

***Rhinoncomimus latipes* (Coleoptera: Curculionidae)
As A Biological Control Agent
For Mile-a-minute, *Persicaria perfoliata* in
New Jersey.**

**Annual Report
2017**



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INTRODUCTION

Mile-a-minute (MAM), *Persicaria perfoliata*, also known as “Devil’s tail tear thumb” is an herbaceous annual trailing vine in the buckwheat family (*Polygonaceae*) (Gerlach 2004). The plant is native to India and Eastern Asia, and was accidentally introduced into York, Pennsylvania on nursery stock (probably from Japan) in the late 1930’s and is now established throughout the northeastern United States (Flanders 2004). MAM produces copious amounts of seed and is most likely to establish along clear cuts, power lines, wood edges, stream banks, and roadsides (Figures 1 and 2). Seed dispersal is mainly by birds and water. MAM is also a problem in untilled agricultural areas such as Christmas tree farms and reforestation seedling plantations because of its’ characteristic ability to climb over and shade out seedlings. The United States Department of Agriculture’s (USDA) decision to use classical biological control, to reduce MAM infestations, was based on the lack of effective chemical and environmentally sound control methods (Flanders 2004).

In the spring of 2004, the New Jersey Department of Agriculture’s (NJDA) Phillip Alampi Beneficial Insect Laboratory (PABIL) entered into a cooperative agreement with the USDA-Forest Service to rear *Rhinoncomimus latipes* (Coleoptera: Curculionidae) and to establish and monitor four mile-a-minute field test sites, for the purpose of gathering field data using the “Mile-a-Minute Monitoring Protocol” developed by Dr. Judith Hough-Goldstein of the University of Delaware, Newark, DE.



Figure 1. Growth habit of Mile-a-minute



Figure 2. Mile-a-minute seedlings

Mile-a-Minute

Mile-a-minute has a reddish stem and alternate, triangular leaves in the shape of an equilateral triangle. Both the stem and the underside of the leaves are armed with downward pointing barbs that aid the plant in climbing and supporting itself on other plants as well as serving a defensive purpose. The plant can grow up to six inches per day with mature plants reaching six feet (Figure 3) or more in height, and can out-compete native plants for space and sunlight. Mile-a-minute has the ability to tolerate partial shade, but needs 63-100% of the available light and uses its climbing ability to achieve that (Gerlach 2004).



Figure 3. Mile-a-minute in April (left) and August (Right).

Mile-a-minute prefers to colonize open and disturbed areas, preferably with high soil moisture and typically shades out other plants greatly reducing their ability to photosynthesize. In areas where rare native plants are sparse, the native plants could be eliminated entirely (Gerlach 2004). Germination usually occurs in April in New Jersey and continues until July with growth lasting until first frost. Early germination gives mile-a-minute an advantage over native plants, allowing it to out-compete them for soil nitrogen and other nutrients.

The plant has distinctive circular cup-shaped leafy structures called ocreas that surround the stem at indeterminate intervals. Buds, flowers and seed heads emerge from these ocreas. The flowers are small, white and generally unnoticeable. Mature fruits, are metallic blue and segmented with each segment containing a single achene (Gerlach 2004). Mile-a-minute is primarily self-pollinating and reproduces until the first frost with each plant capable of producing 50-100 seeds, which can remain viable in the seed bank for three years (Hough-Goldstein 2004a). Birds and water disperse the seeds with the seeds remaining buoyant for 7-9 days. This buoyancy is an important factor in seed dispersal that allows seeds to travel great distances. (Gerlach 2004). Mile-a-minute has been observed throughout New Jersey and is expanding its range within the state but has not been observed in the Pinelands or in Ocean County.

Control Measures

Presently, the main mile-a-minute control method involves the hand removal of young seedlings in early spring and throughout the season, as the seeds continue to germinate. Broad-spectrum herbicides are not practical in areas with a dense varied native plant population because chemicals would affect the native vegetation as well. (Hough-Goldstein 2004b). These temporary control measures do not provide sustained seasonal control of this invasive weed. A classical biological control program that uses natural enemies appears to be the best approach for a long-term control program. The United States Department of Agriculture considered two potential biological control agents, a moth, *Timandra griseata* (Lepidoptera: Geometridae)

which was never approved for release, and a stem-feeding weevil, *Rhinoncomimus latipes* (Coleoptera: Curculionidae).

Biology of Beneficial

In 2004, the USDA approved the rearing and release of *Rhinoncomimus latipes*, a stem-feeding weevil found in China and it was introduced into the United States in July 2004. *R. latipes* is approximately two millimeters long and black when the beetles eclose and get covered by an orange film as they mature, which the weevils derive from feeding on mile-a-minute (Hough-Goldstein 2004a). *R. latipes* (Figure 4) feeds on the flower heads (capitula), leaves and ocreas with the females preferring the high protein capitula for egg production. Females deposit an average of 49 eggs over a 30-day period. The males prefer to feed mainly on the ocreas and leaves (Colpetzer et. al. 2004). The eggs are laid on the capitula and leaves and when the larvae hatch, they bore into the stem and feed for three weeks, before exiting and dropping to the ground to pupate (Flanders 2004). The portion of the stem above the feeding area is killed, thereby reducing seed production.



Figure 4. *Rhinoncomimus latipes* adult and larva

MATERIALS AND METHODS

Study Sites

PABIL field personnel monitored four study sites: one control and one release site in Gloucester County established in 2004 as well as one control and one release site established in Salem County in 2005. The 2005 release site was located in the Abbotts Meadow WMA in Elsinboro Township while the control site was located in the Supawana Meadows National Wildlife Refuge in Pennsville Township. The sites were used to gather data on mile-a-minute field development and to evaluate the effectiveness of *R. latipes* as a biological control agent. The sites were structured according to the “Mile-a-minute Monitoring Protocol”, developed by Dr. Judith Hough-Goldstein of the University of Delaware. Twenty randomly placed one-half square meter quadrats, each at least ten meters apart were arranged throughout the mile-a-minute infestation at each of the four sites. Data was collected in the spring at all sites to assess plant density. In 2006 and then in 2008, monitoring protocols were refined in two ways. First, data sites were monitored three times per year instead of weekly; second, instead of surveying 100 random plants, a two-minute visual survey was performed during each visit. Plants were surveyed for the presence of adult weevils and feeding damage. The control and release sites continued to be monitored monthly for seed production. During the survey all mature and immature seeds were counted within a one-half square quadrat.

Release

Since 2004, the PABIL has released a total of 204,795 *R. latipes* adults into fourteen New Jersey counties and one Pennsylvania County boarding the Delaware River Water Gap National Recreation Area (DEWA) (Appendix). In 2016, 2,550 weevils were released into two new sites but all of the sites already had weevils present. The weevils were brought to the field in Sweetheart® 16oz. hot beverage cups fitted with nylon mesh covered openings on each end. A Pioneer plastics® 7cm by 3cm Petri dish containing a sponge moistened with honey and water was affixed to the bottom of the cup.

RESULTS AND DISCUSSION

Impact of *Rhinoncomimus latipes*

The Gloucester County site located at Floodgate Road received a total of 3,497 *R. latipes* from 2004 to 2005. The weevils at this location quickly established and increased their population size so readily, that the MAM was completely defoliated. By the end of the 2006 season the study site had MAM populations undetectable in all of the 10 quadrats. Figure 5 shows the potential long-term effect of *R. latipes*. In the three photos, the site has gone from an area completely covered by mile-a-minute in 2005, to an area where the mile-a-minute is reduced substantially, to an area where native plant diversity continues to increase in 2011. The overall MAM population at this site has changed over the seven survey seasons to where MAM is no longer the dominant plant species. It can be further noted that the production of seed heads was delayed at this site and other release sites by over a month. This is in line with observations made by Hough-Goldstein (2008).



Figure 5. Mile-a-minute at Floodgate Road July 2005 (left), in October 2006 (middle) and October 2011 (right) after *R. latipes* feeding

Figure 6 shows the 2006 weevil feeding damage along the berm at the Floodgate Road site. Field personnel were able to easily collect 50-100 weevils, in less than a minute, by simply beating defoliated mile-a-minute vines gently by hand.



Figure 6. Defoliated Mile-a-minute.

The release site established at Abbott’s Meadow WMA in Salem County was specifically set up to study the potential impact that large numbers of weevils could have on MAM. This site was inundated with 6,976 weevils in 2005. The plants at this site were heavily defoliated early in the 2005 and 2006 season by the high weevil populations. The same site also had few weevils in the quadrats due to the dense coverage of barnyard grass in mid May during the same years which prevented germination of the MAM, early in the season. However, weevil counts can be problematic and misleading because of the weevil’s tendency to drop from the plant when disturbed. This behavior occurs when handling the plants during the survey process; causing the weevil population to be potentially undercounted or unobserved.

Figure 7a illustrates the reduction in the number of stems during the spring count from 2005 to 2017. The 2017 counts are still well below the original data from 2005. Figure 7b shows the percent cover of mile-a-minute over the same period again with a slight decrease in the percent cover in the release site.

Figure 7a.

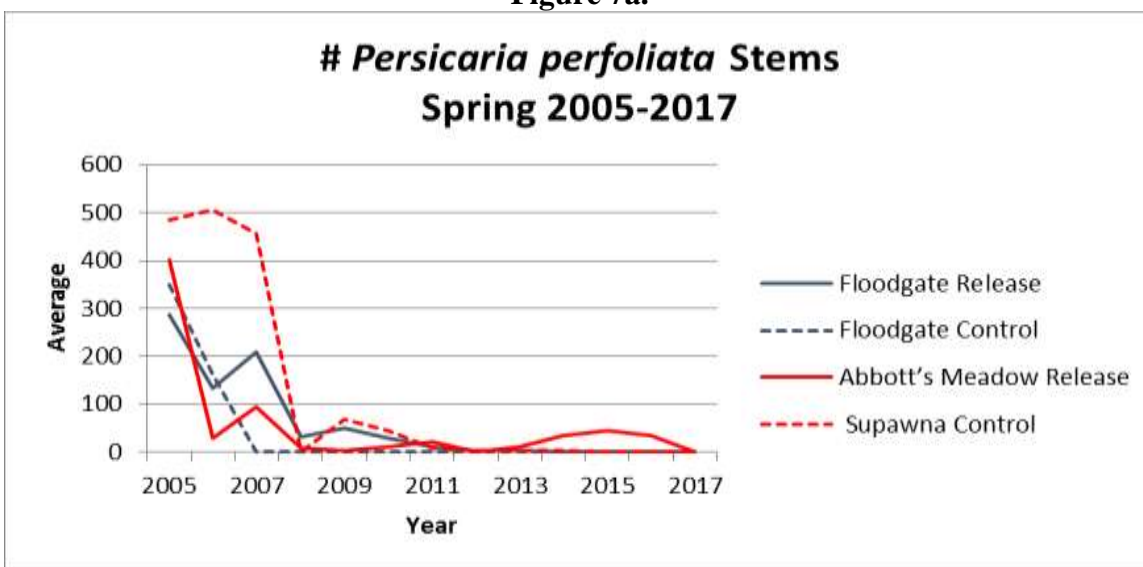
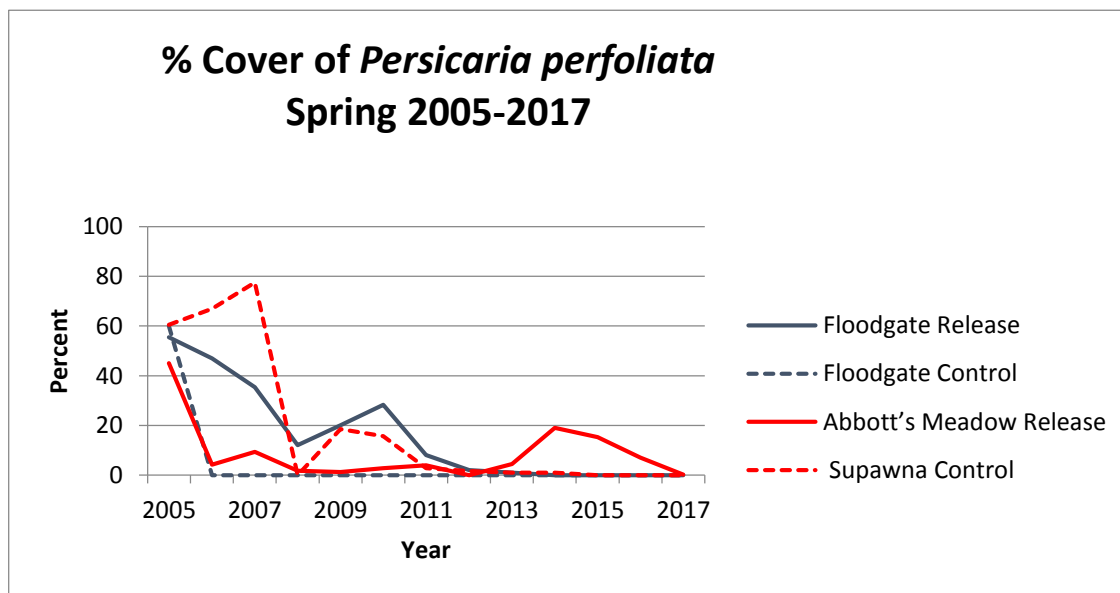


Figure 7b.



The performance of *R. latipes* over the past thirteen years has been extremely encouraging. The plants are impacted by adult feeding as well as the stem destruction by the larvae. Generally, a biological control agent will take six generations to make its' impact and as the weevils have 3-4 generations per year in New Jersey, the mile-a-minute population is being rapidly reduced in the release sites. Also, *R. latipes* has survived at sites that were both flooded, mowed and subject to tidal flooding.

Dispersal of *R. latipes*

In 2006, field staff started monitoring the dispersal of *R. latipes* from the release sites. By 2006, there was no control site at Floodgate Road due to weevil dispersal and in 2008 the weevils found the Supawna site so there are no control sites anymore. *R. latipes* was recovered 4.0 kilometers from the original release sites and by the end of the 2009 season, the weevil was recovered and had caused feeding damage to a mile-a-minute site in Cape May County which was 69.2 kilometers away from the closest release site in Salem County. Field staff has hypothesized that the weevils were possible blown into the area by prevailing winds or possibly carried to the area by heavy equipment used by NJ Division of Fish and Wildlife but they may have reached the area on their own without human intervention. Figure 8 illustrates the location of the dispersal and non-release recovery sites. *R. latipes* appears to have no difficulty moving to other mile-a-minute infestations even across bodies of water. The first non-release recoveries of *R. latipes* were made in 2007, three years after the first release and two years after the first large-scale releases. Weevils have been recovered at all of the surveyed release sites (100%) as well as at 239 dispersal/non-release sites. All of the new 2017 release sites already had *R. latipes* present before any releases were made.

Figure 8. *R. latipes* Release and Recovery Sites Through 2017

Black dot = Release Site;
Red Star = Nonrelease recovery prior to 2014
Green Star = Nonrelease recovery in 2014



R. latipes have been recovered from releases made from April to October. Mile-a-minute has also been observed to be a problem in pastures in Northern New Jersey and in at least one “Pick Your Own” orchard where the grower had a lot of difficulty spraying the plants that got in between the apple trees. By 2010 the number of dispersal sites had exceeded the number of release sites. Although the size and number of mile-a-minute infestations are increasing in New Jersey, fortunately so is the *R. latipes* population.

Some of the new dispersal sites were found in openings in the forest canopy where overstory trees had died or fallen which created breaches where the plants could invade the forest. After Hurricane Sandy, there are many such sites in New Jersey where the mile-a-minute could propagate.

Conclusion

Since 2004, when the PABIL entered into a pilot program with the USDA-Forest Service and the University of Delaware to control the herbaceous annual vine mile-a-minute by the stem-feeding weevil *R. latipes*, a total of 207,295 weevils have been released. The recovery of *R. latipes* 69.2 kilometers away from the Abbott’s Meadow release site shows the weevil’s ability to disperse well. This dispersal ability is important because MAM is being found more frequently and over a greater range each year in New Jersey. The number of stems and % cover of MAM declined at the monitored sites after weevils were released. Although, mile-a-minute is increasingly becoming an agricultural pest in New Jersey, **in 2017 no matter where we found mile-a-minute the weevils were already present!**

2018 Plans

In 2018, the laboratory will continue to provide weevils for new site establishment. Field personnel will continue to monitor the release sites for the presence of overwintering adults and evidence of reproduction. The field staff will also continue to monitor for further distribution of the weevil. Weevil reproduction, plant reduction, and dispersal trends will be evaluated.

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Photos by Mark Mayer except as noted.

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Appendix
Rhinocomimus latipes Releases and Recoveries in NJ

County	Location	Dates	Number Released
2004 Releases			
Gloucester	Floodgate Road *shipped from the University of Delaware	7/28	200*
2005 Releases			
Salem	Mason Point Rd. & Money Island Rd. Abbott's Meadow WMA	4/22-9/9	6,976
Mercer	Washington Crossing State Park, near open air theater	5/13-5/18	652
Mercer	Washington Crossing State Park, near Delaware River	5/18	270
Gloucester	Floodgate Road	6/17-8/29	3,297
Salem	DOD Ponds WMA	10/12	600
2005 Total			11,795
2006 Releases			
Burlington	Pinelands Water Co.	4/28	2,260
Burlington	Taylor's Farm	5/5	1,066
Gloucester	Floodgate Road by Lake	5/12	800
Salem	Supawana Meadows NWR for U.S. Fish & Wildlife Service	6/9-9/29	14,667
Salem	Mesogianes Farm	9/1	1,025
Hunterdon	Hunterdon County Park	10/13	600
Hunterdon	Round Valley Rd	10/13	397
Hunterdon	Pine Bank Rd	10/13	600
Mercer	Washington Crossing State Park, near open air theater	5/19	600
Mercer	Washington Crossing State Park, near Delaware River	5/19	450
2006 Total			22,465
2007 Releases			
Salem	Fort Mott & Lighthouse Road hedge heading toward Ft. Mott	5/4	1,202
Salem	Supawana Road 3 locations NWR "stakes" and 2 Neighbors	5/4, 5/11	3,364
Gloucester	Davidson Road	5/11	1,800
Hunterdon	Dreahrook Road	5/18	1,800
Salem	Killcohook spoils off Finns Point access road	5/25	4,500
Hunterdon	Railroad Avenue	5/18	600
Salem	Harris Road 5 locations on Hancock farm	6/1	1,800
Salem	Mesogianes Farm	6/1	827
Middlesex	Rutgers Horticultural Farm	6/15	719
Salem	Gant Farm	6/29	1,802
Salem	Pennsville-Auburn Road	7/13	1,161
Salem	Pinyard Road	7/20	2,049
Salem	Fort Mott Road	8/3	1,400
Salem	DOD Ponds WMA parking lot	8/9	671
Union	Watchung Reservation	8/16	1,894
Salem	Hook Road	8/24	1,514
Bergen	Overpeck Preserve	8/30	741
Hunterdon	Pine Bank Road (field collected from Floodgate site)	9/13	200
Hunterdon	Pine Bank Road (lab weevils)	9/14	300
Hunterdon	Route 29 one year old weevils	10/5	159
Salem	Park Avenue	9/5	351
Warren	Columbia Lake WMA (main road)	7/27	400
Warren	Columbia Lake WMA Delaware Lake	7/27	800
2007 Total			30,054

County	Location	Dates	Number Released
2008 Releases			
Bergen	Palisades Park Greenbrook Sanctuary	5/16	1,768
Bergen	Palisades Park near headquarters	5/16	1,866
Bergen	Overpeck Preserve, Leonia	6/27	2,129
Gloucester	600 Route 130 Waste Mgmt.	8/1	1,355
Gloucester	Pennsylvania Ave Franklin Twp. recreation area	8/15	1,561
Hunterdon	Pine Bank Road	5/22	1,900
Hunterdon	Route 29 north of Stockton	6/20	892
Hunterdon	South Ridge, Round Valley Reservoir	7/18	1,069
Middlesex	Rutgers Display Gardens	9/12	1,199
Middlesex	Davidson's Mill Pond Park	9/12	995
Monmouth	Creamery Road	8/27	2,158
Monmouth	Thompson Park Site 1	5/8	1,788
Monmouth	Thompson Park Site 2	5/8	1,108
Morris	Joy B's Farm	6/6	2,012
Salem	Lehigh Road Power lines Supawna Meadows NWR	4/25	1,000
Salem	Lehigh Road end of dirt lane Supawna Meadows NWR	5/2	1,645
Salem	Straugh's Mill Road	7/24	1,022
Salem	Church Landing Road	8/8	1,078
Salem	Mesogianes Farm	8/22	1,321
Salem	Pointers-Auburn Road	9/18	1,506
Salem	Swedesboro Road	9/25	1,581
Salem	Route 130 mile marker 85	10/9	1,540
Salem	Route 49 Connective Deepwater Generating Station	10/16	1,706
Sussex	Minisink Island DEWA	5/30	4,715
Warren	Shiloh Road off of Route 519	6/13	1,002
Warren	Columbia Lake WMA (no name lake)	7/11	960
Warren	Columbia Lake WMA (main road)	7/11	2,022
Warren	Honey Run WMA	9/5	1,019
Warren	Flitcroft Brookhollow Farm	10/2	2,199
2008 Total			46,116
2009 Releases			
Bergen	Oradell Reservoir, Lakeshore Drive	7/17	2,000
Bergen	Losen Slote Creek Park	6/5	3,000
Hunterdon	Round Valley Reservoir, Wilderness Campground	6/25	2,000
Hunterdon	Musconetcong River WMA	7/10	2,000
Hunterdon	Deerpath Preserve, NJ Audubon Society, Tunnel Rd.	9/4	2,000
Mercer	Ted Stiles Preserve, FOHVOS	7/24	2,000
Mercer	D&R Canal State Park	7/24	2,000
Middlesex	Rutgers Display Gardens, Heylar Woods	9/10	2,000
Morris	Killion Farm, Parker Road, Long Valley	9/17	2,000
Salem	Mesogianes Farm	5/14	2,858
Salem	Fort Elfsborg-Salem Road, Elsinboro	6/25	2,000
Warren	Flitcroft Brookhollow Farm	8/23	2,000
2009 Total			25,858

County	Location	Dates	Number Released
2010 Releases			
Bergen	Mill Creek Park , Carlstadt	7/23	500
Bergen	Teaneck Conservancy, Teaneck	9/10	1,000
Middlesex	Rutgers Display Gardens, Heylar Woods, New Brunswick	9/10	500
Middlesex	Davidson's Mill Pond Park, South Brunswick	9/16	500
Morris	Great Swamp NWR, Pleasantville Rd., Harding	8/27	3,250
Sussex	DWGNRA Dingmans Riverside, Sandyston	8/12, 9/17	5,000
Union	Schwartz Farm, Union CO. Park, Clark	7/9	1,000
Union	Watchung Reservation, Coles Ave, Mountainside	7/9	1,300
Warren	Makarevich Farm by Power Line, Knowlton	9/3	500
Warren	Columbia Lake WMA, Knowlton	8/31	500
2010 Total			14,050
2011Releases			
Cape May	Coxhall Creek WMA	8/19	1,000
Monmouth	Poricy Park WMA	8/5	1,500
Morris	Berkshire Valley WMA	7/22,9/7	3,500
Sussex	Flatbrook-Roy WMA	7/1,7/15	2,500
Sussex	Allamuchy State Park 1	9/2	500
Sussex	Allamuchy State Park 2	9/2	1,000
2011 Total			10,000
2012Releases			
Hunterdon	Hunterdon County Arboretum	7/6	2,000
Mercer	Saint Micheal's Preserve D&R Greenway	9/20	2,130
Middlesex	Rutgers Ecological Preserve	7/6	2,250
Sussex	Walpack Bend Campground, DEWA	8/14	1,700
Warren	Route 94 Crisman Road, Nracs farm	9/14	2,000
2012 Total			10,080
2013Releases			
Bergen	Green Brook Sanctuary Palisades Interstate Park, Tenafly	9/12	2,000
Burlington	Lounsberry Farms, Springfield	9/12	500
Cumberland	Seabreeze Road, Fairfield	9/6	1,500
Cumberland	Backneck Road, Fairfield	9/6	1,500
Hunterdon	South Branch WMA, Readington	8/9	500
Mercer	St. Micheal's Preserve, D&R Greenway, Hopewell	9/26, 9/27	1,000
Union	Watchung Reservation, Sierra Trail to Water Tower, Mountainside	9/19	2,000
Warren	Woodsedge Farm, White	8/29	1,000
2013 Total			10,000
2014Releases			
Hunterdon	Round Valley Reservoir, Clinton	9/14	2,250
Sussex	Mountain Road DEWA, Walpack	6/27, 8/8, 9/19	5,600
Sussex	17 Davis Road, Sparta	9/19	3,750
2014 Total			11,600
2015 Releases			
Mercer	Griffin Farm	8/28	1,500
Somerset	1664 Fairview Drive	9/25	2,002
Sussex	Walkill River NWR	9//4	2,525
Warren	North Turtle Beach, DEWA	9/11	2,000
Pike, PA	Jerry's Lee, DWA	7/17	500
Pike, PA	Eschback Access, DWA	9/18	1,500
2015 Total			10,027
2016 Releases			
Pike, PA	Eshback Access, DEWA	6/16	1,000
Warren	Belcher Road	9/16	700
Hunterdon	Route 29 north of Stockton ,	9//16	850
2016 Total			2,550
2017 Releases			
Ocean	Ocean County Park, Lakewood	9/14	1,000
Glloucester	Lake Park Cemetary, Swedesboro	9/21	1,000
Cumberland	Old Deerfieldd Pike, Upper Deerfield	9//21	500
2017 Total			2,500

