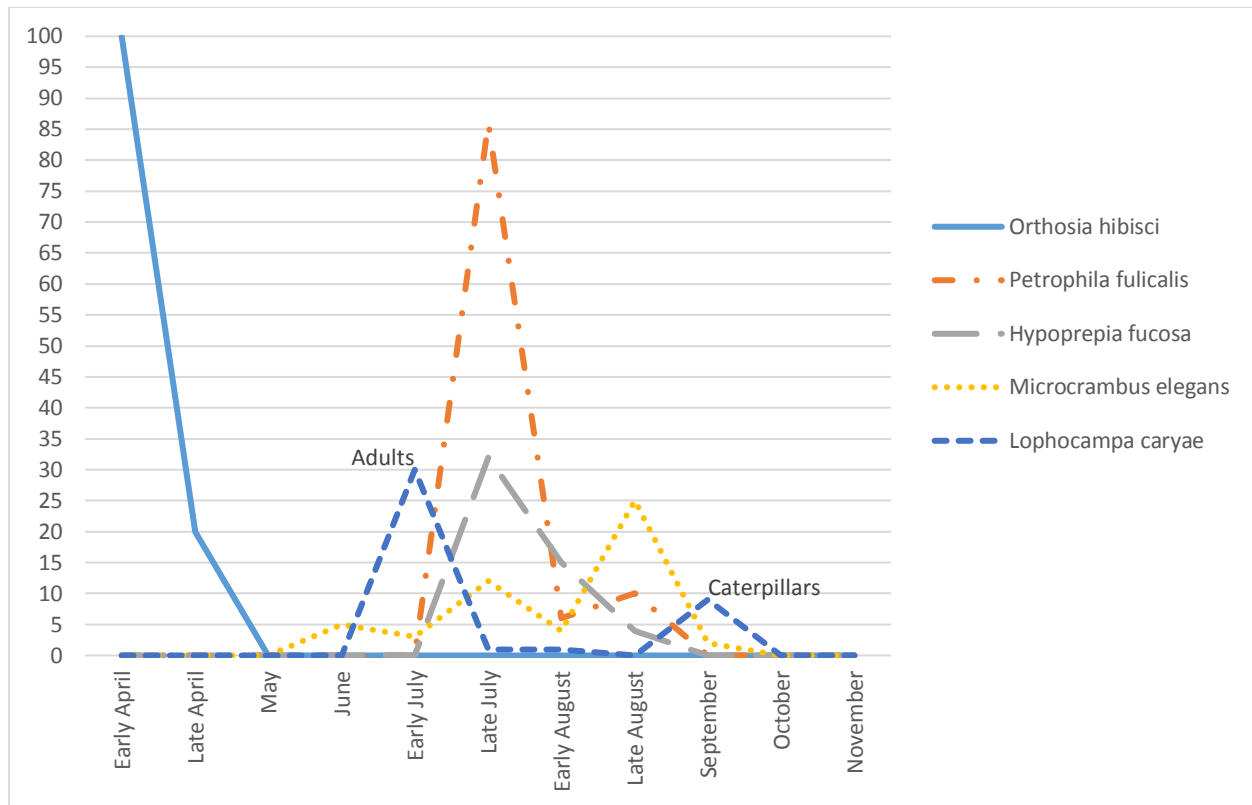


Figure 5. Comparison of the 5 most abundant species (number of individuals) found during the study period across time. *Lophocampa caryae* shows two peaks in numbers; the first represented by adults in early summer and the second represented by caterpillars preparing to overwinter in fall.

Discussion:

There were two surveys where the number of individuals for most of the species weren't recorded, and a few surveys when only the unknown species didn't have a recorded number of individuals. This is why we reported ~2,278 individuals instead of an exact number.

Although we found 37 families within DEWA this year, there are likely more present. We didn't find any members of the Psychidae family, or bagworms, but they are likely present due to the commonality of some species in the family including Evergreen Bagworm (*Thyridopteryx ephemeraeformis*) and the introduced Common

Bagworm (*Psyche casta*). Four-spotted Yellowneck (*Oegoconia quadripuncta*), a member of Autostichidae, is likely found in or around some of the buildings in the park and would add a new family to the list. Ghost Moths (Hepialidae) may be present in DEWA but specific habitats would need to be surveyed at certain times in order to find them. There would be a higher number of families reported except a few families including Arctiidae and Lymantriidae were reduced to subfamily level under the family Erebidae.

Summer is the peak season for moth diversity in the northeast and June, July, and August were the most species rich months on our surveys. Not as many species were found in spring and fall months but they were species not found at other times of the year. *Feralia*, *Orthosia*, and *Psaphida* species are only found in early spring (March-April). *Papaipema* species along with many of the sallows and darts (Noctuidae) and a few geometrid moths (e.g. *Operophtera bruceata*, *Alsophila pometaria*) are primarily found in the fall.

The DEWA Headquarters building was the most species rich site that we surveyed in the park. The habitat mosaic that surrounds DEWA Headquarters is an exceptional mosaic of true-swamp, marsh, deciduous bottomlands and diverse uplands. The vegetational community structure therein, buffered by thousands of greenway connected acres of parkland, is likely responsible for the species richness noted in this inventory. Turtle beach had the highest number of species found on a single night (238) and the second highest species richness. Similar to the Headquarters survey site, Turtle Beach is surrounded by a rich community of habitat-types including a variety of deciduous trees, herbaceous and woody plants, and grasses. Smithfield Beach was

only surveyed once on a driving survey, resulting in 6 species, because there were bats foraging directly above the light, and the majority of insects present were eaten based on the number of wings on the ground and the overall lack of insects resting around the light.

Over half of the time surveying was spent between the Headquarters Building and Turtle Beach. The majority of the time spent at Turtle Beach was from two 9-hour nights. Although 8 more surveys were conducted at the headquarters than at Turtle Beach, there were only 7 hours more spent there. The higher number of surveys were due to 6 stops there on driving surveys that were mostly under an hour in duration. The remaining 5 point surveys averaged just over 5 hours each. The site with the highest species per survey hour was Smithfield Beach followed by Bushkill Access due to the low number of survey hours at those sites. Some of the sites with high numbers of observed species (PEEC, WRA, TB, HQ) had lower numbers of species per survey hour due to higher number of hours spent at those locations.

Every moth species has a flight period when the adults are active and can be found. Some such as the Speckled Green Fruitworm (*Orthosia hibisci*) only fly in early spring while others like the Elegant Grass-veneer (*Microcrambus elegans*) fly for most of the year (Figure 5). Adults of some species aren't frequently encountered at lights but are more commonly found as caterpillars such was the case with the Dogbane Saucrobotys Moth (*Saucrobotys futilalis*) in which caterpillars were found at the headquarters building directly beneath one of the lights in the parking lot but no adults were observed. Hickory Tussock Moths (*Lophocampa caryae*) were observed as adults in early summer and as caterpillars in fall looking for places to overwinter and Isabella

Tiger Moths (*Pyrrharctica isabella*) showed a similar trend where adults were seen first with caterpillars observed in the fall.

Adding Additional Species:

Specifically targeting individual species or groups would be the easiest way to add more species to the park list. Maple Callus Borer (*Synanthedon acerni*) and Peachtree Borer (*S. exitiosa*) were the only members of the Sesiidae family, which is likely a very low representation of the actual number of species present. Sesiid moths are not generally attracted to lights, with the exception of *S. acerni*, but they are readily attracted to pheromone lures. Many species come to specific lures so using pheromones in correct habitats would give a much better representation of the sesiids present within the park.

Daytime searches in certain habitats are likely to add day-flying species that don't usually come to lights. The Infant (*Archiearis infans*) can be found in heavily disturbed areas with gray birch trees in spring flying during the day. Searches in meadow or field habitats would likely add White-spotted Sable Moth (*Anania funebris*) or a few other moths to the list such as the Eight-spotted Forester (*Alypia octomaculata*). Certain species of Fairy Moths (Adelidae) can be found along wooded trails or around young willow trees with catkins. Sycamore Tussock Moth (*Halysidota harrisii*) could likely found along the river where Sycamore trees are present and caterpillars can be found in the fall and are only identifiable as caterpillars unless an adult is dissected to separate it from *H. tessellaris*. *Papaipema* species require specific host plants so finding the host plants and searching for larvae or surveying in areas with specific host plant species would probably be the easiest way to confirm additional

species in the park. Collecting leaf mines and rolled leaves to see what species emerge would likely add more species such as *Olethreutes hamameliana*. Searching for caterpillars would likely add more species to the park list as well.

Surveying the northern end of the park would likely produce some new species found at higher elevations and in different habitats considering the majority of surveys performed were in lowland, river valley areas. More mesic areas could produce some species that may not be found in the wetter areas we surveyed in the southern half of the park.

Searching inside buildings, especially ones with pantries or with stored foods or grains, would likely confirm Meal Moth (*Pyralis farinalis*) and possibly Stored Grain Moth (*Aglossa caprealis*) in the park which can be found in household settings that weren't found on our surveys. Four-spotted Yellowneck (*Oegoconia quadripuncta*) may also be present which would confirm a new family within DEWA. Conducting surveys further off roads and trails would likely add more species in less disturbed areas that require more intact habitats. In general, simply performing more surveys will add more species to the list over time. Adding refugia/micro-niche target sites within the park could reasonably bring the total number of nocturnal Lepidoptera over a thousand. Determining rare community locations within park boundaries should be an important consideration for future inventory work in order to set the foundation for future management and stewardship of target resources.

Products:

There were a few products developed for the National Park Service along with this report. The other products were as follows:

I. List of species and Project Database: A Microsoft Excel spreadsheet containing the list of species found within DEWA during the study sorted into their respective families was included along with a spreadsheet of species found within DEWA sorted by Hodges number but not broken into families. The species found at the site in Blairstown, NJ were also added to this list. For convenience, two running lists were kept, one including the Blairstown site and one found within the park during the study. The raw data from each survey was included in the spreadsheet as separate worksheets (tabs) labeled with the location and date.

II. Photographs: A collection of 293 high-resolution photographs of 282 identified species were assembled along with 64 photos of unidentified individuals (or species pairs). Each photo was labeled using the NPS file-naming system: Genus_species_location_date and presented as uncompressed JPEG files.

III. Datasheet PDFs: 16 scanned copies of the field data sheets (Appendix I) were handed in as PDF files along with the original paper copies. The list from each survey was also typed into the Excel spreadsheet and turned in as well.

IV. Insect collection: A small insect collection was made throughout the field season to represent some of the species found within the park. They were pinned and spread until dry and labeled with appropriate data and stored in a Cornell drawer which was turned into the NPS at the conclusion of the study. 75 specimens of 57 identified species and 20 unidentified specimens were collected for display during the study. The

collection was turned in to the NPS along with the report and photographs and will be displayed and/or stored at their discretion.

Acknowledgements:

First and foremost I would like to thank Blaine Rothauser who was instrumental in being able to conduct this study through use of his light setup and camera equipment. All photos were provided by Blaine for the digital photograph collection. I would also like to thank Jeffrey Shreiner (DEWA) and Dr. Matthew Wallace (ESU) for direction in creating the project proposal, developing the datasheet, and providing direction and advisement in creating the final report. Jeffrey Shreiner acquired funding from the NPS Eastern Rivers and Mountains Network for the project, acquired display boxes for the collected specimens, and assisted with the expediting the permitting process. Matthew Wallace provided assistance and guidance with the data analysis and discussion and applying for independent research credits at ESU. We had lots of help identifying our unknown moths. Anthony McBride helped identify our unknown *Papaipema* species. Steven Johnson and Paul Dennehy were instrumental in identifying many of our remaining unknown moths which greatly increased the total species list for the park. I would also like to thank the other surveyors that joined us and took part in our moth surveys.

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Appendix I. Blank Data Sheet

Delaware Water Gap National Recreation Area Moth Survey

Site Name:		Additional Notes:					
State:	Lat.:						
County:	Long.:						
Date:							
Start Time:	End Time:	Moon Phase:					
Sampling Method(s):		Cloud Cover:					
Observers:		Temperature:					
		Total Sp.:					
Location Description:							
Habitat Description:							
	Common Name	Genus	species	(#)	Hodges #	Photo/ specimen	Notes
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Appendix II. Annotated Species List – Families, species, and Hodges numbers in red font are those that were found at the Blirstown site and are on the list as likely found within the park. Red font in the ‘number of individuals’ column represent species whose number of individuals were not recorded on all surveys and whose recorded numbers are lower than the actual number observed.

Family	Species Name	Hodges No.	Months Observed	Sites	Number of Surveys	Number of Individuals	Photo / Specimen
Eriocrniidae	<i>Dyseriocrania griseocapitella</i>	0003	V	HQ	1	1	P
Proxidae	<i>Tegeticula yuccasella</i> / <i>Prodoxus decipiens</i>	0198 / 0200.1	VI	HQ	1	1	
Tineidae	<i>Monopis dorsistrigella</i>	0416	VII	PEEC	1	1	P
	<i>Monopis pavlovski</i>	0418.1					
Acrolophidae	<i>Acrolophus morus</i>	0367	IX, X	HQ, PEEC	1	1	P
	<i>Acrolophus popeanella</i>	0373	VII	PEEC, TB	2	2	
Psychidae	<i>Psyche casta</i>	0437					
Bucculatricidae			VIII	WRA	1	1	
Gracillariidae	<i>Caloptilia bimaculatella</i>	0595	IV	WRA	1	1	
	<i>Caloptilia blandella</i>	0596	VIII	HQ	1	1	
	<i>Caloptilia packardella</i>	0620	VIII	WRA	1	1	
	<i>Povolnya quercinigrella</i>	0627	V	HQ	1	1	P
Elachistidae	<i>Agonopterix pulvipennella</i>	0867	IV	HQ	1	2	
	<i>Agonopterix canadensis</i>	0878					
	<i>Agonopterix thelmae</i>	0884	VIII, IX	RS, HPA	2	2	P
	<i>Bibarrambra allenella</i>	0911	VIII	TB	1	1	P
	<i>Machimia tentoriferella</i>	0951	IX	HQ, HPA, TB	3	6	
	<i>Antaeotricha schlaegeri</i>	1011	VI	WRA, HQ	2	4	
	<i>Antaeotricha unipunctella</i>	1013	VII	PEEC	1	1	P
	<i>Antaeotricha leucillana</i>	1014	VIII	PEEC	1	1	
Oecophoridae	<i>Epicallima argenticinctella</i>	1046	VI, VII	HQ, TB	3	3	P
	<i>Promalactis suzukiella</i>	1047.1	IX	HPA	1	2	
Autostchidae	<i>Oegoconia quadripuncta</i>	1134					
Coleophoridae			VI, VII, VIII	HQ, WRA, PEEC	4	5	
Cosmopterigidae	<i>Cosmopterix delicatella</i>	1480	VIII	TB	1	1	
	<i>Stagmatophora wyattella</i>	1509	VIII	WRA	1	1	
	<i>Limnaecia phragmitella</i>	1515	VII	TB	1	2	P
Gelechiidae	<i>Aristotelia roseosuffusella</i>	1761					
	<i>Arogalea cristifasciella</i>	1851	V	HQ	1	10	P
	<i>Pubitelphusa latifasciella</i>	1857	VI	HQ	1	1	
	<i>Chionodes mediofuscella</i>	2093	VIII	RS	1	1	P

	<i>Battaristis vittella</i>	2229	VIII	PEEC	1	1	
	<i>Helcystogramma hystricella</i>	2268					
	<i>Dichomeris flavocostella</i>	2295	VII	PEEC, TB	2	2	P
	<i>Dichomeris inserrata</i>	2297	VII	TB	1	1	P
	<i>Dichomeris isa</i>	2301.2					
	<i>Dichomeris picrocarpa</i>	2309					
Plutellidae	<i>Plutella xylostella</i>	2366	V	HQ	1	2	
Ypsolophidae	<i>Ypsolopha dentella</i>	2375	VI	PEEC	1	1	
Yponomeutidae	<i>Atteva aurea</i>	2401	VII, VIII, IX	HQ, TB, WRA, RS, HPA	8	16	
Sesiidae	<i>Synanthedon acerni</i>	2554	VI, VII, VIII	WRA, HQ, PEEC, TB	4	6	P,S
	<i>Synanthedon exitiosa</i>	2583	VIII	PEEC	1	2	S
Cossidae	<i>Zeuzera pyrina</i>	2700	VII	TB, HQ	2	2	
Tortricidae	<i>Episimus argutana</i>	2701	V	HQ	1	1	P
	<i>Endothenia hebesana</i>	2738	VII	HQ	1	1	
	<i>Hulda impudens</i>	2747	VI	WRA	1	1	P
	<i>Zomaria interruptolineana</i>	2750	VIII	HQ	1	1	P
	<i>Apotomis albeolana</i>	2763	VIII	WRA	1	1	
	<i>Phaenasiophora niveiguttana</i>	2772	VI, VII	WRA, HQ, TB	3	3	P,S
	<i>Olethreutes inornata</i>	2788					
	<i>Olethreutes fasciatana</i>	2823	VII	PEEC, TB	2	1	P
	<i>Olethreutes griseoalbana</i>	2828	VIII	HQ, WRA	2	2	P
	<i>Olethreutes astrologana</i>	2837	VII	TB	1	1	
	<i>Metendothenia separatana</i>	2860	V, VIII	HQ, PEEC	2	2	
	<i>Hedya nubiferana</i>	2862					
	<i>Rhyacionia rigidana</i>	2868	V	HQ	1	1	P
	<i>Phaneta raracana</i>	2928	VII, VIII	TB, PEEC	3	2	
	<i>Phaneta ochroterminana</i>	2929	VIII	WRA	1	1	
	<i>Phaneta tomonana</i>	2936	VIII	WRA	1	2	
	<i>Eucosma tocullionana</i>	3074	VI	WRA, HQ	2	3	P
	<i>Eucosma dorsisignatana</i>	3116	IX	HPA, HQ	2	3	P
	<i>Eucosma derelicta</i>	3120	VII, VIII	TB, PEEC, WRA	4	3	P
	<i>Eucosma cataclystiana</i>	3142	VII, VIII	TB	2	1	
	<i>Epiblema strenuana</i>	3172					
	<i>Epiblema glenni</i>	3184.1					
	<i>Epiblema scudderiana</i>	3186					
	<i>Notocelia rosaecolana</i>	3208	VII	PEEC	1	X	P
	<i>Sonia canadana</i>	3219					
	<i>Proteoteras aesculana</i>	3230	V	HQ	1	1	
	<i>Proteoteras crescentana</i>	3233	VII	TB	1	1	P
	<i>Pseudexentera mali</i>	3247	V	MOC	1	X	
	<i>Pseudexentera virginiana</i>	3258	IV	PEEC	1	1	P
	<i>Epinotia transmissana</i>	3310	VI	HQ	1	1	P

	<i>Ancylis nubeculana</i>	3354	VI	WRA, HQ	2	2	P
	<i>Ancylis divisana</i>	3375	VI, VIII	HQ	1	1	
	<i>Ancylis muricana</i>	3377	VII	TB	1	1	P
	<i>Cydia toreuta</i>	3486	V, VI	HQ, WRA	2	2	P, S
	<i>Cydia pomonella</i>	3492					
	<i>Cydia latiferreana</i>	3494	VIII	TB, HQ, WRA, RS	4	10	
	<i>Gymnandrosoma punctidiscanum</i>	3495	VI, VIII	WRA, HQ	3	3	P
	<i>Ecdytolopha insiticihana</i>	3497					
	<i>Acleris curvalana</i>	3504	VI	HQ	1	2	P
	<i>Acleris cervinana</i>	3514	VI	HQ	1	1	P
	<i>Acleris subnivana</i>	3517	IV, VIII	HQ	1	4	P
	<i>Decodes basiplagana</i>	3573	IX	HQ	1	1	P
	<i>Pandemis lamprosana</i>	3593	VIII	RS	1	1	S
	<i>Pandemis limitata</i>	3594	VI, VII, VIII, IX	HQ, PEEC, TB, WRA, RS	7	10	
	<i>Argyrotaenia velutinana</i>	3597	VI, VII, VIII	HQ, PEEC, TB, RS	6	6	P
	<i>Argyrotaenia juglandana</i>	3622	VII	PEEC	1	1	
	<i>Argyrotaenia quercifoliana</i>	3623	VI, VII, VIII	HQ, TB, PEEC	3	3	
	<i>Argyrotaenia alisellana</i>	3624	VI	HQ	1	1	
	<i>Argyrotaenia mariana</i>	3625	V	HQ	1	1	P
	<i>Choristoneura fractivittana</i>	3632	VI	WRA	1	2	P
	<i>Choristoneura rosaceana</i>	3635	VI, VII	HQ, TB	2	2	
	<i>Archips argyrospila</i>	3648					
	<i>Archips semiferana</i>	3653					
	<i>Archips fervidana</i>	3655	VIII	HQ	1	1	
	<i>Archips grisea</i>	3660	VII	HQ	1	1	
	<i>Syndemis afflictata</i>	3672	V	HQ	1	1	P, S
	<i>Clepsis persicana</i>	3682					
	<i>Clepsis clemensiana</i>	3684	VI, VIII	WRA, TB	2	1	P
	<i>Clepsis melaleucanus</i>	3686	VI	WRA	1	1	P
	<i>Clepsis peritana</i>	3688	VI, VII, VIII, IX	WRA, HQ, TB, RS	8	10	
	<i>Xenotemna pallorana</i>	3693					
	<i>Sparganothis sulfureana</i>	3695	VI, VII, IX	HQ, TB, HPA	3	3	
	<i>Sparganothis xanthoides</i>	3706	VI	HQ	1	1	P
	<i>Sparganothis unifasciana</i>	3711					
	<i>Cenopsis diluticostana</i>	3716	VII	PEEC, TB	2	1	P
	<i>Cenopsis reticulatana</i>	3720	VIII	HQ, TB, WRA, RS	5	4	
	<i>Cenopsis pettitana</i>	3725	VI	HQ	1	1	
	<i>Platynota flavedana</i>	3732					
	<i>Platynota idaeusalis</i>	3740	VI, VII, VIII	HQ, PEEC, TB	5	4	
	<i>Platynota exasperatana</i>	3743	VI, VIII	PEEC, HQ, WRA	3	3	P

	<i>Coelostathma discopunctana</i>	3747	VI, VIII	PEEC, TB, RS	4	3	
Zygaenidae	<i>Harrisina americana</i>	4624	VII	TB	1	1	P
Limacodidae	<i>Tortricidia testacea</i>	4652	VI	HQ	1	1	P
	<i>Tortricidia pallida</i>	4653	VIII	HQ, WRA	3	4	P
	<i>Tortricidia flexuosa</i>	4654	VI	HQ	1	1	P
	<i>Packardia geminata</i>	4659	VI	HQ	1	1	P
	<i>Lithacodes fasciola</i>	4665	VIII	PEEC	1	1	
	<i>Apoda y-inversum</i>	4667	VI, VIII	HQ, BA	2	3	
	<i>Apoda biguttata</i>	4669	VI	HQ	1	1	P
	<i>Prolimacodes badia</i>	4671	VI, VII	HQ, PEEC, TB	4	5	
	<i>Isa textula</i>	4681	VII	TB	1	2	
	<i>Adoneta spinuloides</i>	4685	VII	TB	1	1	P
	<i>Euclea delphinii</i>	4697	VI, VII	HQ, PEEC, BA, TB	5	5	P,S
	<i>Parasa chloris</i>	7698	VII	HQ, TB	3	3	
	<i>Achardia stimulea</i>	4700	VII, IX	TB, HPA	2	1(5)	P
Crambidae	<i>Scoparia biplagiata</i>	4716	VII	PEEC	1	X	
	<i>Scoparia penumbralis</i>	4717					
	<i>Eudonia strigalis</i>	4738	VI, VII, VIII, IX	HQ, TB, PEEC, WRA, RS	9	13	
	<i>Elophila icciusalis</i>	4748	VI, VII, VIII	WRA, HQ, TB, PEEC	9	14	
	<i>Elophila gyralis</i>	4751	VIII	HQ	1	1	P
	<i>Elophila oblitalis</i>	4755	VI, VIII	TB, WRA	3	3	
	<i>Parapoynx maculalis</i>	4759	VIII	WRA	1	1	
	<i>Parapoynx obscuralis</i>	4760	VIII	TB, HQ	2	2	
	<i>Parapoynx badiusalis</i>	4761	VII, VIII, IX	HQ, TB	3	3	S
	<i>Parapoynx allionealis</i>	4764	VIII	HQ, WRA	3	3	S
	<i>Petrophila fulicalis</i>	4777	VII, VIII	TB, SB, HQ, BA, WRA	11	102	P,S
	<i>Eustixia pupula</i>	4794					
	<i>Glaphyria sequistralis</i>	4870	VIII	TB	1	1	P
	<i>Lipocosma sicalis</i>	4881	VII	TB	1	1	P
	<i>Dicymolomia julianalis</i>	4889	VI, VIII	HQ	3	3	P
	<i>Chalcoela iphitalis</i>	4895	VIII	TB	1	1	
	<i>Evergestis pallidata</i>	4897	VIII, IX	RS, HPA	2	8	
	<i>Saucrobotys futilalis</i>	4936	VI	HQ	2	5	
	<i>Nascia acutella</i>	4937	VI	HQ	1	1	P
	<i>Crocidophora serratissimalis</i>	4944	VI	HQ	1	1	P
	<i>Ostrinia nubilalis</i>	4949	VI, VIII	HQ, TB, WRA	3	4	
	<i>Fumibotys fumalis</i>	4950	VIII	WRA	1	2	
	<i>Perispasta caeculalis</i>	4951	VIII	TB, HQ	2	2	
	<i>Anania coronata</i>	4953	VIII	TB, WRA	2	1	
	<i>Sitochroa palealis</i>	4986.1	VIII	WRA	1	1	

	<i>Pyrausta demantrialis</i>	5018	VIII	WRA	1	1	
	<i>Pyrausta bicoloralis</i>	5040	VII, VIII, IX	TB, HQ, WRA	5	5	
	<i>Pyrausta rubricalis</i>	5051	VII, VIII	TB, WRA	3	2	P
	<i>Pyrausta acronalis</i>	5071	V, VIII	HQ, PEEC, RS	3	3	P
	<i>Udea rubigalis</i>	5079	V, VI, VIII, XI	HQ, BA, TB	6	5	
	<i>Diacme elealis</i>	5142	VII	TB	1	1	
	<i>Nomophila nearctica</i>	5156	VI, VII, VIII, IX	WRA, HQ, PEEC, TB	7	7	
	<i>Desmia funeralis</i>	5159	VIII	PEEC, TB, WRA	3	3	
	<i>Desmia maculalis</i>	5160	VIII	TB, WRA	2	2	P
	<i>Hymenia perspectalis</i>	5169					
	<i>Diathrausta harlequinialis</i>	5175	VII, VIII	TB	2	2	
	<i>Anageshna primordialis</i>	5176					
	<i>Blepharomastix ranalis</i>	5182	VI, VII	HQ, PEEC	3	6	
	<i>Palpita magniferalis</i>	5226	V, VI, VIII, IX	HQ, TB, WRA, RS, HPA	6	6	
	<i>Polygrammodes flavidalis</i>	5228					
	<i>Pantographa limata</i>	5241	VI, VII, VIII, IX	TB	2	4	
	<i>Lygropia rivulalis</i>	5250	VII	TB	1	1	
	<i>Diastictis ventralis</i>	5255					
	<i>Herpetogramma bipunctalis</i>	5272					
	<i>Herpetogramma pertextalis</i>	5275	VII, VIII	TB, PEEC, WRA	4	5	
	<i>Herpetogramma thestialis</i>	5277	VIII	WRA	1	2	
	<i>Herpetogramma sphingalis</i>	5279.1	VII, VIII	TB	2	4	P
	<i>Crambus praefectellus</i>	5355	VIII	HQ	1	1	P
	<i>Crambus albellus</i>	5361	VII, VIII	PEEC, TB, RS	3	6	
	<i>Crambus agitatellus</i>	5362	VII	PEEC, BA, HQ	5	18	
	<i>Crambus saltuellus</i>	5363	VI	WRA	1	1	P
	<i>Crambus laqueatellus</i>	5378	VI	WRA	1	2	
	<i>Chrysoteuchia topiarius</i>	5391	VII, VIII	PEEC, HQ, TB, WRA	4	3	
	<i>Agriphila ruricolellus</i>	5399	VIII	RS	1	2	
	<i>Agriphila vulgivagellus</i>	5403	IX	TB, HPA, HQ	3	12	
	<i>Pediasia trisepta</i>	5413	IX	TB	1	2	P
	<i>Microcrambus biguttellus</i>	5419	VI, VII	HQ, TB	2	2	
	<i>Microcrambus elegans</i>	5420	VI, VII, VIII, IX	HQ, PEEC, TB, WRA, RS	12	51	
	<i>Microcrambus minor</i>	5422	VII	TB	1	3	P
	<i>Fissicrambus mutabilis</i>	5435					
	<i>Urola nivalis</i>	5464	VII, VIII	PEEC, TB, HQ, WRA	4	4	
	<i>Argyria auratella</i>	5465					
	<i>Argyria critica</i>	5466	VII	BA	1	1	S

	<i>Haimbachia placidella</i>	5489	VII	TB	1	1	P
Pyralidae	<i>Pyrallis farinalis</i>	5510					
	<i>Aglossa disciferalis</i>	5512	VII	TB	1	1	
	<i>Aglossa cuprina</i>	5518	VII, VIII	TB, HQ, WRA	4	4	P
	<i>Hypsopygia costalis</i>	5524					
	<i>Hypsopygia olinalis</i>	5533	VI, VII	HQ, PEEC	3	2	
	<i>Galasa nigrinodia</i>	5552					
	<i>Arta statalis</i>	5566	VII	TB	1	10	
	<i>Condylolomia participalis</i>	5571	VI, VII	HQ, PEEC, TB	4	16	
	<i>Epipascia superatalis</i>	5577	VII	TB	1	1	
	<i>Oneida lunulalis</i>	5588	VI, VII, VIII	HQ, TB, WRA	4	5	
	<i>Pococera robustella</i>	5595	VII	PEEC	1	1	P
	<i>Pococera militella</i>	5604	VIII	HQ	1	1	P
	<i>Pococera asperatella</i>	5606	VII, VIII	TB	2	2	P
	<i>Pococera expandens</i>	5608	VII, VIII	PEEC, TB, HQ, WRA, RS	6	7	
	<i>Acrobasis aurorella</i>	5670	VII	TB	1	1	P
	<i>Acrobasis exsulella</i>	5672	VIII	HQ	1	1	P
	<i>Acrobasis angusella</i>	5673	VIII	TB, HQ	2	2	
	<i>Salebriaria engeli</i>	5773	VII	HQ	1	1	
	<i>Sciota virgatella</i>	5797	VII	TB	1	1	P
	<i>Sciota basilaris</i>	5799	VI	HQ	1	1	P
	<i>Sciota rubrisparsella</i>	5804	VI	HQ	1	1	P
	<i>Dioryctria zimmermani</i>	5852	VIII	WRA	1	1	
	<i>Canarsia ulmiarrosorella</i>	5926	VIII	PEEC	1	1	
	<i>Eulogia ochrifrontella</i>	5999	VII, VIII, IX	HQ, TB, WRA, RS	7	9	
	<i>Plodia interpunctella</i>	6019	VI	WRA	1	2	
	<i>Peoria approximella</i>	6053					
Thyrididae	<i>Dysodia oculatana</i>	6078	VI	HQ	1	1	
Pterophoridae	<i>Emmelina monodactyla</i>	6234	VII	TB, BA	2	2	
Thyatiridae	<i>Habrosyne scripta</i>	6235	VIII	WRA	1	2	S
	<i>Pseudothyatira cymatophoroides</i>	6237	VI, VII, VIII	WRA, HQ, PEEC, TB	5	12	P, S
	<i>Euthyatira pudens</i>	6240					
Drepanidae	<i>Drepana arcuata</i>	6251	V, VI, VII, VIII	HQ, WRA, TB, BA	8	10	P
	<i>Oreta rosea</i>	6255	VI, VII	WRA, HQ	2	3	P
Geometridae	<i>Alsophila pometaria</i>	6258	XI	HQ	1	2	
	<i>Heliomata cycladata</i>	6261	VI	HQ	1	1	
	<i>Speranza pustularia</i>	6273	VI, VII, VIII	HQ, PEEC, TB	7	26	
	<i>Macaria notata</i>	6330	VI	WRA	1	1	
	<i>Macaria minorata</i>	6340	VI, VII, VIII	WRA, HQ, PEEC, TB	4	2	

	<i>Macaria bisignata</i>	6342	VII, VIII	PEEC, HQ, WRA	3	6	P
	<i>Macaria multilineata</i>	6353					
	<i>Digrammia continuata</i>	6362					
	<i>Hesperumia sulphuraria</i>	6431	VII	TB	1	1	
	<i>Glenoides texanaria</i>	6443	VII, IX, XI	TB, SB, HQ	6	14	
	<i>Aethalura intertexta</i>	6570	VI, VII	WRA, TB	2	2	P
	<i>Iridopsis larvaria</i>	6588	VII, VIII	HQ, TB	3	2	
	<i>Anavitrinella pampinaria</i>	6590	VI, VIII	WRA, PEEC, TB, HQ, RS	6	5	
	<i>Cleora sublunaria</i>	6594	V	HQ	1	1	
	<i>Ectropis crepuscularia</i>	6597	IV, VII, VIII	PEEC, TB, SB, HQ, BA	6	8	P
	<i>Protoboarmia porcelaria</i>	6598	VI, VII, VIII	WRA, HQ, RS	4	5	
	<i>Epimecis hortaria</i>	6599	VII	TB, HQ	2	2	
	<i>Melanolophia canadaria</i>	6620	VII	TB	1	1	
	<i>Melanolophia signataria</i>	6621	VI	WRA	1	1	
	<i>Biston betularia</i>	6640	VI, VII, VIII	WRA, HQ, TB, RS	6	7	
	<i>Hypagyrtis unipunctata</i>	6654	VI, VII, VIII	WRA, HQ, PEEC, BA, TB, RS	11	13	
	<i>Hypagyrtis esther</i>	6655	VII	PEEC	1	1	P
	<i>Phigalia titea</i>	6658	IV	HQ, PEEC	2	6	P, S
	<i>Lomographa vestaliata</i>	6667	V, VII, VIII, IX	HQ, TB, PEEC	4	4	
	<i>Cabera erythemaria</i>	6677	VIII	WRA	1	1	
	<i>Cabera variolaria</i>	6678	VI	WRA	1	1	P
	<i>Ilexia intractata</i>	6711	VII	PEEC, TB	2	2	P
	<i>Lytrosis unitaria</i>	6720	VI, VII	HQ, PEEC	2	1	P
	<i>Euchlaena serrata</i>	6724					
	<i>Euchlaena muzaria</i> / <i>Euchlaena obtusaria</i>	6725 / 6726	VIII	TB, WRA	2	X	P
	<i>Euchlaena amoenaria</i>	6733	VI, VIII	WRA, TB	2	1	P
	<i>Euchlaena tigrinaria</i>	6737	VI	WRA	1	1	P
	<i>Xanthotype urticaria</i> / <i>Xanthotype sospeta</i>	6740 / 6743	VI, VII, VIII	HQ, BA, PEEC	5	5	S
	<i>Phaeoura quernaria</i>	6763	V, VI	HQ	2	2	
	<i>Campaea perlata</i>	6796	VI, VIII, IX	WRA, HQ, RS, TB, HPA	8	11	
	<i>Ennomos magnaria</i>	6797	VII, VIII, IX	TB, HQ, WRA	7	13	P
	<i>Ennomos subsignaria</i>	6798	VII	PEEC, TB, HQ	3	3	
	<i>Metanema inatomaria</i>	6819					
	<i>Metarranthis duaria</i>	6822	VI	WRA	1	1	P
	<i>Metarranthis hypochraria</i>	6826					
	<i>Metarranthis homuraria</i>	6828	VIII	TB	1	1	P

	<i>Cepphis armataria</i>	6835	VII	PEEC	1	1	P
	<i>Plagodis pulveraria</i>	6836	VII	TB	1	1	P
	<i>Probole amicararia</i>	6838	VI	WRA	1	1	P
	<i>Plagodis serinaria</i>	6840	VI	WRA	1	4	P,S
	<i>Plagodis kuetzingi</i>	6841	VI	WRA	1	1	S
	<i>Plagodis phlogosaria</i>	6842	V, VI	HQ, TB	4	6	
	<i>Plagodis fervidaria</i>	6843	V	HQ	1	1	
	<i>Plagodis alchoolaria</i>	6844	VII	TB	1	1	
	<i>Caripeta divisata</i>	6863	VII	RS	1	1	P
	<i>Carpia pinata</i>	6864	VII	PEEC	1	1	S
	<i>Besma endropiaria</i>	6884	VI	HQ	1	1	
	<i>Besma quercivoraria</i>	6885	VII, VIII	TB, HQ, PEEC, WRA	5	5	
	<i>Lambdina fiscellaria</i>	6888	VIII	HQ	1	1	P
	<i>Cingilia catenaria</i>	6898	IX	TB, HPA, HQ	3	3	P
	<i>Nepytia canosaria</i>	6906	IX	HQ	1	4	
	<i>Sicya macularia</i>	6912					
	<i>Eusarca confusaria</i>	6941	VI, VII, VIII, IX	WRA, PEEC, HQ, TB, RS, HPA	8	7	
	<i>Tetracis cachexiata</i>	6964	VI	WRA, HQ	2	2	P
	<i>Eugonobapta nivosaria</i>	6965	VII	BA	1	1	
	<i>Eutrapela clemataria</i>	6966	V, VII	HQ, TB	3	3	P
	<i>Patalene olyzonaria</i>	6974	VI	HQ	1	1	
	<i>Prochoerodes lineola</i>	6982	VII, VIII, IX	PEEC, TB, HPA, HQ	6	6	
	<i>Antepione thisoaria</i>	6987	VIII	HQ	1	1	S
	<i>Nematocampa resistaria</i>	7010	VII, VIII	HQ, PEEC, TB	3	3	
	<i>Nemoria lixaria</i>	7033	IX	TB	1	1	
	<i>Nemoria bistraria</i>	7046	V, VII	HQ, TB	4	9	P
	<i>Synchlora aerata</i>	7058	VIII	TB, WRA	2	2	
	<i>Chlorochlamys chloroleucaria</i>	7071	VII, VIII	TB	2	2	
	<i>Lobocleta ossularia</i>	7094	VIII	WRA	1	1	
	<i>Idaea demissaria</i>	7114					
	<i>Pleuroprucha insulsaria</i>	7132	VI, VIII	HQ, TB, WRA, RS	6	5	
	<i>Cyclophora packardi</i>	7136	VII, VIII	TB, WRA	2	2	
	<i>Cyclophora pendulinaria</i>	7139	VII, VIII	TB, HQ, WRA	3	4	
	<i>Timandra amaturaria</i>	7147	VIII	TB	1	1	
	<i>Scopula cacuminaria</i>	7157	VI	WRA	1	1	P
	<i>Scopula limboundata</i>	7159	VI, VII, VIII	WRA, HQ, PEEC, TB, RS	9	11	P
	<i>Scopula inductata</i>	7169	VIII	WRA	1	1	
	<i>Eulithis diversilineata</i> / <i>Eulithis gracilineata</i>	7196 / 7197	VI, VII, VIII	HQ, PEEC, TB, BA, WRA	6	3	
	<i>Eulithis explanata</i>	7206	VII	PEEC	1	1	P
	<i>Hydriomena renunciata</i>	7236	V	MOC	1	X	P

	<i>Coryphista meadii</i>	7290	VI, VII, VIII, IX	WRA, TB, HQ, RS, HPA	6	8	
	<i>Rheumaptera undulata</i> / <i>Rheumaptera prunivorata</i>	7291 / 7292	VI, VII	HQ, TB	2	2	
	<i>Anticlea vasiliata</i>	7329	IV	PEEC	1	1	P
	<i>Xanthorhoe ferrugata</i>	7388					
	<i>Xanthorhoe lacustrata</i>	7390	VII, VIII	PEEC, TB, WRA	4	4	
	<i>Epirrhoe alternata</i>	7394	VI, VIII	HQ, WRA, RS	3	3	
	<i>Euphyia intermediata</i>	7399	VIII	TB, HQ, WRA	3	3	
	<i>Orthonama obstipata</i>	7414	IX	HQ	1	1	P
	<i>Costaconvexa centrostrigaria</i>	7416	VII, VIII	TB, RS	2	2	
	<i>Hydrelia albifera</i>	7423					
	<i>Venusia comptaria</i>	7428	IV	PEEC	1	2	
	<i>Trichodezia albovittata</i>	7430	V	FTR	1	X	
	<i>Eubaphe mendica</i>	7440					
	<i>Horisme intestinata</i>	7445	VIII	TB, HQ	2	2	
	<i>Pasiphila rectangulata</i>	7625	VI	HQ	1	1	
	<i>Cladara limitaria</i>	7637	V	HQ, MOC	2	1	P,S
	<i>Cladara atroliturata</i>	7639	IV, V	PEEC, HQ	2	7	P,S
	<i>Heterophleps triguttaria</i>	7647	VII	PEEC	1	1	
	<i>Dyspteris abortivaria</i>	7648	VII, VIII	TB, HQ	3	3	P
Uraniidae	<i>Calledapteryx dryopterata</i>	7653	VI, VIII	WRA, HQ, TB, RS	5	5	
Mimallonidae	<i>Lacosoma chiridota</i>	7659	VI	HQ	1	3	
Bombycidae	<i>Apatelodes torrefacta</i>	7663	VII	PEEC, BA, TB	3	4	
	<i>Olceclostera angelica</i>	7665	VII	PEEC, TB	2	2	P
Lasiocampidae	<i>Tolyte velleda</i>	7670	VIII, IX	RS, TB	2	5	
	<i>Tolyte laricis</i>	7673	VII	TB	1	1	P
	<i>Artace cribrarius</i>	7683	VII	HQ	1	1	
	<i>Phyllodesma americana</i>	7687	IV, V	PEEC, HQ	2	3	P,S
	<i>Malacosoma disstria</i>	7698	VI, VII	HQ, PEEC	2	X	P
	<i>Malacosoma americana</i>	7701	VI, VII	HQ, PEEC	2	X	
Saturniidae	<i>Eacles imperialis</i>	7704	VII, VIII	TB, HQ	4	4	P
	<i>Dryocampa rubicunda</i>	7715	V, VI, VII, VIII	HQ, WRA, PEEC, BA, TB	9	15	P
	<i>Hemileuca maia</i>	7730	X	Milford	1	X	
	<i>Automeris io</i>	7746	VI, VII	WRA, HQ, PEEC, TB	5	9	P,S
	<i>Antheraea polyphemus</i>	7757	VII	TB	1	2	
	<i>Actias luna</i>	7758	V, VI, VII, VIII	HQ, WRA, PEEC, RS	7	8	P
	<i>Callosamia promethea</i>	7764	V	FTR	1	X	
	<i>Hyalophora cecropia</i>	7767	IV	SB	1	X	
	<i>Manduca sexta</i>	7775	VIII	HQ	1	1	
Sphingidae	<i>Manduca jasminearum</i>	7783	VII	TB	1	2	P
	<i>Ceratomia amyntor</i>	7786	VII	TB	1	3	P,S

	<i>Ceratonia undulosa</i>	7787	VI, VII, VIII	HQ, PEEC, TB, WRA	4	3	
	<i>Lintneria eremitus</i>	7796					
	<i>Sphinx chersis</i>	7802					
	<i>Sphinx kalmiae</i>	7809					
	<i>Sphinx gordius</i>	7810	VI	WRA	1	1	P
	<i>Sphinx poecila</i>	7810.1	VI, VII	WRA, PEEC	2	2	
	<i>Lapara coniferarum</i>	7816	VII	PEEC	1	1	
	<i>Lapara bombycoides</i>	7817	VII	PEEC, HQ	2	3	
	<i>Smerinthus jamaicensis</i>	7821	VI	WRA	1	1	P
	<i>Paonias excaecata</i>	7824	VII, VIII	PEEC, TB, HQ	3	5	
	<i>Paonias myops</i>	7825	VI, VII	WRA, TB	2	4	
	<i>Paonias astylus</i>	7826					
	<i>Amorpha juglandis</i>	7827	VII	PEEC	1	1	P
	<i>Pachysphinx modesta</i>	7828					
	<i>Hemaris thysbe</i>	7853	VIII	RR	1	4	
	<i>Hemaris diffinis</i>	7855	VIII	RR	1	1	
	<i>Eumorpha pandorus</i>	7859	VII, VIII	TB, PEEC	3	7	S
	<i>Sphecodina abbotti</i>	7870	V, VI	HQ, WRA	2	2	P
	<i>Deidamia inscriptum</i>	7871	VI	WRA	1	1	P
	<i>Darapsa myron</i>	7885	VI, VIII	HQ, TB	2	1	P
	<i>Darapsa choerilus</i>	7886	VI	HQ	1	1	P
	<i>Hyles galii</i>	7893	VIII	TB	1	1	P
Notodontidae	<i>Clostera albosigma</i>	7895	V, VI, VII	HQ, WRA, TB	5	5	P
	<i>Clostera strigosa</i>	7898	VIII	WRA	1	1	
	<i>Clostera apicalis</i>	7901	VII	TB	1	1	P
	<i>Datana angusii</i>	7903	VII	TB	1	1	P
	<i>Nadata gibbosa</i>	7915	VI, VII	WRA, HQ, TB	3	5	P
	<i>Hyperaeschra georgica</i>	7917	V, VI, VII	HQ, PEEC	3	3	P
	<i>Peridea angulosa</i>	7920	VIII	TB, HQ	2	2	
	<i>Peridea ferruginea</i>	7921	VI, VII	HQ, TB	2	3	P
	<i>Phoesia rimosa</i>	7922	VI	WRA	1	1	
	<i>Odontosia elegans</i>	7924	VI, VII	HQ, TB	2	2	P
	<i>Nerice bidentata</i>	7929	VII	TB	1	1	P
	<i>Ellida caniplaga</i>	7930	VII	HQ, TB	2	2	
	<i>Gluphisia septentrionis</i>	7931	VIII	HQ	1	1	
	<i>Gluphisia lintneri</i>	7934	IV	PEEC	1	1	P
	<i>Furcula borealis</i>	7936	VI	WRA	1	1	P
	<i>Symmerista albifrons</i>	7951	VIII	TB	1	1	
	<i>Symmerista leucitys</i>	7953	VII	PEEC	1	1	S
	<i>Dasylophia thyatiroides</i>	7958	VII	TB	1	1	P
	<i>Macrurocampa marthesia</i>	7975	VI, VII	HQ, TB	2	3	P
	<i>Heterocampa umbrata</i>	7990	VI	WRA	1	1	P
	<i>Heterocampa biundata</i>	7995	VI, VIII	WRA, HQ	2	2	P

	<i>Schizura ipomoeae</i>	8005	VII, VIII	TB	2	3	
	<i>Schizura unicornis</i>	8007	VII, VIII	PEEC, TB, HQ, WRA	5	5	
	<i>Schizura leptinoides</i>	8011	VII, VIII	TB, RS	2	2	
	<i>Oligocentria semirufescens</i>	8012	VII	TB	1	1	
	<i>Oligocentria lignicolor</i>	8017	VI, VII, VIII	HQ, WRA	4	5	S
Erebidae	<i>Crambidia pallida</i>	8045.1	VIII	BA	1	1	S
	<i>Hypoprepia miniata</i>	8089	VIII	HQ	1	1	P
	<i>Hypoprepia fucosa</i>	8090	VII, VIII	TB, SB, HQ, BA, PEEC, WRA, RS	13	51	
	<i>Clemensia albata</i>	8098	VI, VIII	WRA, TB, HQ, RS	5	6	
	<i>Comachara cadburyi</i>	8104	V, VI	HQ, WRA	2	2	P, S
	<i>Haploa clymene</i>	8107	VII, VIII	TB, HQ, PEEC	6	9	S
	<i>Virbia opella</i>	8118	VII	TB	1	1	
	<i>Virbia aurantiaca</i>	8121	VI	WRA	1	1	P
	<i>Pyrrharctica isabella</i>	8129	VI, VII, VIII, IX	WRA, HQ, PEEC, TB, HPA	9	12	P
	<i>Spilosoma congrua</i>	8134	V, VI, VII	HQ, WRA	4	8	
	<i>Spilosoma virginica</i>	8137	VI, VII, VIII	WRA, PEEC, TB, HQ	6	4	
	<i>Hyphantria cunea</i>	8140	VI, VII, IX	WRA, PEEC, TB, HQ	4	3	
	<i>Hypercompe scribonia</i>	8146	VI, VII, VIII	HQ, PEEC, TB	5	5	
	<i>Phragmatobia fuliginosa</i>	8156	VI, VII	HQ, TB, BA	4	4	
	<i>Grammia virguncula</i>	8175	VI	WRA	1	1	
	<i>Grammia parthenice</i>	8196					
	<i>Grammia virgo</i>	8197	VII	TB	1	2	
	<i>Halysidota tessellaris</i>	8203	VI, VII, VIII	HQ, PEEC, BA, TB, WRA	7	11	
	<i>Lophocampa caryae</i>	8211	VI, VIII, IX	WRA, HQ, PEEC, TB, HPA	5	41	P
	<i>Cynia tenera</i>	8230	VI, VII, VIII	WRA, HQ, PEEC, TB	7	8	
	<i>Cynia oregonensis</i>	8231	VIII	HQ	1	1	P
	<i>Euchaetes egle</i>	8238	VI, VIII	WRA, HQ	2	11	P
	<i>Ctenucha virginica</i>	8262					
	<i>Cisseps fulvicollis</i>	8267	VII, VIII, IX	TB, BA, HQ, WRA, HPA	6	6	
	<i>Dasychira tephra</i>	8292	VII	TB	1	1	P
	<i>Dasychira plagiata</i>	8304	VII	PEEC, HQ, TB	3	3	P
	<i>Orgyia definita</i>	8314	VIII, IX	BA, HPA, HQ	3	3	P
	<i>Lymantria dispar</i>	8318	VI, VII, VIII	HQ, PEEC, TB	6	13	P
	<i>Idia americalis</i>	8322	VI, VII, VIII, IX	HQ, TB, RS	6	6	
	<i>Idia aemula</i>	8323	VI, VII, VIII, IX, XI	HQ, PEEC, WRA, RS, HPA	8	17	

	<i>Idia rotundalis</i> / <i>Idia julia</i>	8326 / 8328	VII	TB	1	1	
	<i>Idia denticulalis</i>	8333	VIII	TB	1	1	P
	<i>Idia lubricalis</i>	8334	VIII	TB, RS	2	1	
	<i>Phalaenophana pyramusalis</i>	8338	VII, VIII	TB, PEEC, HQ, WRA, RS	6	5	
	<i>Zanclognatha lituralis</i>	8340	VII	TB	1	1	
	<i>Zanclognatha laevigata</i>	8345	VII	TB, HQ	3	4	S
	<i>Zanclognatha obscuripennis</i>	8347	VIII	HQ, TB	1	1	
	<i>Zanclognatha pedipilalis</i>	8348	VIII	HQ	1	1	P,S
	<i>Zanclognatha cruralis</i>	8351	VI, VIII	HQ, TB, RS	4	3	
	<i>Zanclognatha jacchusalis</i>	8353	VII, VIII	TB, HQ	2	4	
	<i>Macrochilo absorptalis</i>	8357					
	<i>Macrochilo litophora</i>	8358	VII, VIII	TB, WRA	2	3	
	<i>Macrochilo orciferalis</i>	8360					
	<i>Macrochilo louisiana</i>	8361	VI	HQ	1	1	P
	<i>Phalaenostola metonalis</i>	8362	VII, VIII	TB	2	2	P
	<i>Phalaenostola eumelusalis</i>	8363	VII, VIII	PEEC, WRA	2	1	
	<i>Phalaenostola larentioides</i>	8364	VII, VIII	PEEC, TB	3	1	P
	<i>Bleptina caradrinalis</i>	8370	VI, VII, VIII	HQ, PEEC, WRA	4	4	
	<i>Renia discoloralis</i>	8381	VIII	TB, HQ	2	1	
	<i>Renia flavipunctalis</i>	8384.1	VIII	HQ	1	1	S
	<i>Renia adspersigillus</i>	8386					
	<i>Lascoria ambigualis</i>	8393	VII	TB	1	1	
	<i>Palthis angulalis</i>	8397	VI, VII, VIII, IX	WRA, HQ, TB, PEEC, RS, HPA	9	12	
	<i>Palthis asopialis</i>	8398	VII, VIII, IX	BA, TB, HQ, WRA, RS, HPA	8	8	
	<i>Redectis vitrea</i>	8401	VII, VIII	PEEC, WRA, RS	3	5	
	<i>Rivula propinquialis</i>	8404	VI, VII, VIII	WRA, TB, BA, RS	6	7	
	<i>Hypenodes caducus</i>	8420	VII	TB	1	1	
	<i>Hypenodes fractilinea</i>	8421	VIII	TB, WRA	2	2	P
	<i>Hypena manalis</i>	8441	VI, VIII	WRA, HQ, TB	5	5	P
	<i>Hypena baltimoralis</i>	8442	V, VI, VII, VIII	HQ, TB, PEEC, RS	8	8	
	<i>Hypena bijugalis</i>	8443	VIII	WRA	1	1	
	<i>Hypena abalienalis</i>	8445	VI, VII, VIII	HQ, TB, WRA	5	4	
	<i>Hypena deceptalis</i>	8446	VII, VIII	TB	2	1	P
	<i>Hypena madefactalis</i>	8447	VII, VIII	PEEC, TB, HQ	5	4	P
	<i>Hypena scabra</i>	8465	IV, V, VII, VIII	HQ, TB, PEEC, WRA	5	5	
	<i>Spargaloma sexpunctata</i>	8479	VIII	TB	1	1	
	<i>Pangrapta decoralis</i>	8490	VI, VIII	HQ, TB, WRA	3	3	
	<i>Ledaea perditilis</i>	8491	VIII	WRA	1	1	

	<i>Isogona tenuis</i>	8493	VII, VIII	TB	2	3	P
	<i>Metalectra discalis</i>	8499	VII, VIII	TB	2	2	
	<i>Scolecocampa liburna</i>	8514	VII	HQ	1	1	
	<i>Calyptra canadensis</i>	8536	VIII	TB, WRA	2	2	P
	<i>Anomis privata</i>	8547	VIII	TB	1	1	P
	<i>Panopoda rufimargo</i>	8587	VI, VII, VIII	HQ, TB	3	4	P
	<i>Panopoda carneicosta</i>	8588					
	<i>Phoberia atomaris</i>	8591	IV, V	PEEC, HQ	2	2	
	<i>Drasteria grandirena</i>	8641					
	<i>Zale lunata</i>	8689	V, VII, VIII	HQ, TB	4	3	
	<i>Zale galbanata</i> / <i>Zale phaecapna</i>	8692 / 8698	VII	TB	1	1	P,S
	<i>Zale minerea</i>	8697					
	<i>Zale squamularis</i>	8700					
	<i>Zale duplicata</i>	8703	V	HQ	1	1	P
	<i>Zale metatoides</i>	8707					
	<i>Zale horrida</i>	8717	V, VII	HQ, TB	2	2	P
	<i>Euparthenos nubilis</i>	8719	VII, VIII	PEEC, WRA, RS	3	2	
	<i>Allotria elonympha</i>	8721					
	<i>Parallelia bistriaris</i>	8727	VII, VIII	TB, PEEC, WRA	3	3	
	<i>Caenurgina crassiuscula</i>	8738	V, VI, VII, VIII	HQ, PEEC, WRA	4	4	
	<i>Caenurgina erechtea</i>	8739	VII, VIII, IX	BA, TB, HQ	4	4	P
	<i>Mocis texana</i>	8745	VIII	TB	1	1	
	<i>Celiptera frustulum</i>	8747	VI, VIII	WRA, TB, HQ	3	3	P
	<i>Catocala innubens</i>	8770	VII, VIII	HQ, WRA	2	2	
	<i>Catocala piatrix</i>	8771	VIII	TB, HQ, RS	3	3	
	<i>Catocala epione</i>	8773	VII	TB	1	1	
	<i>Catocala habilis</i>	8778	VIII, IX	TB, HQ, WRA, RS	5	6	P
	<i>Catocala serena</i>	8779	VII, VIII	TB, PEEC, HQ, WRA	4	4	P,S
	<i>Catocala obscura</i>	8784	VIII	HQ, TB			
	<i>Catocala residua</i>	8785	VIII	HQ	X	X	P
	<i>Catocala resecta</i>	8788	VIII	PEEC, TB, HQ, WRA, RS	5	5	
	<i>Catocala dejecta</i>	8790					
	<i>Catocala vidua</i>	8792	VIII	RS	1	1	
	<i>Catocala palaeogama</i>	8795	VIII, IX	PEEC, TB, HQ, WRA, RS	6	18	P,S
	<i>Catocala nebulosa</i>	8796	VIII, IX	TB, WRA, HQ	3	6	S
	<i>Catocala neogama</i>	8798	VII, VIII	TB, HQ, PEEC	4	4	S
	<i>Catocala ilia</i>	8801	VII, VIII	HQ, TB, WRA	4	6	S
	<i>Catocala cerogama</i>	8802	VIII	WRA	1	1	
	<i>Catocala unijuga</i>	8805	VIII	HQ	1	1	P

	<i>Catocala parta</i>	8806	IX	TB	1	2	P
	<i>Catocala cara</i>	8832	VIII, IX	RS, TB	2	2	
	<i>Catocala amatrix</i>	8834					
	<i>Catocala sordida</i>	8846	VIII	HQ	1	1	
	<i>Catocala gracilis</i>	8847	VII, VIII	BA, HQ	2	2	
	<i>Catocala andromidae</i>	8849	VII	TB	1	1	
	<i>Catocala coccinata</i>	8851	VII	TB	1	2	S
	<i>Catocala ultronia</i>	8857	VII, VIII	HQ, TB, BA, PEEC, WRA, RS	8	8	S
	<i>Catocala crataegi</i>	8858	VIII	PEEC, TB	2	2	P,S
	<i>Catocala grynea</i>	8864	VII, VIII	TB, PEEC	2	2	
	<i>Catocala blandula</i>	8867	VII	PEEC	1	1	S
	<i>Catocala minuta</i>	8874	VII	HQ, TB	3	7	
	<i>Catocala micronympha</i>	8876	VII	TB	1	1	
	<i>Catocala lineella</i>	8878.1	VII, VIII	TB, HQ, WRA, RS	6	9	P
Eutelidae	<i>Marathyssa basalis</i>	8956	V	HQ	1	1	P
	<i>Paectes oculatrix</i>	8957	VI	HQ	1	1	
	<i>Eutelia pulcherrima</i>	8968					
Nolidae	<i>Baileya ophthalmica</i>	8970	VI, VII	WRA, TB	2	2	
	<i>Baileya dormitans</i>	8971	VI	WRA, HQ	2	2	
	<i>Baileya australis</i>	8973	VIII	PEEC	1	1	
	<i>Garella nilotica</i>	8974	VII	TB	1	1	P
	<i>Meganola minuscula</i>	8983	V	HQ	1	1	P
	<i>Nola pustulata</i>	8989	VI	WRA	1	1	P
	<i>Nola cilicoides</i>	8990					
	<i>Nola cereella</i>	8991					
	<i>Nola triquetra</i>	8992	IV	HQ, MOC	2	1	P
Noctuidae	<i>Abrostola ovalis</i>	8880	VII	TB	1	1	P
	<i>Abrostola urentis</i>	8881	VII, VIII	TB, WRA	2	2	P
	<i>Ctenoplusia oxygramma</i>	8889	VII	TB	1	1	P
	<i>Chrysodeixis includens</i>	8890	VIII, IX	WRA, HPA, HQ	3	3	
	<i>Diachrysia aereoides</i>	8896					
	<i>Diachrysia balluca</i>	8897	VII	PEEC, TB	2	2	P
	<i>Allagrapha aerea</i>	8898	VI, VIII	HQ, TB, WRA	4	3	
	<i>Chrysanympha formosa</i>	8904	VI	HQ	1	1	
	<i>Eosporopteryx thyatyroides</i>	8905	VI, VII, IX	HQ, TB, HPA	3	3	
	<i>Autographa precatationis</i>	8908	VI, VII, VIII, IX	HQ, PEEC, TB, WRA, HPA	7	9	P
	<i>Anagrapha falcifera</i>	8924	VI	HQ	1	1	P
	<i>Plusia contexta</i>	8952	VII	TB	1	1	P
	<i>Hyperstrotia pervertens</i>	9037	VI	HQ	1	1	P
	<i>Marimatha nigrofimbria</i>	9044	VIII	TB, HQ, WRA	3	5	
	<i>Protodeltote muscosula</i>	9047	VIII	HQ, TB, RS	4	4	
	<i>Protodeltote albidula</i>	9048	VI, VIII	HQ, WRA	3	3	

	<i>Maliattha synochitis</i>	9049	VI, VII	HQ, PEEC	2	2	
	<i>Lithacodia musta</i>	9051	VII, VIII	PEEC, TB, RS	3	3	
	<i>Pseudeustrotia carneola</i>	9053	VI, VII, VIII, IX	HQ, TB, PEEC, WRA, RS, HPA	7	8	P
	<i>Cerma cerintha</i>	9062					
	<i>Leuconycta diphteroides</i>	9065	VI, VII, VIII	WRA, HQ, PEEC, TB	6	8	
	<i>Ponometia erastrioides</i>	9095	VI, VII, VIII	HQ, TB, PEEC, RS	6	7	P
	<i>Spragueia leo</i>	9127					
	<i>Panthea furcilla</i>	9182	VI	WRA, PEEC	2	2	
	<i>Colocasia flavicornis</i>	9184	V	HQ			P
	<i>Colocasia propinquilinea</i>	9185	V, VI, VII	HQ	4	5	
	<i>Charadra deridens</i>	9189	VI	WRA, HQ	2	2	P
	<i>Raphia frater</i>	9193	VII	HQ	1	1	
	<i>Acronicta rubricoma</i>	9199	V	HQ	1	1	P
	<i>Acronicta americana</i>	9200	VI, VII	HQ, TB	2	2	S
	<i>Acronicta dactylina</i>	9203	VI	WRA	1	1	P
	<i>Acronicta lepusculina</i>	9205	VII	HQ	1	1	
	<i>Acronicta superans</i>	9226	VII	HQ	1	1	
	<i>Acronicta hasta</i>	9229	V	HQ	1	1	P
	<i>Acronicta interrupta</i>	9237	VII	TB	1	1	
	<i>Acronicta lobeliae</i>	9238	V, VI, VIII	HQ, WRA	3	3	
	<i>Acronicta ovata</i>	9243	VII	PEEC, HQ	2	3	
	<i>Acronicta modica</i>	9244					
	<i>Acronicta increta</i>	9249	VI, VII	HQ, TB	2	3	
	<i>Acronicta retardata</i>	9251	VII	TB	1	1	P
	<i>Acronicta afflicta</i>	9254	VII, VIII	PEEC, HQ	2	2	
	<i>Acronicta impleta</i>	9257	VII	TB	1	1	P
	<i>Acronicta impressa</i>	9261	VIII	WRA	1	1	
	<i>Acronicta lithospila</i>	9266	VI	HQ	1	1	
	<i>Acronicta oblinita</i>	9272	V, VI, VII, VIII	HQ, WRA	5	5	P
	<i>Simyra insularis</i>	9280	V, VIII	HQ, TB	3	2	P
	<i>Agriopodes fallax</i>	9281	VI, VIII	WRA, HQ	4	4	
	<i>Anterastria teratophora</i>	9284					
	<i>Polygrammate hebraeicum</i>	9285	VI, VIII	WRA, HQ	3	4	P
	<i>Harrisimemna trisignata</i>	9286	VI, VII, VIII	WRA, TB, HQ	4	4	P
	<i>Eudryas unio</i>	9299	VI, VII, VIII	HQ, TB, BA	5	5	P
	<i>Eudryas grata</i>	9301	VI, VII, VIII	HQ, TB, BA	4	4	P
	<i>Psychomorpha epimenis</i>	9309	IV			1	
	<i>Apamea lignicolora</i>	9333					
	<i>Laterologia ophiogramma</i>	9385.1	VII	TB	1	2	

	<i>Eremobina leucoscelis</i>	9398	VII	TB	1	1	P
	<i>Oligia chlorostigma</i>	9402					
	<i>Mesapamea fractilinea</i>	9406					
	<i>Neoligia exhausta</i>	9408	VII	TB	1	1	P
	<i>Meropleon diversicolor</i>	9427	IX	TB, HQ	2	3	P
	<i>Capsula oblonga</i>	9449	VII, VIII, IX	HQ	4	4	P
	<i>Loscopia velata</i>	9454	VII	PEEC, TB	2	1	P
	<i>Amphipoea americana</i>	9457	VII, VIII	TB	2	2	
	<i>Papaipema arctivorens</i>	9471	VIII	RS	1	1	P
	<i>Papaipema impecuniosa</i>	9473	IX	HQ	1	1	P
	<i>Papaipema lysimachiae</i>	9479	IX	HPA	1	1	P
	<i>Papaipema speciosissima</i>	9482	IX	HQ	1	1	
	<i>Papaipema inquaesita</i>	9483	VIII, IX	WRA, TB, HPA, HQ	4	4	
	<i>Papaipema baptisiae</i>	9485	IX	TB	1	1	
	<i>Papaipema furcata</i>	9495	IX	TB	1	1	P
	<i>Papaipema nebris</i>	9496	IX	TB	1	1	
	<i>Papaipema eupatorii</i>	9501	IX	HQ	1	1	P
	<i>Papaipema rigida</i>	9503	IX	HPA	1	1	
	<i>Achatodes zeae</i>	9520					
	<i>Euplexia benesimilis</i>	9545	VII, VIII	TB, WRA	2	2	
	<i>Phlogophora iris</i>	9546	VI	WRA	1	1	P
	<i>Phlogophora periculosa</i>	9547	VIII	HQ, RS	2	2	P
	<i>Ipimorpha pleonectusa</i>	9555	VIII	HQ	1	1	P
	<i>Chytonix palliatricula</i>	9556	VI, VII	WRA, HQ, PEEC, TB	4	4	P
	<i>Niphonyx segregata</i>	9558.1	VIII	WRA	1	1	P
	<i>Dypterygia rozmani</i>	9560					
	<i>Hyppa xylinoides</i>	9578	VIII, IX	HQ, WRA, RS, TB	4	7	
	<i>Nedra ramosula</i>	9582	VIII, IX	TB, HQ	2	2	P
	<i>Phosphila turbulenta</i>	9618					
	<i>Phosphila miselioides</i>	9619					
	<i>Callopietria mollissima</i>	9631	VI, VII, VIII	HQ, PEEC, TB	4	3	P
	<i>Magusa divaricata</i>	9637.1	IX	HQ	1	1	P
	<i>Amphipyra pyramidoides</i>	9638	VII, VIII, IX	TB, HQ, WRA	4	14	P
	<i>Proxenus miranda</i>	9647	VI, VIII	WRA, TB	2	3	P
	<i>Athetis tarda</i>	9650	VIII	HQ, WRA	2	8	P
	<i>Balsa tristrigella</i>	9663					
	<i>Balsa labecula</i>	9664	VII	TB	1	2	
	<i>Spodoptera frugiperda</i>	9666	IX	HQ	1	2	
	<i>Spodoptera ornithogalli</i>	9669	VII, VIII, IX	TB, PEEC, HQ, WRA	6	5	

	<i>Elaphria versicolor</i>	9678	VI, VII, VIII	WRA, TB, HQ, RS	7	8	P
	<i>Elaphria alapallida</i>	9681.1	VI	HQ	1	1	P
	<i>Elaphria grata</i>	9684	VII, VIII	TB, PEEC, WRA	4	3	
	<i>Galgula partita</i>	9688	VII, IX	TB, HPA	2	2	P
	<i>Perigea xanthioides</i>	9689	VIII, IX	WRA, HQ	2	4	
	<i>Condica videns</i>	9690	VII, VIII	TB, WRA	3	2	
	<i>Condica vecors</i>	9696	VI, VII, VIII	WRA, HQ, TB	4	5	
	<i>Condica sutor</i>	9699	IX	HQ	1	1	P
	<i>Ogdoconta cinereola</i>	9720	VI	HQ	1	1	
	<i>Azenia obtusa</i>	9725	VII	BA, TB	2	2	
	<i>Cirrhophanus triangulifer</i>	9766	VIII	HQ, WRA	2	2	P
	<i>Cosmia calami</i>	9815	VI, VII	HQ, PEEC, TB, BA	6	9	P
	<i>Amolita fessa</i>	9818					
	<i>Xylena curvimacula</i>	9874	IV	HQ	1	2	P,S
	<i>Lithophane innominata</i>	9888	IV	HQ, PEEC	2	3	
	<i>Lithophane hemina</i>	9893	IV, IX	HQ, MOC	3	5	S
	<i>Lithophane baileyi</i>	9902	IX	HQ	1	1	P
	<i>Lithophane querquera</i>	9904	IV	PEEC	1	2	
	<i>Lithophane antennata</i>	9910					
	<i>Lithophane pexata</i>	9922	IV	HQ	1	1	P
	<i>Pyreferra hespridago</i>	9929	IV	HQ, MOC	2	1	P
	<i>Pyreferra citrombra</i>	9930	IV	HQ	1	3	
	<i>Pyreferra pettiti</i>	9932	IX	HQ	1	1	P
	<i>Eupsilia tristigmata</i>	9935	IV	HQ	1	2	
	<i>Eupsilia morrisoni</i>	9936	IV	PEEC	1	1	
	<i>Eucirroedia pampina</i>	9952	IX	TB, HPA	2	2	P
	<i>Sunira bicolorago</i>	9957	IX	HPA, HQ	2	5	
	<i>Anathix ralla</i>	9961	VIII	PEEC, WRA	2	3	
	<i>Feralia jocosa</i>	10005	IV	HQ, PEEC	2	6	P,S
	<i>Feralia major</i>	10007	IV	HQ, PEEC	2	9	P,S
	<i>Psaphida electilis</i>	10012	IV	PEEC	1	2	P,S
	<i>Psaphida rolandi</i>	10014	IV	HQ	1	5	P,S
	<i>Psaphida styracis</i>	10016	IV	HQ	1	3	P
	<i>Psaphida resumens</i>	10019	IV	HQ	1	2	P,S
	<i>Psaphida thaxterianus</i>	10020	IV	HQ	1	1	P
	<i>Copivaleria grotei</i>	10021	IV	HQ, PEEC	2	12	P,S
	<i>Cucullia asteroides</i>	10200	VIII	TB, RS	2	3	
	<i>Cucullia convexipennis</i>	10202	VII, VIII	TB, PEEC	3	3	P
	<i>Orthodes detracta</i>	10288	VI	HQ	1	1	P
	<i>Morrisonia latex</i>	10291	VI	HQ	1	1	P
	<i>Melanchra adjuncta</i>	10292	VI, VIII	WRA, TB	3	5	P

	<i>Lacanobia subjuncta</i>	10299	VI	WRA	1	1	P
	<i>Spiramater lutra</i>	10301	VI	WRA	1	2	P,S
	<i>Trichordestra legitima</i>	10304	VIII	TB, WRA	2	2	P
	<i>Lacinipolia renigera</i>	10397	VI, VIII, IX	WRA, HQ, TB, HPA	7	8	P
	<i>Lacinipolia implicata</i>	10414	IX	HPA	1	2	P
	<i>Dargida diffusa</i>	10431	VI, VIII	WRA, TB	2	2	P
	<i>Mythinma oxygala</i>	10436	VI	WRA	1	1	P
	<i>Mythinma unipuncta</i>	10438	VI, VII, VIII, IX	WRA, HQ, PEEC, TB, RS	12	12	
	<i>Leucania phragmitidicola</i> / <i>Leucania linda</i>	10444 / 10445	VI	HQ	1	1	
	<i>Leucania multilinea</i> / <i>Leucania lapidaria</i>	10446 / 10446.1	VI	HQ	1	1	
	<i>Leucania commoides</i>	10447					
	<i>Leucania scirpicola</i>	10455					
	<i>Leucania adjuta</i>	10456					
	<i>Leucania inermis</i>	10459	VII, VIII, IX	TB, WRA, HQ	4	4	
	<i>Leucania ursula</i>	10461	VI, VIII	WRA, HQ, TB	5	7	
	<i>Orthosia rubescens</i>	10487	IV	HQ, PEEC	2	3	P
	<i>Orthosia hibisci</i>	10495	IV	HQ, PEEC	2	120	P,S
	<i>Himella fidelis</i>	10502	V	HQ, MOC	2	1	
	<i>Achatia distincta</i>	10518	IV, V	PEEC, HQ, MOC	3	8	P
	<i>Morrisonia evicta</i>	10520	IV	PEEC	1	4	P
	<i>Morrisonia confusa</i>	10521	V, VI	HQ	2	2	
	<i>Nephelodes minians</i>	10524	IX	TB	1	7	
	<i>Orthodes majuscula</i>	10585	VI, VIII, IX	WRA, TB, HQ, RS	6	5	P
	<i>Orthodes cynica</i>	10587	VI	WRA	1	1	P
	<i>Tricholita signata</i>	10627	VIII	WRA, RS	2	5	
	<i>Agrotis gladiaria</i>	10648	IX	HPA, HQ	2	3	P
	<i>Agrotis venerabilis</i>	10651	IX	TB, HPA	2	3	
	<i>Agrotis ipsilon</i>	10663	VII, VIII, IX	PEEC, TB, SB, WRA, HQ	7	6	
	<i>Feltia jaculifera</i>	10670	VIII, IX	WRA, HPA, HQ	3	7	
	<i>Feltia herilis</i>	10676	VIII, IX	PEEC, TB, HQ, WRA, RS, HPA	7	8	P
	<i>Euxoa tessellata</i>	10805	VI, VII	HQ, PEEC	2	2	P
	<i>Ochropleura implecta</i>	10891	VI, VII, VIII	WRA, HQ, TB, RS	7	13	
	<i>Anicla forbesi</i>	10902					
	<i>Anicla illapsa</i>	10903					
	<i>Anicla infecta</i>	10911	IX	HQ	1	1	
	<i>Peridroma saucia</i>	10915	VII, IX	TB	2	3	
	<i>Xestia c-nigrum</i>	10942	VI, VII, VIII, IX	WRA, HQ, PEEC, TB, RS	9	9	

	<i>Xestia dolosa</i>	10942.1	VIII, IX	TB, HQ, WRA, HPA	5	6	P
	<i>Xestia normanianus</i>	10943	IX	HPA	1	1	P
	<i>Xestia smithii</i>	10944	VIII, IX	WRA, TB, HPA, HQ	4	11	
	<i>Pseudohermonassa bicarnea</i>	10950	VIII, IX	TB, WRA, RS, HPA	4	5	
	<i>Agnorisma badinodis</i>	10955	IX	TB, HPA, HQ	3	3	
	<i>Xestia dilucida</i>	10969	IX	TB	1	1	P
	<i>Cerastis tenebrifera</i>	10994	IV	HQ, PEEC	2	4	P
	<i>Cerastis salicarum</i>	10996	IV	HQ	1	1	P
	<i>Noctua pronuba</i>	11003.1	VI, VII, VIII, IX	WRA, HQ, TB, RS	9	17	
	<i>Protolampra brunneicollis</i>	11006					
	<i>Eueretagrotis sigmoides</i>	11007	VII	TB	1	1	P
	<i>Abagrotis alternata</i>	11029	IX	HPA	1	2	P
	<i>Pyrrhia cilisca</i>	11063					
	<i>Helicoverpa zea</i>	11068	IX	HPA	1	1	P
	<i>Schinia arcigera</i>	11128	VIII	TB, WRA, RS	3	3	
	<i>Schinia rivulosa</i>	11135	VIII	WRA	1	2	
	<i>Schinia trifascia</i>	11149	VIII	PEEC	1	1	
	<i>Schinia florida</i>	11164	VIII	HQ	1	1	P

Appendix III. Other identified insect species incidentally observed within the DEWA separated by order. Unidentified insects were not included in this list.

Orthoptera	Oblong-winged Katydid	<i>Amblycorypha</i>	<i>oblongifolia</i>
	Rattler Round-winged Katydid	<i>Amblycorypha</i>	<i>rotundifolia</i>
	Greater Anglewing	<i>Microcentrum</i>	<i>rhombifolium</i>
	Slightly Musical Conehead	<i>Neoconocephalus</i>	<i>exiliscanorus</i>
	Sword-bearing Conehead	<i>Neoconocephalus</i>	<i>ensiger</i>
	Two-spotted Tree Cricket	<i>Neoxabea</i>	<i>bipunctata</i>
	Red-headed Bush Cricket	<i>Phyllopalpus</i>	<i>pulchellus</i>
	Common True Katydid	<i>Pterophylla</i>	<i>camellifolia</i>
	Northern Bush Katydid	<i>Scudderia</i>	<i>septentrionalis</i>
Hemiptera	Northern Flatid Planthopper	<i>Flatormenis</i>	<i>proxima</i>
	Green Stink Bug	<i>Chinavia</i>	<i>hilaris</i>
	Whitecrossed Seed Bug	<i>Neacoryphus</i>	<i>bicrucis</i>
	Dog-day Cicada	<i>Tibicen</i>	<i>canicularis</i>
	Lyric Cicada	<i>Tibicen</i>	<i>lyricen</i>
	Swamp Cicada	<i>Tibicen</i>	<i>tibicen</i>
Diptera	Giant Crane Fly	<i>Tipula</i>	<i>abdominalis</i>
	Common Snipe Fly	<i>Rhagio</i>	<i>mystaceus</i>
		<i>Psilonyx</i>	<i>annulatus</i>
Coleoptera	Rhinoceros Beetle	<i>Xyloryctes</i>	<i>jamaicensis</i>
	Red-lined Carrion Beetle	<i>Necrodes</i>	<i>surinamensis</i>
		<i>Hesperophanes</i>	<i>pubescens</i>
		<i>Sarosesthes</i>	<i>fulminans</i>
		<i>Monochamus</i>	<i>carolinensis</i>
	Japanese Beetle	<i>Popillia</i>	<i>japonica</i>
	Oriental Beetle	<i>Exomala</i>	<i>orientalis</i>
Neuroptera	Spotted-winged Antlion	<i>Dendroleon</i>	<i>obsoletus</i>
Odonata	Canada Darner	<i>Aeshna</i>	<i>canadensis</i>
	Stygian Shadowdragon	<i>Neurocordulia</i>	<i>yamaskanensis</i>
Hymenoptera	Pelecinid Wasp	<i>Pelecinus</i>	<i>polyturator</i>
	Bald-faced Hornet	<i>Dolichovespula</i>	<i>maculata</i>