Interim Report
State Wildlife Grants
T-1-7
F13AF01086

Endangered, Threatened and Rare Wildlife Conservation Projects

Interim Report for Project Year
September 1, 2014 – August 31, 2015

NJ Department of Environmental Protection

DIVISION OF FISH AND WILDLIFE
ENDANGERED AND NONGAME SPECIES PROGRAM
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NEW JERSEY DIVISION OF
Fish and Wildlife

Conserve Wildlife
New Jersey Division of Fish & Wildlife
Endangered & Nongame Species Program

SPORT FISH & WILDLIFE RESTORATION

Performance Report

Project: **1. SGCN Research, Monitoring and Management**
Federal Aid Project: T-1-7 (State Wildlife Grants)
Segment dates: September 1, 2013 to August 31, 2014

JOB A. Bird Conservation

Subjob A.1. Raptors
Bald Eagle Monitoring and Management Planning
Project leader: Kathleen Clark, Supervising Zoologist

Objective: To conserve and manage a self-sustaining bald eagle population in New Jersey; to determine the threat of environmental contaminants to survival of bald eagles along the lower Delaware River and upper Delaware Bay; and to monitor and conserve the wintering population of bald eagles in New Jersey.

Key Findings:
Population monitoring:

- ENSP biologists monitored all nesting pairs known and continued the tracking in list format. Eighty eagle project volunteers conducted most of the monitoring in the state and reported on nests on a weekly or bi-weekly basis from January through fledging in July.
    - In 2015, 161 eagle nests were monitored during some or all of the season, of which 150 were active (exhibiting incubation), and 11 were territorial (maintaining a nest area); 27 more nest territories remain on our list but were unknown (pair or nest could not be found, or we lacked observation effort).
    - During the 2015 nesting season, 122 of 150 known-outcome nests were successful in producing 199 young, for a productivity rate of 1.33 young per known-outcome, active nest. This is just above the 10-year median in New Jersey of 1.25 young per active nest. Overall nest success rate was 81%, above the average of 75%. These results reflect a continuing growing population.
    - Thirteen new eagle nests were discovered this season, a 9% increase from last year's known nesting population. Just one of the state's 21 counties lacked a known nest.
    - We documented 28 (19%) nest failures, most from unknown causes.
- ENSP biologists visited a sample of nests to band young with federal and color leg bands and to take blood samples. In 2015 we banded 18 eaglets at 10 nests. We took blood from 14 of the banded eaglets and stored it for future analyses. A small portion of each sample was separated for DNA analysis by a cooperating researcher who will be analyzing the genetic heritage of eagles across the country. No unviable eggs were found during nest visits.
- Relationships with landowners, whether private citizens, conservation organization, or public agencies, all required attention and directed management to ensure protection from disturbance or significant habitat alterations. Most nests (about 60%) were located on private land, with the balance on state, federal, county, municipal and conservation-organization lands.
- The ENSP did not participate in the standard, national, Midwinter Eagle Survey in January, 2014 or 2015. The survey transects no longer represent the statewide wintering population, and the program did not have the funds to pay a coordinator. Instead, we directed our Eagle Project volunteer nest observers to seek out and record eagles in likely communal roosting areas. Several new roosts were located and mapped, and ENSP has partnered with the College of William and Mary's Center for Conservation Biology to map roosts documented with telemetry or visual surveys.

Nest site protection:

- Nest areas were posted against trespassing in all cases where the nest is highly visible and where law enforcement officers specifically recommended.

- Staff provided technical assistance to owners and clients of cell towers, and distributed guidelines for managers of man-made structures (especially cell and transmission towers), who must deal with osprey and eagle nests on those structures.
- The Conserve Wildlife Foundation of NJ distributed two new brochures (for landowners and volunteers) developed with ENSP input as to NJ-specific information and recommendations.
- ENSP staff worked with Bureau of Law Enforcement to address specific problems at nest sites; most problems arose from people approaching nests that are highly visible. Law Enforcement officers were included in the pre-season eagle project orientation meeting held February 8, 2014, attended by approximately 40 project volunteers.
- In a separately-funded project, we attached a GPS-GSM transmitter to one eaglet in Cumberland County. The transmitters are yielding new data on post-fledging movements and roosts within and outside of the state. All tracking data is made public on CWF-NJ's website.

Habitat protection and planning:

- New nests found in 2014 were GPS'd in the non-nesting season and were added to the database. Revised Landscape Project mapping that included new nests was provided to DEP offices for use in environmental review.
- Site-specific habitat management plans were provided during the NJDEP permit review process on a few sites due to pending development applications. ENSP also worked with the USFWS regional office to condition permits granted under BGEPA.
- The status assessment portion of the proposed Bald Eagle Recovery Plan was not conducted due to time limitations.

Conclusions:

- We documented 13 new nests in 2015, a population increase of 9% to 150 active nesting pairs. As the population grows, on average 17% per year since 2000, it has become more difficult to track all known nesting pairs to determine nest occupancy and nest success. While ENSP and partner Conserve Wildlife Foundation of NJ have been successful in determining the location and outcome of nearly 90% of eagle pairs, the growing population has made it increasingly difficult to report on all nests in the list format. In 2013 and 2014, about 10% of known pairs changed nest trees; while that figure dropped to 6% in 2015, it present the difficulty of finding the new nest locations by local searching. In 2015, the number of pairs with "unknown" status increased from 11% (2014) to 18% with 27 nests in the unknown category.
- The state's eagle population has been increasing as a result of 14 years of average productivity of 1.25 young per active nest (median=1.26 young/active nest), but population growth has been substantial only since 2002. Key to this success has been management that includes nest-site protection in cooperation with landowners.
- Maintaining the eagle recovery depends on cooperation from private landowners, where most of the nests are located. Nest site protection is accomplished with a combination of local landowners and nest observers, Division law enforcement, and land use regulatory protection, all essential ingredients in the current recovery and necessary to sustain it. With federal delisting and strengthening of the federal Bald and Golden Eagle Act, we have expanded our coordination with the USFWS in select cases to minimize disturbance and habitat loss to development and other activities.
- As the eagle population has increased, it has become more challenging to maintain the "list" of eagle nests and territories that is the basis for reporting the population to the USFWS under requirements of the post-delisting monitoring plan (USFWS 2009). With declining funding and an eagle population reaching recovered status, it is unlikely we will be able to continue this level of population monitoring far into the future.
- Disturbance is a major management issue at particular nests, especially those most visible and near roads. Posting and regular surveillance by staff and nest observers have been essential to ensuring or maintaining nest success.

Recommendations:

- Maintain efforts to monitor population size, nest activity and productivity through weekly or bi-weekly observations of nests by volunteers. Continue coordination with the U. S. Fish and Wildlife Service in accordance with the post-delisting monitoring recommendations, via conference calls and regional/subregional meetings.
- We have ended the Mid-winter Eagle Survey in favor of deploying volunteers to identify winter roosts and concentration areas. We need to map those areas that may be significant to maintaining the local and regional population of bald eagles, and prioritize them for protection through management and acquisition.
- Seek partnerships to continue eagle telemetry that helps identify suitable habitats in migration and wintering areas to support long term planning for eagle population recovery.
- Continue to monitor population health indicators by visiting a representative sample of nests to band nestlings with USFWS bands and state color bands, take measurements and blood samples. Seek assistance with contaminant analysis from researchers interested in any and all aspects of contamination issues.
- Continue to work with Division of Law Enforcement, private landowners, nest observers, conservation organizations, and local governments to ensure protection of nesting and foraging sites.
- Work with the NJ Field Office of the USFWS to maintain essential nesting habitat free from disturbance, in accordance with state law and the federal Bald and Golden Eagle Act. Develop proactive planning to identify and conserve suitable bald eagle habitat in anticipation of a fully recovered eagle population.

Literature cited.

U.S. Fish and Wildlife Service. 2009. Post-delisting Monitoring Plan for the Bald Eagle (*Haliaeetus leucocephalus*) in the Contiguous 48 States. U.S. Fish and Wildlife Service, Divisions of Endangered Species and Migratory Birds and State Programs, Midwest Regional Office, Twin Cities, Minnesota. 75 pp.

Peregrine Falcon

Project leader: Kathleen Clark, Supervising Zoologist

Objective: To conserve and manage the New Jersey Peregrine Falcon (*Falco peregrinus anatum*) population at a self-sustaining level.

Key Findings:

- The 2015 New Jersey peregrine falcon population remained relatively stable with 32 known pairs (28 active) occupying suitable nesting habitat across the state. There was good nesting success overall with 24 pairs successful in producing 63 young, for a productivity rate of 2.25 young per active nest and a success rate of 71% (Table 1). A brief summary of data collected during the 2015 nesting season follows.
  - ✓ Sixteen pairs utilizing towers and buildings continued to be the core of the nesting population, producing 43 young, for a productivity rate of 2.69 young per active nest. This is above the long term average. We used bird-lice spray at nests in the winter, and treated <2-week old hatchlings at two sites (Stone Harbor, Egg Island) to reduce infestations of parasitic flies (*Carnus hemapterus*). These flies have caused mortality of young hatchlings in recent years. We did not see any total brood failure due to flies that we saw in 2014.
  - ✓ Six pairs were known to occupy territories in natural cliff habitat in northeastern NJ. Nine young fledged for a productivity rate of 1.50 young per active nest. One site that presumably failed was discovered as a result of an adult female recovered injured during May; she was successfully treated and released to the wild in July.
  - ✓ Six pairs of falcons were known to nest on bridges this year. Four of those bridges lie completely within the boundaries of NJ, while two span the Delaware River between NJ and PA and are monitored by NJ. All bridge pairs fledged a total of 11 young for a productivity rate of 1.83 young per active nest. Nesting can be difficult to confirm, as the nest sites are often located out of sight or on inaccessible sections of the bridge. Some previously occupied bridges (e.g., Trenton and Newark Bay) were not tracked due to

insufficient staff or volunteers. Other bridges may have been occupied, but the program lacked monitors in northern NJ to document all possible sites.

- The Jersey City falcons failed to nest this year when an entirely new pair occupied the site. The previous female had been approximately 15 years old and the male 11 years old, and both were replaced by young birds in 2015. Although the new birds were mature and courted, they did not lay eggs. The Jersey City site continued to be on webcam taken over by CWF-NJ in 2015.
- We banded 39 of the 63 young produced this year, using both a federal band and an auxiliary, bicolor band with an alpha-numeric code following USGS Bird Banding Lab protocol.
- Seven addled eggs were collected from five different nest sites this season. Addled eggs from 2014 and 2015were submitted for contaminant analysis to Dr. Da Chen at Southern Illinois University, where previous years' eggs were analyzed. Dr. Chen's research focuses on the accumulation and effects of flame retardants.
- We continued to use remote, motion-activated cameras to photograph peregrines at nests. Using this method we read the leg bands on 20 breeding adults at 11 nest sites. An additional 12 adults were identified using optics. A minimum of 5 adults (12%) were unbanded. The oldest females identified were a 17-year old Atlantic City bird that failed to lay eggs a third consecutive year, and a 15-year old Tuckahoe female that laid no eggs. The oldest known male was 11 years, at the Burlington-Bristol Bridge where he has little fear of people. The median age of males and females was 8.5 and 7.0, respectively. The information that these identifications provide is valuable for relating peregrine origin and age to nest success, site fidelity and turnover rate in the population.
- In addition to the resightings we recorded at NJ nest sites, we received reports of peregrines sighted here and elsewhere:
    - 14/AM AC Hilton 2012, resighted 1/2/15 at Holgate
    - 15/AM AC Hilton 2012, resighted Stone Harbor in fall 2013, and spring 2014, 2015
    - 48/Y Ocean Gate 2007 male nesting at Walt Whitman Bridge 2015
    - *Y/*4 Betsy Ross 2006 female nesting in VA 2011-2015
    - *Y/*9 AC Hilton 2006 female continued to nest in NY (Brooklyn 2009) at Water St/Manhattan 2013-2015
    - 30/AN Elizabeth 2012 male nesting Water St/Manhattan 2015 (mated with *Y/*9)
    - 60/Y Tuckahoe 2006 female continued to nest at Phila City Hall 2009-2015
    - 31/AN Elizabeth 2012 female nesting bridge, Montgomery Co, PA 2015
    - 32/AN Tuckahoe 2012 female nesting Yorktown Power, VA 2015
    - 78/AN Sea Isle 2014 female recovered injured in yard in Fallston, MD in Sept 2014.
    - 82/AN Wildwood Crest 2015 female resighted at Holgate; later found dead Beach Haven Sept 2014
    - 88/AN Somers Point 2014 female resighted April 2015 in Montezuma NWR, NY
    - 98/AN Somers Point 2015 female recaptured/released at Cape May, Sept 2015
    - BD/04 Heislerville 2015 female resighted August 2015 near Moore's Beach
    - BD/12 Ocean Gate 2015 female resighted August 2015 in Hockessin, DE
    - BD/14 Atlantic City 2015 female resighted August 2015 in Brigantine
    - 79/AN Jersey City 2014 female recaptured September 2015 in Toronto

- The 2015 season was the first season that Conserve Wildlife Foundation of NJ had full operation of the Jersey City peregrine falcon nest webcam. Unfortunately, the two falcons that had been long term residents were replaced by new falcons. The new female is banded 41/AX, a 2012 bird from the Bayonne Bridge; the male is not banded (the previous male was *2/*6 and 11 years old last year). Both were mature enough to nest, and although some of their courtship was caught on camera, they did not lay eggs. Next year should bring the birds back to the viewing public.
- New sites were added to the Biotics database, along with an updated record of existing sites.

Conclusions:

- The peregrine population remained stable but 2015 saw improved nest success and productivity. Across all sites – towers, buildings, bridges and cliffs – nest success was 79% and produced 2.25 young per active site, figures that are above average. The tower and building nest sites are the consistent center of the population in NJ, without which the population would fluctuate widely year to year. Management of nest sites, mainly to provide safe, undisturbed nesting environments for the birds, continues to be the predominant factor in a stable and productive population.
- Nest success at cliff sites was improved in 2015. We had documentation on six occupied territories and a total of nine fledged young yielding a 1.50 productivity rate. Observations continued to be difficult in the more remote locations and where nest sites cannot be viewed after leaf-out. One adult female with a brood patch was recovered injured in May, which indicated an occupied territory but where no nest could be directly observed; the injured bird was successfully rehabilitated but missed the nesting season. The highly variable nest success at the cliff territories continues to be a problem if we consider occupancy of historic habitat important to a fully recovered population. Targeted investigation of the cause of those losses is necessary to guide future management.
- Management of nesting pairs and nest sites is essential to maintain peregrines in New Jersey. Bridge-nesting birds are especially vulnerable to nest-site problems, and many other pairs occupy human-constructed sites. With site management and the cooperation of bridge and building staff, these sites can contribute to population viability and stability, but proper site management takes staff time and attention. Building managers, in particular, are key partners in improving some nest sites and expanding the potential peregrine population.

Recommendations:

- Continue to monitor the peregrine falcon nesting population to maintain the database of nest site occupancy and nest success.
- Investigate cliff-nesting sites to determine causes of nest losses and improve nest sites where possible. Deployment of cameras would be the best means of getting a better level of monitoring.
- Continue the identification of adult nesters to track breeding population turnover, age structure and origin of successful nesters. The relation of the age structure to nest success and contaminant levels will inform conservation decisions regarding species status and recovery planning.
- Continue the investigation of contaminants in unhatched, salvaged eggs, as well as the close monitoring of nesting pairs to detect problems. Our partnership with Dr. Da Chen at Southern Illinois University to characterize the threat of organochlorine pesticides and brominated fire-retardant chemicals (polybrominated diphenyl ethers) is a cost-effective means of adding to the science concerning peregrine falcons.
- Conduct nest maintenance to reduce or eliminate parasitic flies from nests by cleaning nest substrate during the non-nesting season. Reduce mortality of nestlings by monitoring nestlings in their first two weeks and treating infested young with an anti-lice spray.

Table 1. Site-specific results of peregrine falcon nesting in New Jersey, 2015

Site Name	Occupied	Active	Eggs	Young Hatched	Young @ Band Age	Young Fledged	2015 Comments
101 Hudson, Jersey City	Y	N	0	-	-	-	
Atlantic City water tower	Y	Y	?	3	3	3	2 banded after grounding
Bayside Prison Water Tower	Y	Y	?	2 (5/4)	2 (6/1)	1	1 died fledging (6/22)
Drag Island	Y	Y	4	4 (5/4)	4 (5/28)	4	
Egg Island WMA	Y	Y	4 (4/12)	4 (5/15)	4 (6/6)	4	
Elizabeth-Union Co Ct House	Y	Y	4	4 (5/6)	4	4	
Forsythe NWR/Barnegat	Y	Y	5	4 (5/9)	4 (5/30)	4	
Forsythe NWR/Brigantine	Y	Y	3	1 (5/28)	1 (6/20)	1	
Great Bay WMA/Water Tower	N	N	-	-	-	-	
Hilton-closed Atlantic Club	Y	N	0	-	-	-	
Logan Generating Plant	Y	Y	4	4 (5/8)	4 (5/26)	4	First year active
Marmora WMA	Y	Y	4	2 (4/5)	2 (5/22)	2	
Ocean Gate	Y	Y	4	3 (5/12)	3 (6/8)	3	
Paulsboro Refinery	Y	Y	4	4 (5/2)	4 (5/26)	4	
Sedge Island WMA	Y	Y	3	3 (5/10)	3 (6/4)	3	
Sewaren Generating Station	Y	Y	?	1 (5/17)	0	0	Rainstorm killed 1 chick
Stone Harbor	Y	Y	3	2 (5/15)	2 (6/7)	1	1 fostered @Tuckahoe
Swan Bay WMA	Y	Y	4	4 (5/10)	4 (5/30)	4	
Trenton-Roebling Bldg	N						Winter birds, new igloo.
Tuckahoe WMA	Y	Y	3	0	0	1	Fostered 1
Wildwood Crest-Grand Condo	Y	N	0	-	-		
SUBTOTAL: TOWERS & BUILDINGS		*16*			*44*	*43*	*2.69 young/active site*
Delaware Water Gap	N	N					
Natural Site C-1	Y	Y	3	3 (5/14)	3 (6/8)	3	
Natural Site C-2	Y	Y	?	2 (6/3)	2 (6/24)	2	
Natural Site C-3	N	N					
Natural Site C-4	N	N					
Natural Site C-5	Y	Y				0	
Natural Site C-6	Y	Y		U	U	2	
Natural Site C-7	N	N					
Natural Site C-8	Y	Y	?			U	
Natural Site C-9	Y	Y	?	2 (5/10)	2	2	
SUBTOTAL: NATURAL SITES	*6*	*6*			*7+*	*9*	*1.5 young/active site*
Ben Franklin Br.	PA				1 (5/28)		
Betsy Ross Bridge	Y	N					Possibly only female?
Burlington-Bristol Br.	Y	Y	4	4 (5/8)	4 (5/29)	4	
Commodore Barry Br.	PA				4 (5/27)		
Geo. Washington Bridge	NY						
Newark Bay Br (NJTP/Conrail)	U	U					
NJ-PA Turnpike Br@Delaware	PA				3 (6/2)		
Ocean City-Longport Bridge	U	U					
Route 1 Br./Raritan	Y	Y		3 (5/3?)	3	3	
Route 3 Br./Hackensack (NJDOT)	Y	Y	?	3	3	3	1 fledgling p/u 7/9; treated/released 9/7, Meadowlands
Route 35 Bridge-Belmar	Y	Y	?	0		0	Incubated 5/1-5/23
Route 46 Br./ Ridgefield Pk	N	N					
Route 72 Bridge (2015)	Y	Y	>1	0	-	0	Coll 1 egg
Scudders Falls Bridge*	PA						
Secaucus-Kearny NJTP Bridge	U	U					
Tacony-Palmyra Br.	Y	Y	4	1 (5/2)	1 (5/26)	1	
Trenton RR Bridge	U	U					
Vince Lombardi – NJTP Bridge	U	U					
Walt Whitman Bridge	PA				4 (6/4)		
SUBTOTAL: BRIDGES (NJ only)	*7*	*6*			*11*	*11*	*1.83 young/ active site*
TOTALS (NJ Only)		28				63	2.25 young/active

Osprey

Project leader: Kathleen Clark, Supervising Zoologist

Objective: To conserve and manage the New Jersey osprey population at a self-sustaining level.

Key Findings:

- NJ Division of Fish and Wildlife biologists last censused the population in 2013, documenting 542 nesting pairs. New pairs located in 2014 (25) and 2015 (31) suggest the statewide population is close to 600 nesting pairs. Recent population growth has slowed from 18% in 2006-2009 to 10% in 2010-2013.
- In 2015, biologists and volunteers surveyed 534 nests and determined outcome at 423 nests (79%) across 12 major colonies on the Atlantic and Delaware Bay coasts and the Delaware River (Table 1). During ground surveys nestlings were banded with USGS leg bands by licensed bird banders.
- Biologists and volunteers conducted ground surveys in June and July to document nest occupancy and productivity at 423 nests (Table 1). We grouped nests by watershed or water-body areas to which they were closest. Nest success averaged 1.74 young per active nest, which is close to the ten-year average of 1.82 young per active nest. Weather was favorable with average temperatures and precipitation. There were one wind storm in early July but did not result in major nest failures. Nest productivity varied by geographic area, with slightly higher productivity (2.11 young/active) at 53 Delaware Bay nests compared to the other regions (1.66 young/active).
- A total of 432 young were banded for future tracking. In addition, we began using an alpha-numeric color band on nestlings banded in Barnegat Bay nests. Thirty-eight red auxiliary bands were deployed this summer to add to the 62 deployed in 2014. A re-sighting project will be implemented to determine nest site fidelity, foraging habitat, and to engage the public in osprey conservation.
- Nine volunteer banders checked nests across ten colonies and donated 175 hours toward the accomplishing this work. A pre-season orientation meeting was held in June to discuss data filing using an Excel format, in addition to reviewing survey and handling methods.
- Twenty osprey eggs were collected during nest visits. Eggs were collected only if they remained when nestlings were at least two weeks of age. Eggs were wrapped in aluminum foil and refrigerated, and were later opened and contents placed in chemically-clean jars and frozen. Eggshells were rinsed and will be archived for measurements.
- All nest locations are maintained in Excel and GIS databases, tracking all occupied nests. Those databases were used to update the state's Biotics database, which is the basis for the Landscape Project critical habitat mapping. We have identified the need for a more streamlined data-handling system, and compiled standardized Excel datasheets for all banders to use. We plan to design and implement an online data entry system for next year.
- Nest locations were made public in 2013 by sharing data with the Center for Conservation Biology's "Osprey-Watch.org" website. We anticipate this website will support citizen reports that help us census and maintain data on the population. Partnering with Osprey-Watch has been a valuable asset, and we received data on 26 nests in 2014 and 29 nests in 2015. Much of this data was from areas where we lacked survey data: the Delaware River, Monmouth County and northern NJ.
- CWF organized volunteers to install six new nest platforms along the Atlantic Coast. CWF also worked to maintain many of the existing platforms throughout New Jersey. Repairs were made to more than 30 nest structures.

Conclusions:

- This year's ground surveys by volunteers and cooperators documented one of the highest nest success rates for a population estimated near 600 pairs. Weather conditions during the nesting season were relatively mild, with no major storms causing damage nests during incubation or chick-rearing.
- The coordination of volunteers and licensed banders by CWF-NJ has made it possible to accurately track occupied nests and nest success as a measure of population stability.

- ENSP's partnership with the Conserve Wildlife Foundation of NJ has improved the availability of functional nest platforms for ospreys, which directly supports the stability and growth of the osprey population in the state. The future of the osprey population is heavily dependent on the long-term maintenance of suitable nest structures, assuming that the availability of dead trees will continue to be limited in the highly developed barrier islands of NJ.

Recommendations:

- Conduct a population census every four to five years (next survey in 2017/18) to monitor population changes statewide and regionally. Maintain integrated databases on the population and nest locations on an annual basis, so they can inform habitat mapping and land-use regulations.
- Continue to measure annual productivity of ospreys to monitor regional conditions and trends (e.g., Atlantic vs. Delaware Bay regions, and Atlantic subregional comparisons), as nest success is one of the most accurate means of monitoring threats and population stability. Recruit and train additional volunteers to conduct nest checks.
- Continue to refine the data-reporting system to ease data handling.
- Continue to collect addled and unhatched eggs to archive for monitoring contaminant levels regionally and statewide.

Table 1. Osprey nesting and productivity in 2015 in all NJ nesting areas. Productivity determined by aerial and ground surveys in May-July. Productivity rates in 2014-2011 provided for comparison.

						Previous Years			
Nesting Area	**# Nests**	**Known-Outcome Nests**	**# Young**	**# Banded**	**Productivity 2015**	**2014**	**2013**	**2012**	**2011**
Delaware River & N. Jersey	5	5	10	0	2.00	n/a	n/a	n/a	n/a
Hackensack River/s	3	3	3	0	1.00	1.20	1.50	2.33	2.67
Raritan Bay & Cheesequake	44	15	29	13	1.93	1.92	1.74	2.00	1.54
Monmouth County	23	11	14	2	1.27	2.00	2.00	2.20	2.00
Barnegat Bay	63	49	65	37	1.33	1.48	1.88	1.94	1.88
Sedge Islands WMA	28	20	33	15	1.65	1.05	2.00	2.10	2.38
Great Bay to Atlantic City	83	59	86	36	1.46	1.84	1.79	1.68	2.12
Great Egg Harbor/Ocean City	73	66	121	62	1.83	2.30	2.09	1.32	2.43
Sea Isle City	35	30	56	23	1.87	2.43	1.68	1.78	1.91
Avalon/Stone Harbor Bays	63	57	100	79	1.75	2.12	1.79	1.75	2.02
Wildwood Bays & Cape May	34	32	60	38	1.88	2.46	2.00	2.13	1.50
Maurice River & Estuary Marshes	70	67	144	127	2.15	2.30	2.12	2.09	2.06
Salem Co./ Artificial Island / Delaware	10	9	16	0	1.60	2.50	1.90	1.62	2.38
TOTAL of Study Areas	**534**	**423**	**737**	**432**	**1.74**	**2.02**	**1.92**	1.81	2.07
Atlantic Coast only	449	347	577	305	1.66	1.97	1.88	1.76	2.07
Delaware Bay only	80	76	160	127	2.11	2.32	2.09	2.00	2.10
Total Statewide		**423**	**737**	**432**	**1.74**		**542**		

American Kestrel

Project leaders: William Pitts, Assistant Zoologist, & MacKenzie Hall, Environmental Services

Objective: Gather and analyze data to inform conservation status and recovery plan actions of this species.

Key Findings:

- Late in 2014, staff changes resulted in new leadership roles within the kestrel project. With those changes, the ENSP took the opportunity to refine the nest box project and remove nest boxes that had never been productive or had not been occupied by kestrels in years. Many of the removed boxes were from suboptimal locations, or where volunteer help or landowner support was lacking. In a few cases, nest boxes or their supporting structures had simply broken or fallen down and may be replaced. In all, the ENSP selected 153 nest boxes for monitoring in 2015 (Figure 1), focusing on the most productive boxes from our original study areas while adding a small subset of boxes (5 or so) from partners' efforts where kestrel activity had been documented in the previous five seasons. Additionally, partners from the Nature Conservancy (TNC) installed and monitored 40 new boxes in 2015 in Salem, Cumberland, and Cape May Counties. These new study areas expand the nest box program to other important habitat areas for kestrels in NJ while maintaining representation within all previous study areas (Clinton, Amwell Valley, Assunpink, and Southern NJ). New study areas will be reassessed after four more years, when plans for continued monitoring will be based on kestrel activity (or lack thereof) and partner/volunteer support.
    - Four new volunteer monitors were recruited and trained in 2014. Staff at Duke Farms (Hillsborough, Somerset Co.) installed two new boxes in 2015 and plan to move at least two others for the 2016 season in order to improve their chances for success. The ENSP will be informed of all new nest box locations by Duke.
    - A total of 155 nest boxes were monitored every 12-15 days from April through early August 2015: Fourteen volunteers monitored 114 nest boxes while staff monitored 41 boxes.
        - Of the 155 actively monitored nest boxes, 38 (24.5%) were occupied by American kestrels. Three of the Nature Conservancy's 40 boxes (7.5%) were active and nestlings were banded by the ENSP in 2015.
        - Of the total nesting attempts (n= 41), 28 (68%) were successful, as defined by a nesting attempt resulting in nestlings that reached the bandable age of 14-22 days. Thirteen nests or nesting attempts (32%) failed.
        - Volunteers and staff continually entered data online through a Google documents interface following each nest box route check.

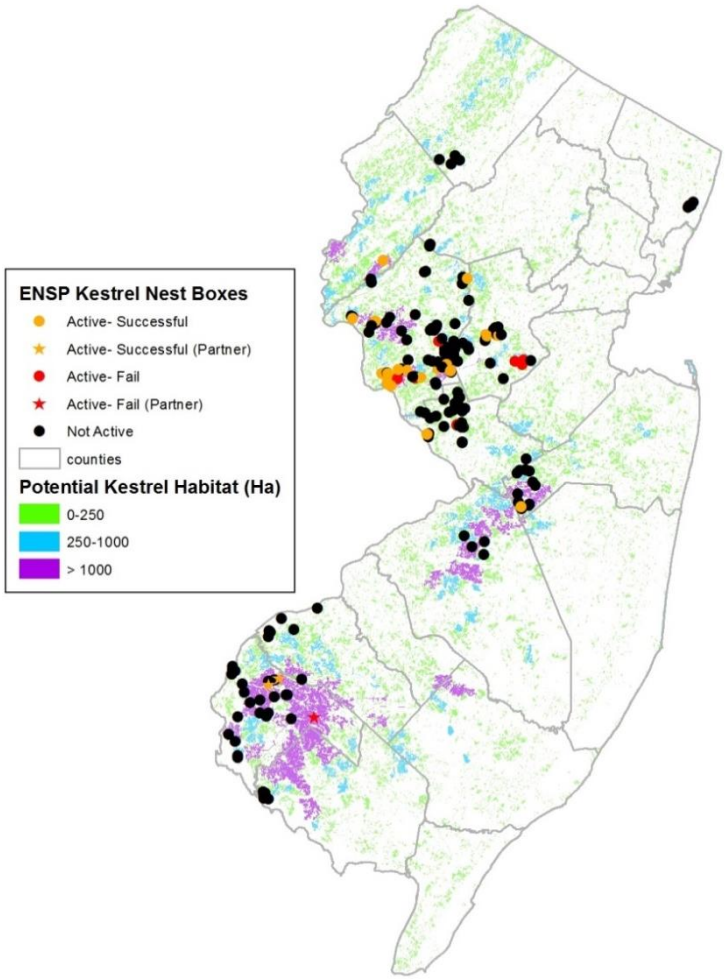


Figure 1. American kestrel nest boxes monitored in

    - Nesting success was lower in 2015 (68%) than 2014 (76%), but slightly higher than 2013 (66%). Total nesting attempts were slightly higher in 2015 than the previous year (41 vs. 38), however when looking at only the ENSP's monitored boxes (i.e. excluding the Nature Conservancy's three new active boxes), the attempts were

the same for both years (n=38). Average productivity per successful nest was 3.82 in 2015, and productivity for all occupied nests was 2.61; both of these figures are down from 2014 but higher than in 2013.

- The predictive American kestrel patch model (patch sizes 0-250 ha, 250-1,000 ha, and >1,000 ha) of suitable kestrel habitat in NJ was not updated with the 2012 LULC source for patches because the layer is not yet completed. With the previous project lead leaving the ENSP in fall 2014, this goal may not be completed.
- Based on the existing patch model, 63% of the 2014 nest boxes were placed in the top two patch categories, 250-1,000 ha and >1,000 ha, which is consistent with previous years' findings.

- The 2015 banding season resulted in the following:
  - 131 kestrels were newly banded in total: 107 young (60 female, 47 male) and 24 adults (22 female, 2 male) were banded at 23 nest boxes. All banding data was supplied to the Bird Banding Lab via BandIt.
    - Eleven previously banded adults were recaptured (8 female, 3 male). Three female kestrels originated outside of our nest box program; all three were found to have been banded as fledglings in eastern Pennsylvania in 2014. The remaining recaptured birds had been banded by the ENSP prior to the 2015 season; their bands dated back as far as 2010 (one bird, banded as a fledgling) and 2011 (two birds, banded as fledglings).

Geo #F071 – AMKE adult female (band # 1783-22152) from nest box AV94 in Ringoes, Hunterdon Co.

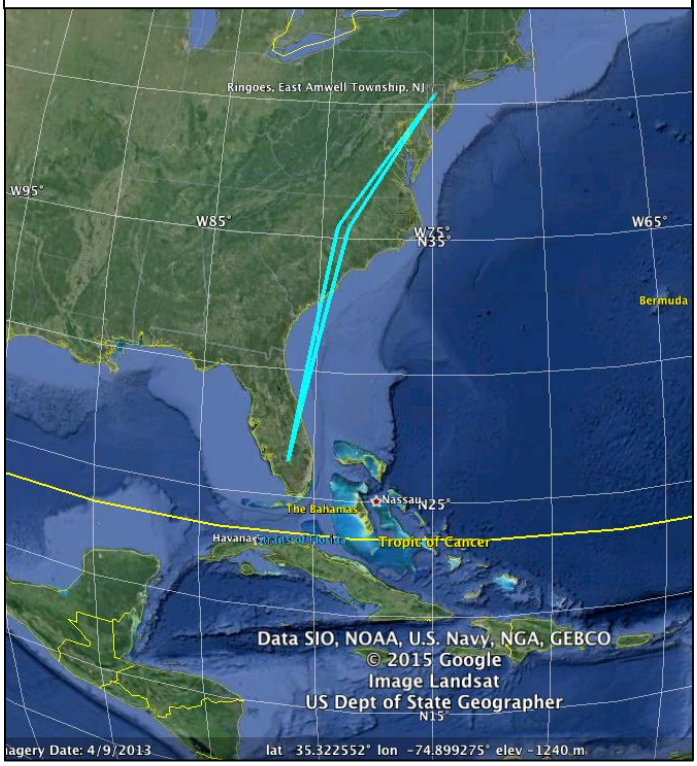


Figure 2. Map of a kestrel's seasonal movements, as interpreted fromgeolocator data. Note: Lines connect known stopover points but do not infer the bird's route of travel.

  - Of the 15 light-sensing geolocators placed on adult female kestrels in 2013, five were recovered in 2014; four from birds recaptured at nest boxes and the other from a kestrel found dead in Quakertown, PA. None of the remaining ten host birds were recaptured in 2015, despite a focused effort to do so. New adult females were found nesting in six of the boxes used by "geo birds" in 2013, suggesting that our host birds have either perished or been replaced at those sites.
    - Light and temperature data from the five recovered geolocators were analyzed by Ron Porter, an invaluable project partner and geolocator pioneer. Results indicate that three of the female kestrels remained in the same general area in winter as in the summer, while the other two migrated to south Florida for winter (Figures 2 and 3). Abrupt changes in the daily light signatures round dawn and dusk suggest that both Florida birds spent nights in a barn or other structure. Light data collected by the geolocators offered insights about nesting behavior as well. For example, the length of incubation bouts and amount of time spent outside the nest box can be determined. One bird was always inside the box at dawn, typically incubated her eggs for 1-3 hours at a time, and made 10-15 minute long trips outside the box.

Geo #F069 – AMKE adult female (band # 1783-21800) from nest box AV48 at Duke Farms in Hunterdon Co.

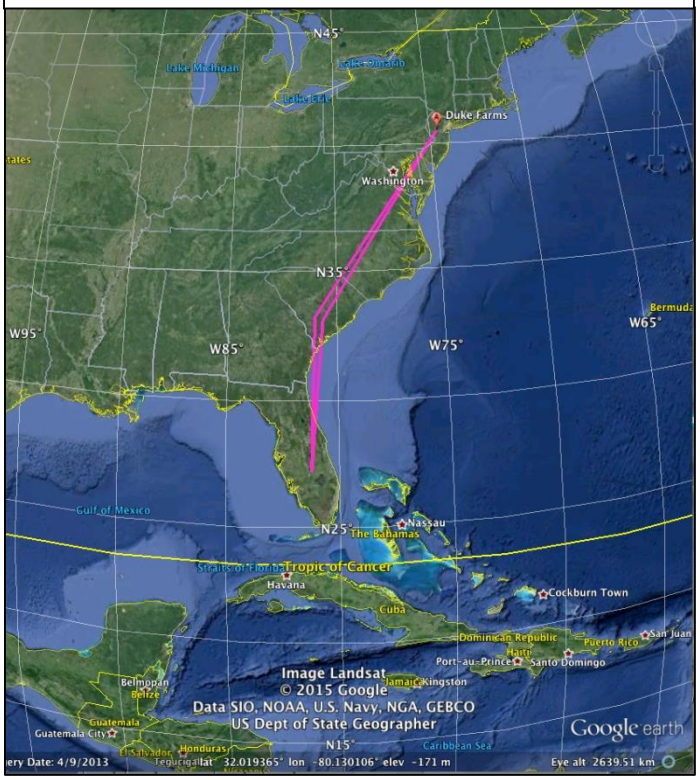


Figure 3. Map of another kestrel's seasonal movements, as interpreted from geolocator data. Note: Lines connect known stopover points but do not infer the bird's route of

- Five new geolocators were deployed on adult female kestrels in 2015; four in Hunterdon County and one in Mercer County. One of the birds (a 5-year old in Hunterdon Co.) was an original geolocator subject from 2013; recovering her geolocator in 2016 will give us our first multi-year glimpse of a NJ kestrel's seasonal movements.
- Due to lack of staff time a nest box manual was not created.
- The Peregrine Fund did not hold an annual meeting in 2015, thus no staff attended.

Conclusions:

- Nest box placement has been successful; we have determined and maintain that open habitat patches >250 ha are the most suitable and should be the priority for kestrel management.
- Volunteers are a critical component for successful monitoring and data collection. The ENSP must work on maintaining volunteer relationships because we do not have the staff resources to adequately monitor the current nest box program.
- Banding chicks and adults provides good baseline data for tracking survival, turnover and breeding territory fidelity in the NJ population. This data may help identify problems related to population declines.
- The ENSP monitored fewer nest boxes in our historic project areas but maintained a success rate on par with previous years. This change allowed us to maximize staff and volunteer time as well as the number of kestrel pairs monitored. We will continue to refine our approach based on occupancy data.
- Through a new partnership in southern NJ with TNC, we have found that the most productive areas in Salem and Cumberland Counties for American Kestrels tend to be closer to farmlands that are less intensively farmed (smaller scale operations) and areas of grazed pasture. These areas will continue to be investigated by TNC in 2016.
- Our new urban study area in Bergen County had no known nesting attempts in 2015. We will reevaluate the placement of these boxes after the 2016 season if it continues to be unproductive.

Recommendations:

- Identify a sample of nest boxes in our most productive areas to determine occupancy by kestrels and competitors, kestrel productivity, and causes of mortality and nest failures. Attempt to quantify starling nesting competition.
- Review historical data to further identify and characterize unproductive nest boxes, and relocate them to locations in the largest patch size categories and to properties that are permanently protected from development in order to maximize use by kestrels.
- Investigate the possible effects of pesticides, cultivation practices, and other factors on kestrel success.
- Continue to evaluate the effectiveness of the nest box program in aiding kestrel recovery.
- Recruit and train additional Citizen Scientist volunteers to monitor nest box activity throughout the breeding season.

- Increase efforts to capture and band adult kestrels and maintain efforts to band all nestlings to enable evaluation of survival and site fidelity.
- Develop a framework and funding for investigating kestrels' use of habitats along their migration routes, and the significance of habitat loss along those routes, using geolocator data as examples.
- Draft an update to the comprehensive report and create a preliminary geolocator report with current findings to add to Raptor Webpage.
- Build relationships with other researchers across the northeast via the American Kestrel Northeast Working Group, and continue relationships with the Peregrine Fund's Kestrel Program.

Woodland Raptors

Project leader: Kathleen Clark, Supervising Zoologist

Objective: Gather and analyze data to inform conservation status and recovery plan actions of woodland raptor species.

Key Findings:

- No additional work was done since the 2013-2014 project year due to time constraints that came with other work, particularly the State Wildlife Action Plan revision. Preliminary analysis of the transect-based surveys of woodland raptors (barred owl, red-shouldered hawk, Cooper's hawk, northern goshawk) suggested that the data were not reliable enough to provide trends due to changes made in routes in response to habitat loss. The next step is to revisit the analyses for other conclusions and for informing redesigned survey methods.
- Other work on habitat use by barred owls continued under a separate grant (NJ W-70-R-1).

Conclusions/Recommendations:

- We recommend working to conclude this study so that ENSP can adopt the best survey protocols to detect population trends in woodland raptors, and to use survey and occurrence data to identify optimal forest habitat conditions. Seek to implement best management practices for forest-dependent SGCN birds within the state's forestry management system.

Subjob A.2. LANDBIRDS

Golden-winged Warbler

Project Leader: Sharon Petzinger

Objective: To conserve and manage the New Jersey golden-winged warbler (*Vermivora chrysoptera*) population and gather and analyze data to inform conservation status and recovery plan actions of this species.

Key Findings:

- Biologists surveyed 107 points in the spring 2015 for golden-winged warblers in potential habitats (utility ROW, shrub swamp, successional forest, old field) to aid in the identification of priority areas for golden-winged warbler management. General habitat data were collected at all survey points in 2015.
  - Eighty-four of the points were in NJ, 23 were in NY.
  - Twenty points were part of the Golden-winged Warbler Atlas Project (GOWAP), a regional effort to monitor GWWA population trends and changes in distribution.
  - Eight points had never been surveyed for GWWA prior to 2015.
  - One previous GWWA point could not be surveyed in 2015.
- NJ Audubon surveyed 15 additional points, using a similar protocol, within select spans of PSEG's utility ROW and provided ENSP with nine additional golden-winged warbler observations. No other data (other spp., habitat) were provided

- Out of the 122 locations surveyed in 2015, 25 golden-winged warblers and seven hybrids were observed, and 66 blue-winged warblers were observed in 107 survey locations. Nineteen golden-winged, 50 blue-winged, and all seven hybrid (6 Brewster's, 1 Lawrence's) observations were in NJ.
    - Three (6%) of the 47 NJ locations occupied by golden-winged warblers in 2014 were not occupied in 2014, and 3 (7%) of the 43 locations without golden-winged warbler observations in 2014 were recolonized in 2015.
- None of the 16 golden-winged warbler males banded in 2012, 2013, or 2014 were observed in 2015.
    - Two male golden-winged warblers were mist-netted and color-banded in 2015.
- Data will be submitted for entry into the NJ DEP's Biotics database by mid-November.
- Staff attended the Appalachian Mountain Joint Venture Technical Meeting in Blacksburg, VA from August 18-20, 2015.
- The area of forest and shrubs around each golden-winged warbler survey point are being calculated to inform the golden-winged warbler status assessment and recovery.

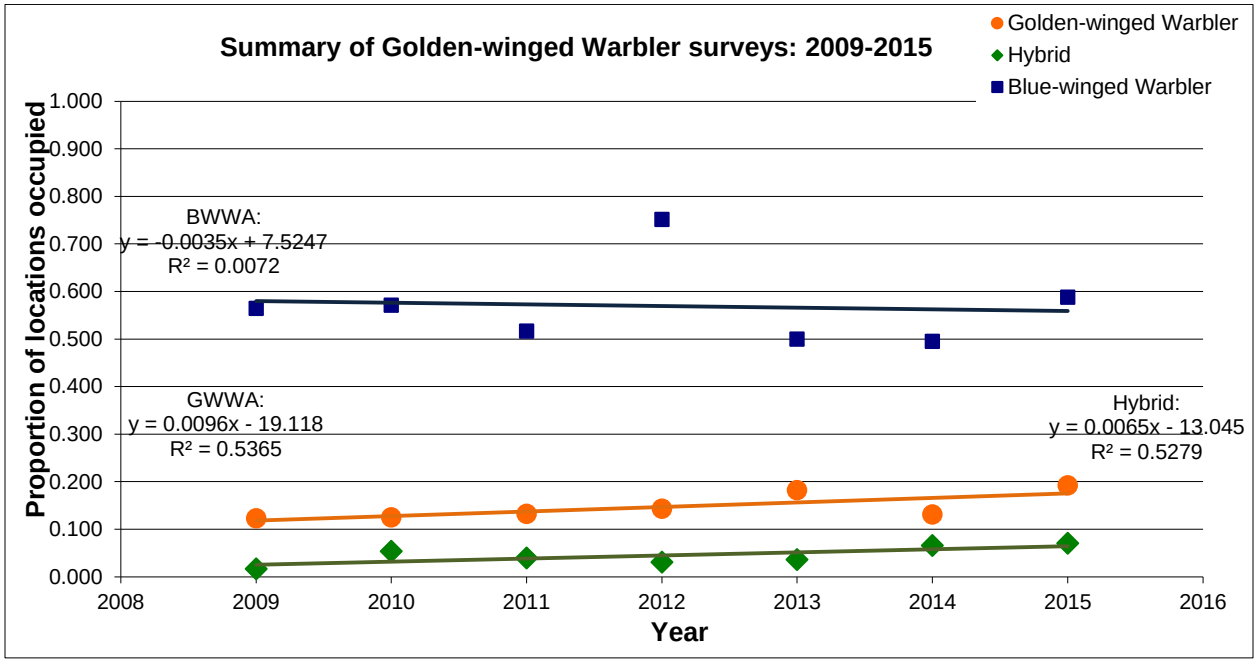


Figure 1. Proportion of golden-winged warblers, blue-winged warblers, and hybrids observed per survey location during the 2009 (n=179), 2010 (n=117), 2011 (n=151), 2012 (n=161), 2013 (n=110), 2014 (n=107), and 2015 (n=100) surveys.

Conclusions:

- The number of breeding golden-winged warblers observed in NJ has been fairly stable since 2011, but the proportion of survey locations occupied is slightly increasing at a rate of 1%/year since 2009 (Fig. 1). In 2015 we observed another net gain of breeding GWWAs (based on: previously vacant sites recolonized + new occupied sites discovered - previously occupied sites lost). Similar to 2014, about half of NJ's observed golden-winged warbler breeding population was located on a 1.5-mile stretch of utility right-of-way maintained by PSEG.
- Blue-winged warblers are slightly decreasing while hybrids are slightly increasing overall. However, when looking at only repeated survey points, GWWAs are increasing 2%/year, BWWAs increasing 4%/year, and hybrids 0.5%/year. Over the past few years it appears as though there is an inverse relationship between the proportion of locations with BWWAs/hybrids and GWWAs (Fig. 2).
- Collaboration with PSEG regarding the maintenance of their spans where almost half of NJ's GWWAs are breeding has been successful in retaining most of the breeding pairs in that area – one GWWA area that was lost was the only area along that ROW that was mowed in winter 2014.

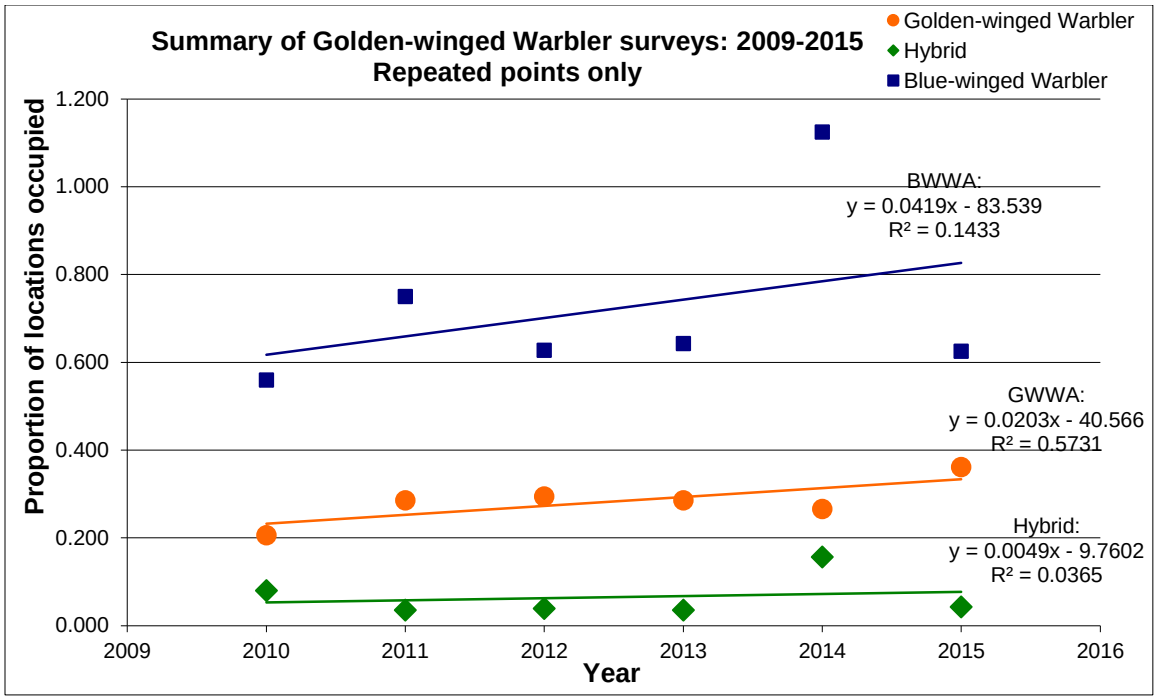


Figure 2. Proportion of golden-winged warblers, blue-winged warblers, and hybrids observed per repeated survey locations in 2009-10 (n=25), 2010-11 (n=28), 2011-12 (n=51), 2012-13 (n=56), 2013-14 (n=64), and 2014-15 (n=47).

Recommendations:

- Continue to coordinate surveys with NJ Audubon and GOWAP.
- Continue to collaborate with PSEG to retain the breeding GWWAs on their spans.
- Without the maintenance of existing and/or creation of new breeding habitat in NJ specifically for golden-winged warblers, the population will once again begin to decrease as NJ runs out of new potential breeding sites to survey, and occupancy or recolonization of previously-occupied sites continues to decline.
    - Continue to provide technical assistance pertaining to forest management for golden-winged warblers on private and public lands, including WLFW.
    - Continue to work with utility companies, NJ Division of Parks and Forestry, NJ Division of Fish and Wildlife's Bureau of Land Management, Morris County Park Commission, and The Nature Conservancy-New Jersey Chapter to manage the last remaining active golden-winged warbler breeding areas.
- Complete the status assessment and draft species recovery plan for golden-winged warblers in NJ.

Grassland LIP Evaluation

Project Leader: Sharon Petzinger

OBJECTIVE: To conserve and manage the New Jersey grassland bird population and analyze data to inform conservation status and recovery plan actions of these species.

Key Findings:

- Due to staff departures, predictive models, habitat management guidelines, and a status assessment for grassland bird species were not completed.

Conclusions and Recommendations:

- Further data analyses should be done that will help develop habitat management guidelines and models to prioritize parcels and management activities for specific grassland bird species.

Conservation of Migrants

Project Leader: Kathleen Clark

Objective: Identify and enhance critical habitat necessary to maintain the concentrations of migrating birds that rely on NJ's coast and peninsula for successful migration.

Key findings:

- ENSP biologists continued to work with other DFW biologists and others in DEP to create plans to enhance habitat around Cape May Point, on Higbee Beach Wildlife Management Area. The restoration of Pond Creek marsh will result in converting approximately 170 ac of Phragmites-dominated brackish marsh into a more tidally-influenced estuarine and mudflat system. Partly as a result of ENSP input, the restoration will include an upland dike to protect ~100 ac of freshwater wetlands from saltwater tidal inundation during restoration of the inlet and flow to Pond Creek. Non-federal funding was secured and engineering was completed. Staff reviewed the engineer's surveys and recommended water depth targets for the marsh plain to benefit marsh birds and shorebirds, and other migrating birds.
- Pre-construction surveys for bird use were conducted in September-October 2013, and post-restoration surveys are planned.

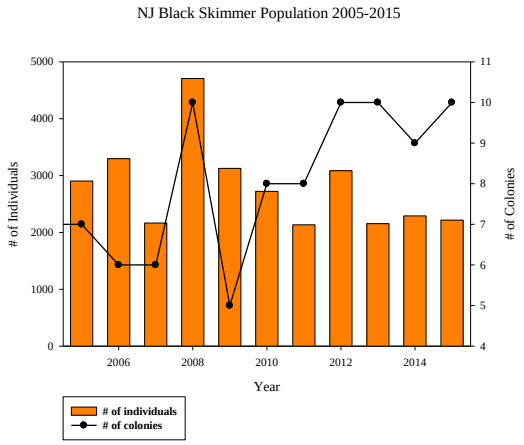
Conclusions/Recommendations:
Outside funding for habitat restoration in the Cape May peninsula provides good opportunities for ENSP to help improve conditions for migratory birds that rely on this peninsula stopover. Habitat enhancement is a critical need given the continuing loss of habitat to residential and commercial development. ENSP should continue to leverage outside and non-federal funding to accomplish our objective of maintaining important habitats for migrating birds.

Subjob A.3. SHORE AND MARSH BIRDS

Beach nesting Birds (Piping Plover, Black Skimmer and Least Tern)

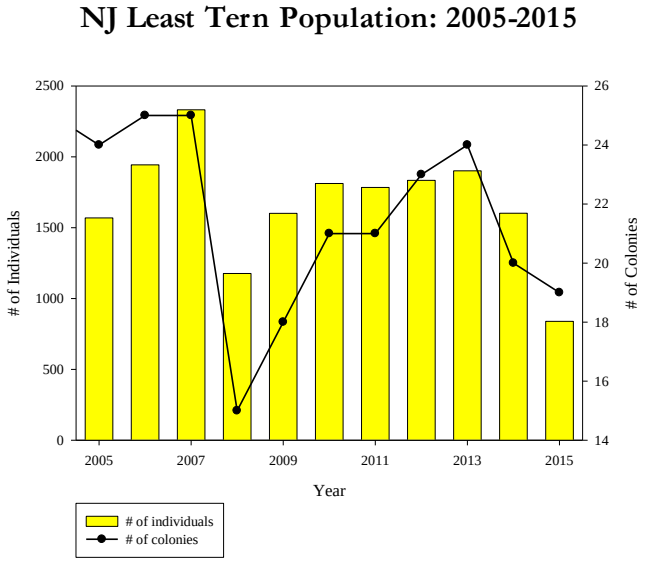
Project Leaders: Christina Davis and Dave Jenkins
The portions of this job applying to Piping Plover are jointly supported by State Wildlife Grants and ESA Section Six funding.

Key Findings:
Black Skimmer



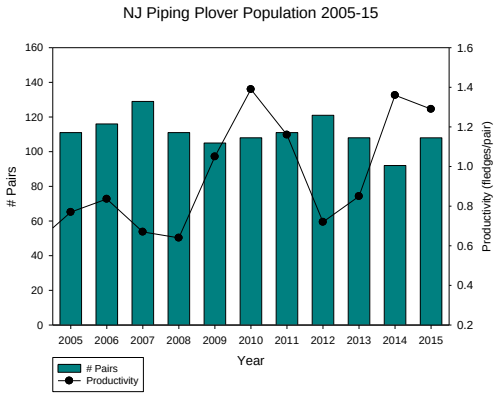
- Black skimmer breeding surveys were conducted approximately every two weeks from mid-May until the end of September on beaches along the entire Atlantic coast and marsh islands from Barnegat Bay south. Surveys took place at 20 sites and active nesting (at least one nest with eggs) was observed at 10 sites. Observations were made at these locations for the duration of active nesting at each site. A total of 2,216 adults were present at the active sites (this figure is usually based on a cumulative total of peak counts that occurred in the peak survey period but this year the nesting was disjunct and it made more sense to sum site peak totals, regardless of survey period). As has been the case in recent years, the majority (85%) of the state's known population was present at just one site, which was located at Seaview Harbor Marina (1,873).
- A peak count of 450 adult black skimmers was observed incubating. The incubation number was lower than might be expected given the number of adults present and was likely lower than what actually nested. As is generally the case, the vegetation at the two largest colonies blocked observers from garnering an accurate count of these ground nesters. However, predator pressure was so intense that it was not worth increasing the vulnerability of the colony by walking through it to count nests (and which ENSP biologists have never found to be an effective count method).
- Black skimmer productivity was high, with 1,518 fledglings produced statewide, or 3.37 chicks per pair, a figure that is clearly an overestimate given the issues in the pair count numbered detailed above. If we simply halve the total adult number and use that as pair count, the productivity becomes 1.37. The true rate is likely somewhere in the middle but even 1.37 represents an excellent year for this species. Only two sites fledged young, with almost all the young (90%) produced at one site, Seaview Harbor Marina, and the remaining 10% at Belmar – Shark River Inlet, a new site for black skimmer nesting. Predation was the primary factor responsible for poor reproductive success at other beach strand sites. For the marsh nesting birds, the reasons for the failures were not known, but likely flooding and predation, given the lower number of observations at those sites.
- ENSP staff surveyed for the second year the marsh island sites located between the barrier islands and mainland. These sites made up the majority of the non-active sites, where adult nesting behavior was observed but no nesting was recorded. Marsh island sites are more difficult to determine outcomes due to the longer periods between visits. Although all sites are visited at least once every 2 weeks, the beach strand sites are visited at a far greater rate due to related work with other species and ease of access.

Least Tern



- Least tern breeding surveys were conducted approximately every two weeks from mid-May until the end of August at beaches along the entire Atlantic coast. Colonies were located at 19 nesting sites and observations were made at these locations for the duration of the nesting season. A total of 839 adults were present at these sites (based on a cumulative total of peak counts that occurred in the 16-31 June survey period). The population was distributed fairly evenly throughout the state and six colonies had >100 adults with one colony nearly 300 strong. The largest colony was located in Seaview Harbor Marina, with 273 adults on its peak count followed by Belmar- Shark River Inlet with 178 adults at its peak. The adult numbers were similar to 2014 but down from recent years. Some of this lower number was likely due to some adults at Sandy Hook not being tallied (adults are only "counted" if associated with active nesting. If observers somehow miss the period of incubation between laying and nest loss, those adults may not get officially counted, which appeared to be the case at Sandy Hook in 2015 to a larger degree than normal). Some of it was related to the difficulty in tallying birds in dense vegetation and some of it was because eroded sites, like Strathmere Natural Area, continued to be unavailable for nesting.
- A peak total (census period of 1-15 June) of 409 adult least terns were observed incubating. Productivity was good for least terns with 281 fledglings produced statewide (0.64 chicks per pair, based on the peak number of incubating adults). The fledge rate represents high productivity for this species in New Jersey and was one of the most successful seasons in recent years (even if the adult tally was a bit underestimated). Low levels of flooding and increased predation management were likely to have influenced this outcome.
- A project to restore habitat on Ring Island for black skimmers attracted both American oystercatchers and least terns. The two tern pairs fledged three chicks and by season's end, fifteen least terns were observed roosting at the site. This represents the first known occurrence of nesting least terns on a marsh island since 1992. In the 1970s and 80s, this was a far more common occurrence but unknown factors, possibly related to sea level rise, erosion and the vegetation of dredge material islands, have dramatically reduced marsh islands as major nesting areas in the state.

Piping Plover (*Full Piping Plover reporting can be found in NJ E-1-37*)



- One hundred eight (108) pairs of piping plovers nested in New Jersey in 2015, a 17% increase from 2014 (92). Despite the increase, the current number of nesting pairs remains below the long-term average since federal listing (118 pairs) and significantly below the peak count of 144 pairs in 2003. Furthermore, the statewide population trend remains flat to slightly declining over the period since federal listing, once you factor in an initial population "bump" due to an increase in survey intensity immediately following listing
- The total number of adults recorded for the entire nesting season (218) was somewhat higher than during the date-restricted survey conducted June 1-9 (205). Likewise, the number of pairs tallied during the entire nesting season (108) was higher than the pairs recorded during the date-restricted census (95).
- Pairs nested at 19 sites statewide, down from 21 sites in 2014, and well below the peak count of 30 sites recorded in both 2004 and 2005. It was the lowest total since federal listing. As in most years, ENSP monitored more than half of the state's *active sites* but the total number of *active pairs* monitored by ENSP remained far lower than would be suggested by the number of sites monitored. ENSP monitored 10 of the active nesting sites (52% of the sites statewide), accounting for 17 nesting pairs (16% of the nesting pairs statewide), the lowest proportion ever recorded. This continued downward shift in the percentage of pairs monitored is the result of multiple variables (including degraded habitat at some sites and the sharp jump in pairs at Sandy Hook, monitored by the National Park Service) and is deeply concerning for the long-term viability of this population. Notably, there were just seven pairs and one chick fledged from all of Cape May county.
- Statewide pair-nest success (the percentage of pairs that successfully hatch at least one nest) increased in 2015 compared to 2014 (79% vs. 75%, respectively), and above-average for the period since federal listing (68%). Looking at just ENSP-monitored sites, 2015 pair-nest success (65%) was lower than the state-wide tally, about on par with the period since federal listing (66%) and higher than 2014 and 2013 (47% and 59% respectively).
- The statewide fledgling rate, which incorporates data collected by all the state cooperators was 1.29 fledges per pair, a slight decrease from 2014 (1.36 fledges/pair). Although still below the 1.50 fledglings per pair recovery goal, it was above the 1.245 fledglings per pair range-wide threshold for population maintenance established in the USFWS Recovery Plan for the Atlantic Coast population of piping plovers (USFWS, 1996) and the average for New Jersey for the period since federal listing (0.99 fledges/pair). Productivity at ENSP-monitored sites (1.41 fledges/pair for 17 pairs) was nearly double the 2014 metric (0.74 fledges/pair) and also the 2015 statewide tally, an unusual occurrence.

Conclusions:

- In 2013, it was noted that the **black skimmer** statewide breeding population appeared to have shrunk back to the lowest numbers seen since 2004. 2015 did not seen greater declines, but appeared to stay in the same

range as 2013-2014. It is still not clear whether this is a new long-term trend, the result of less suitable nesting habitat, depressed productivity for a number of years, predator pressure or just that the birds are moving around the region (such as to NY). NY DEC has begun banding some of their skimmers and ENSP staff did observe some of these in NJ later in the season so there is confirmation of some degree of movement, but whether that is just post-breeding or something more remains to be seen.

- Black skimmer productivity was higher than it has been in many years, which was a relief to ENSP as these numbers have been on the dismal side recently. The increase is at least partially attributed to another year of low flood rates and a focused predator management effort at some key sites. Predator management must remain at the forefront of recovery strategy and be sustained if skimmers are to continue to be successful statewide.
- With breeding behavior observed at 20 sites and confirmed nesting at 10 sites, ENSP is less concerned about the small number of nesting colonies than it was in the late 2000s (down to five colonies in some years). In fact, as noted in Key Findings, ten may have been an underestimate as many of the sites where no was nesting confirmed were areas that were not visited more than once/two weeks. However, the fact that the majority of the birds are at just one site continues to be a cause for concern.
- The impact of sea-level rise in the marsh islands may be impacting occupied nesting areas. The largest colonies are located either on the beach strand or on large, relatively stable marsh islands with a sandy substrate. Whether or not this represents a true move away from wrack nesting marsh colonies or is just an anecdotal observation is yet to be determined but something ENSP will be closely tracking in future years.
- ENSP staff continued to monitor the marsh islands for black skimmer by boat surveys in 2015 (prior to 2013, this work was contracted out but ended due to lack of funds) with only moderate challenges. It was time consuming but since there are fewer piping plovers than years past, staff was able to adhere to a workable schedule.
- The statewide **least tern** breeding population was the lowest it has been in over 10 years and remained low with respect to the long-term trend. Productivity, however, in 2015 was very high for this species (1.21 chicks per pair), an encouraging sign that the predator management and other protective measures worked well this year. A decided lack of flooding also helped produce this outcome.
- The number of active least tern colonies (19) was a decrease over 2014 (20). However, it is in line with long-term trends for least terns where over time numbers of colonies have ranged from the mid-teens to the mid-20s. Some of the decrease was due to erosion of sites, such as Strathmere Natural Area, that previously hosted colonies.
- The state recorded its second consecutive year of strong productivity for **piping plover**, well above the long term average in New Jersey and above the levels believed necessary to maintain a range-wide stationary population. Last year's robust productivity likely helped spur the population growth seen in the state this year, as productivity and abundance are typically fairly closely correlated in New Jersey, thus one would expect the population to continue to grow or at least not lose ground next year, as well. While these are positive results, any chance for long-term recovery still rests with sustained higher than average productivity, which has proved difficult to achieve in New Jersey.
- As is starting to become the norm, the larger federally managed sites (Sandy Hook, Holgate and Little Beach) held the majority (85%) of the state's pairs (up from 79 % and 72% in 2014 and 2013). Accordingly, all possible efforts to ensure the birds at these sites succeed should be paramount to the state's beach nesting bird program. However, increasing the number of pairs and raising the productivity level at other locations in the state will be the only way to meet regional recovery goals as the major sites reach capacity.
- The fruits of increased predator control efforts and Hurricane Sandy's habitat improvements continued to be reaped in terms of strong statewide reproductive success. At sites that did not perform well, predation was the key factor that led to low reproductive success as flooding continued to have negligible impact on nesting birds (it is unclear why this is, but some speculate that Sandy increased the elevation of the berm just enough to prevent flooding of nests). Documented predators included fish crows, laughing gulls, peregrine falcons, red fox, and cat as well as unidentified species.
- ENSP continued to use predator exclosures judiciously in 2015 with 46% of nesting attempts were exclosed (statewide was 64%). Of the nests not exclosed, 62% were lost to predation, a not unexpected outcome. The

exclosed hatch rate for ENSP nests was 85%, much more in line with normal rates and better than 2014's 44% which was related to a high abandonment rate.

- Seaview Harbor Marina's importance to all beach nesting species continued unabated this year. In addition to housing the vast majority of the black skimmer adult and fledges, it also hosted a least tern colony, a common tern colony and American oystercatchers (a piping plover pair nested on the adjacent site in Hurricane Sandy created habitat but would have otherwise likely been at the marina). Belmar- Shark River Inlet, in Monmouth County, was a strong back-up to Seaview, hosting good numbers of many beach nesting species and producing many fledges.
- Hurricane Sandy was detrimental to many human landscapes around the state but for beach nesting birds, the overall net impact to their habitat continued to be extremely positive. The uptick in plover numbers was due, in part, to the excellent nesting and foraging conditions that existed in 2014 and allowed high productivity in that season, resulting in more adults returning this year. Given this was also the third year of near-record low number of flooding events on the beach strand it continues to be hypothesized that even in areas that visually looked the same as pre-storm conditions, sand distribution may have been such that some areas gained elevation, making them less prone to flooding. This third field season post-Sandy may be the last of optimal conditions and although the habitat should hold for another season or two, vegetation will begin to creep back in and return many areas towards pre-storm conditions.

Recommendations:

- Continue to annually monitor population and productivity at least tern and black skimmer nesting sites along the Atlantic Coast (as well as black skimmer colonies on marsh islands) about once every two weeks during the breeding season in order to make a statewide assessment of population trends. Consider increasing the number of visits to marsh island locations as staff and resources allow.
- Periodically monitor (no less than once every three years) other back bay island complexes within the coastal region of the state to ensure that large numbers of skimmers are not nesting in these areas. When sites are identified through this or other means, such as the long-legged wader aerial survey, include them in the once every two weeks survey rotation.
- Continue to incorporate management strategies for piping plovers, black skimmers and least terns into comprehensive beach management plans being developed for municipalities in the coastal zone. Develop similar plans for state managed parks and natural areas.
- Continue to refine a comprehensive predator control plan as it is the primary way forward to recovery for these species. Work within and among DEP Divisions to obtain permission and create action plans for state lands, continue to encourage federal partners to do the same and work on initiatives to complete more aggressive predator control on municipal lands.
- Lead and/or coordinate restoration efforts to improve beach nesting bird habitat as Hurricane Sandy created habitat and other locations lose their suitability. Targeted sites include Barnegat Light, Malibu Beach WMA and Cape May Point State Park.
- Continue to make every effort to allow Seaview Harbor Marina's beach nesting birds to flourish. This includes continuing intense predator control but also considering undertaking vegetation thinning to ensure the habitat stays suitable for as long as possible.
- Continue intensive monitoring of piping plover populations and reproductive success, and continue monitoring to ascertain causes of nest failure and brood loss. Encourage research projects focusing on improving reproductive success for all three species by reaching out to potential collaborators, supporting their proposals and providing technical guidance as needed.
- Work with regional partners, through in-person meetings and conference calls, to ensure that NJ is making the best decisions possible when it comes to predator exclosures. What was once an important management tool may no longer so as NJ continues to evaluate their use and determine future paths to reproductive success for piping plovers.
- Continue to follow the piping plovers that were banded in 2012-13 and 2015 (though a non-state research project). Monitor arrival and departure dates and local movements of all banded birds. Peruse records of

observations of birds on their migratory stopover and wintering grounds through birding listservs, eBird, social media and other online documentation tools. Enlist volunteers to help with survey efforts.
- Continue to coordinate management with municipalities, as well as county, state and federal landowners.
- Continue to incorporate breeding data into the Landscape Project and NJ DEP's Biotics database.

Colonial Waterbirds

Project Leaders: Christina Davis

Aerial Survey was inactive in T-1-7. It is active in PR grant, NJ W-70-R-1

Key Findings:

- Inland night-heron colonies are defined as nesting areas with at least one pair of yellow- and/or black-crowned night herons which are not on the Atlantic Coast marsh islands (those islands are surveyed via the aerial effort). While the marsh island colonies are typically on undeveloped islands, the inland sites are characterized by a decidedly more human influenced landscape. Colonies can occur in parks, backyards, campgrounds and the like, often closer to human activity than many would assume desirable to the species. This is particularly true for yellow-crowned night-herons.
- The survey protocol was developed using techniques described in Steinkamp et al. (2003) and was first utilized in the 2004 survey (prior to that, surveyors only visited colonies one time). These are visual surveys where observers were asked to visit each colony three times over the course of eight months. The first visit was timed early in the season to determine if the site was active and how many adults and nests were present. The second survey was timed to coincide with late incubation/early brooding and observers counted the number of adults, nests and young/fledges that were visible (views are generally obscured during this survey by the leaves on trees). The final survey will take place in late fall after the trees have lost their leaves and the birds have migrated. Observers are asked to get a post-season nest count during this period. The stick nests that these species build are persistent and still present at this point, but the timing allows for easier observation with no disturbance to the birds.
- Five colonies with 22 yellow-crowneds (at four colonies) and 84 black-crowneds (at one colony) were tallied in 2015 on the first two surveys (visit #3 takes place after the end of the grant period but is not likely to offer additional information so will not be reported next year). This number (both total number of colonies and number of individuals) was far lower than has been recorded in the past (for both metrics). Seven fledges were counted but poor viewing conditions (leafed out trees) mean this number is notoriously unreliable.
- The analysis of the colonial waterbird distribution and trends over time was not completed within the grant year. Montclair University staff and graduate students have been tasked with this effort and results are expected by the end of the next grant year.

Conclusions:

- The numbers this season were lower for two reasons, one proven and one theoretical. The proven reason was that less survey effort was dedicated this year due to staff constraints and the inability to dedicate time to organizing volunteers. The survey effort that was completed was what was feasible given the number of staff available to conduct it. The theoretical reason is that there were fewer known inland sites to survey. Many of the sites that have been occupied in the past six years (since inland surveys began in earnest) are no longer active. This may be due to inland sites having less fidelity than marsh islands, to birds moving to inland locations that were not problematic to humans (the most common way ENSP finds out about these colonies are distressed calls from the public and there were virtually none of these in 2015), to birds moving to the marsh islands (2015 survey results were the highest for yellow-crowned night-herons since 2008) or some other unknown factor. Future surveys may help determine if lower number at inland sites is truly a declining trend or simply the result of less survey effort.

- The inland night-heron colonies, as noted above, seem to be less stable than their marsh counterparts. This may be a reflection of the increased amount of human disturbance that they encounter as well as the threats that are indirectly human related, such as the role feral cats and human-subsidized predators (such as raccoon) may play in their success. These sites are also susceptible to habitat changes, as land/homeowners sometimes remove the nest, branches and trees in the non-breeding season (although ENSP encourages them not to do this, as it often does not deter persistent birds).
- It is not well understood why some night-herons select the inland sites when there is unoccupied, seemingly suitable and superior habitat in the marsh islands. This is an area that can use additional research. Notably, on the aerial survey, a number of great horned owls (*Bubo virginianus*) were observed flushing from unoccupied (by wading birds) marsh islands and perhaps they are playing a role in site selection.
- The survey protocol continued to work well, balancing data needs without an overly intensive survey protocol that individual staff/volunteers may struggle to maintain.

Recommendations:
- Continue to use the protocol that was developed for these surveys in future years.
- Continue to conduct both the aerial and the inland ground-based surveys during the same field season so as to better understand the state's population and any fluctuations that occur.
- Utilize online tools and social media to find new colonies. For example, if aerial photographs that appear on Google or Bing were taken in the winter months, the large nests of the great blue heron are visible and can be identified for ground truthing the following field season.
- In future years, when a volunteer corps is again utilized, consider creating an online tool using a platform like Google Drive, which will allow volunteers to directly upload their data to a central database and for ENSP to more closely monitor which sites are being surveyed and which are not being covered.
- Continue to work with Montclair University to produce a trend and distribution analysis of colonial waterbirds on the marsh islands.
- Despite travel and budgetary constraints, every effort should be made to continue to attend regional and international waterbird meetings.

Migratory Shorebirds Conservation and Management

Project leader: Amanda Dey

This project was inactive here, but funded under Section 6 (NJ E-1-37) for beach protection and under Pittman-Robertson (NJ W-70-R-1) for research and management.

Objective 1: Protect critical habitats and resources on the Delaware Bay stopover for migratory shorebirds: continue regional collaboration with state and federal agencies to recover horseshoe crab and shorebird populations, reduce anthropogenic disturbance to shorebirds enhance/create coastal habitat and impoundments for crab spawning/shorebird foraging and roosting. *Beach steward disturbance protection was funded and reported in 2013-14 under NJ E-1-36.*

Objective 2: Assess recovery of red knot and other shorebird species: monitor mass gain and adult survival through resightings of marked individuals; monitor stopover population size through baywide aerial survey and mark-and-resighting methods.

Objective 3: Assess recovery of the horseshoe crab egg resource: monitor horseshoe crab egg densities on Delaware Bay beaches. *This work in 2013-14 funded and reported under NJ E-1-36.*

JOB C. REPTILE AND AMPHIBIAN CONSERVATION
Subjob C.1. TURTLES

Project Leader: Brian Zarate

KEY FINDINGS:

- Bog turtle habitat restoration on private or public lands was coordinated in fall, 2014 (woody vegetation treatment and invasive species) and spring, 2015 (restoration grazing) under SWG. Field visits at the request of restoration partners (e.g., NRCS) to potential restoration sites was completed, as well, through SWG while the implementation of restoration was funded through partner groups (e.g., NRCS, FWS-Partners). Development of management plans followed the FWS/NRCS bog turtle biological opinion on habitat restoration practices.
- ENSP coordinated bog turtle population monitoring volunteer surveys in Spring 2015. Nine individual sites were sampled 23 times collectively. Thirty-three volunteers participated in the surveys. The surveys followed protocols established by the bog turtle northern population regional team.
- ENSP performed habitat monitoring at six bog turtle sites in Spring/Summer 2015. A total of 88 vegetation monitoring plots were established at the six sites. The sampling followed protocols established by the bog turtle northern population regional team.
- One-kilometer wood turtle stream transect surveys following the protocols established under the finalized wood turtle RCN project were conducted in both Fall 2014 and Spring 2015. A multi-year Competitive SWG grant was awarded to continue work on the regional scale for wood turtle and Spring 2015 wood turtle work was funded through NJ-awarded Comp SWG funding. ENSP coordinated all volunteer efforts.
    - In Fall 2014 a total of 11 sites were sampled and transects were run 25 times. ENSP conducted transect surveys at eight sites and volunteers lead efforts at four sites.
    - In Spring 2015 a total of eight sites were sampled and transects were run 22 times. ENSP conducted transect surveys at three sites and volunteers lead efforts at five sites.
- No surveys using a dog-handler team were conducted for wood turtle during the project year and it is unknown at this time if this specific task will continue.
- ENSP coordinated with the Bureau of Freshwater Fisheries to recommend proposing amendments to the 2016 - 2017 Fish Code that impact the harvest of snapping turtle. In order to protect populations of snapping turtles the Fish and Game Council proposes the following changes to rules governing their harvest:

    a) In order to prevent further expansion of commercial harvest in New Jersey, the Council proposes to limit commercial harvest permits to those already actively engaged in permitted commercial harvest under a special permit. Only harvesters who have been issued a permit from January 1, 2010 to December 31, 2014, and have submitted harvest reports, prior to January 1, 2015, indicating the harvest of at least one turtle, will be issued permits in the future. This approach allows current harvesters, who have successfully trapped turtles, to continue to trap while precluding expansion through additional permittees.

    b) All turtles harvested, either recreationally or commercially, have a minimum carapace length of 12 inches. The minimum carapace length will protect turtles until they reach sexual maturity.

    c) To expand the existing nesting season closure of May 1 to June 15, to May 15 to July 15 to more closely correspond with peak nesting period for snapping turtles. The Council also proposes to protect turtles during their hibernating season by closing the season from October 31 to April 1 for both recreational and commercial harvest. Commercial harvest permits currently expire on October 31 of each year, with new permits for the subsequent year allowing harvest to begin once turtles become active. However, there is no winter closure for turtles taken under a fishing license. Snapping turtles are vulnerable to harvest during hibernation and in early spring when they first become active. The proposed closures will help protect the turtles during these particularly susceptible periods.

d) Commercial harvesters are required to tend traps at least once every 24 hours. In order to help ensure the survival of turtles captured within traps, the Council proposes to establish a maximum number of 30 traps may be set to ensure harvesters do not set more traps than can be properly tended. The 30-trap limit also protects existing turtle populations from over harvest as trapping efforts typically increase with increases in market values. Trapping efforts may also increase in response to reduced population levels.

e) The Council proposes to require recreational and commercial harvesters to report sightings of any State endangered or threatened species of turtles by completing a Division Sighting Report Form.

f) Reduce the daily limit for turtles taken under a Fishing License (not Commercial Harvest Permit) from 3 to 1. The existing three per day limit for those harvesting these species under a recreational fishing license allows an angler to take as many as 90 turtles per month, an amount which can rival that of commercial harvesters. Reducing the limit better aligns recreational harvest with personal use. Turtles taken recreationally may not be sold.

g) In order to protect unhatched young, the Council proposes that turtle eggs may not be taken at any time. The Council also proposes that turtles may not be taken from land at any time as they are much more vulnerable out of the water.

h) The Council proposes that traps may only be used by harvesters with a Commercial Permit and not for those harvesting under a fishing license. Traps are inconsistent with common angling methods.

RECOMMENDATIONS:

- Continue participation in regional turtle conservation projects. In spring 2016 work on bog turtles and wood turtles will primarily be funded through Comp-SWG funding.
- Await finalization of public comment period for proposed changes to snapping turtle harvest regulations and prepare responses.

Subjob C.2. SNAKES

Project Leader: Kris Schantz

Key Findings:

- ENSP continued to manage the Venomous Snake Response Team (VSRT) and respond to telephone inquiries regarding potential venomous snake presence on private lands and public recreation areas.
  - No trainings were held in 2015 due to time constraints on ENSP personnel.
  - In 2014, ENSP restructured the response team identifying those that are considered "volunteers" that receive no compensation for their effort versus those that are compensated (e.g., State workers, town-contracted animal control officers, police). This required additional paperwork and for all volunteers to obtain State photograph identification.
    - Seventy-two team members out of 105 fulfilled the administrative requirements and therefore, were permitted to respond to snake calls. Of that, only 27 submitted information regarding their responses, time and mileage incurred. Ten out of those 27 responded to 48 venomous snake calls, confirming 37 Timber Rattlesnakes and six Northern Copperheads. ENSP still awaits their official sighting report forms to submit for entry into NJ DEP's Biotics database (Biotics).
  - ENSP made no progress of developing a structure to maintain and expand the team while decreasing ENSP responsibilities and time required.
- ENSP reviewed rare species observations for potential entry into Biotics.
  - During this reporting period, the following sightings were entered into Biotics:
    - 16 Timber Rattlesnake sightings
    - 10 Northern Copperhead sightings
    - 1 Eastern King Snake sightings

        - 0 Northern Pine Snake sightings
        - 0 Corn Snake sightings
    - Additional sightings were entered into ENSP's tracking database (preliminary database used prior to entry into the Biotics database) and will be reviewed by ENSP staff over the next year for entry into the Biotics database including:
        - 45 Timber Rattlesnake sightings
        - 12 Northern Copperhead sightings
        - 15 Northern Pine Snake sightings
        - 8 Eastern King Snake sightings
        - 0 Corn Snake sightings
- ENSP biologist conducted site meetings and preliminary habitat assessments for potential management to improve snake basking, gestation/birthing habitat (Timber Rattlesnakes) and nesting habitat (Northern Pine Snakes).
    - Met with NJ Conservation Foundation to discuss habitat management of some of their newly acquired land.
    - ENSP targeted habitat assessments within the Pinelands including Wharton State Forest, Brendan Byrne State Forest, Bass River State Park and prior to the Division of Parks & Forestry finalizing the forest stewardship plan, Double Trouble State Park.
    - ENSP revisited four previously managed sites within Wharton State Forest to conduct opportunistic surveys for snake presence and conduct necessary maintenance of the areas.
    - Additional habitat assessments, management and monitoring were conducted and supported through non-federal funds dedicated under a mitigation agreement.
- ENSP biologist was unable to commit additional time to the Timber Rattlesnake status assessment and recovery plan development due additional responsibilities regarding the State Wildlife Action Plan review and environmental permit reviews requiring an inordinate amount of time.
- ENSP biologists continued to work on the Northern Pine Snake recovery plan as time permitted.
    - Staff met with a panel of experts to participate in the development of the recovery plan and identify critical conservation units throughout the Northern Pine Snake's range in New Jersey.
    - Staff continued to develop the plan by integrating the results of the aforementioned meeting and identifying information gaps within the plan in need of further review/development.
- ENSP biologist leading the planning effort for the Northern Pine Snake recovery determined that it would be more useful and beneficial to create a Pinelands' rare snakes' recovery plan given they share many, if not all, of the same threats, and a significant portion of the landscape. Such a plan would include Northern Pine Snake, Timber Rattlesnakes of the Pinelands only, Corn Snake, Eastern King Snake, and possibly additional species currently under assessment for listing.
- No den surveys were conducted in search of undocumented dens. ENSP's focus during spring emergence was revisiting known dens in search of potentially infected snakes (snake fungal disease); funded through Competitive SWG.

<u>Conclusions:</u>

- The VSRT underwent a transition in 2014 distinguishing team members who are official volunteers to ENSP and therefore, covered under the Division of Fish and Wildlife's Wildlife Conservation Corps (WCC) insurance policy and those who are funded through State or local government and not covered under the WCC insurance policy. This differentiation has continued to cause confusion and many team members did not document their responses, time or mileage. The verbal interaction ENSP had with members in August indicated the team continues to provide the necessary services to protect NJ's venomous snakes and citizens.

<u>Recommendations</u>:

- The VSRT will continue in 2016 as ENSP continues to attempt to develop a structure to maintain and expand the team while decreasing ENSP responsibilities and time required. ENSP must continue to work

with the team members so they understand what is required of them as official volunteers and as team members not covered under DFW insurance.

- Continue conducting work to identify, assess, manage and monitor habitats to benefit snake conservation within the Pinelands, Highlands and Ridge and Valley Regions. *When possible, use alternate funding sources to accomplish this work.*
- Complete the recovery plan for the Northern Pine Snake.
- Continue to gather information for the Timber Rattlesnake status assessment and recovery plan as time and resources permit.
- Focus spring emergence and gestation/birthing site surveys on documented dens and gestation/birthing areas in search of potentially infected snakes. Collect the snakes for transfer to the Wildlife Conservation Society, Bronx Zoo, to undergo testing and medical treatment. *When possible, use alternate funding sources to accomplish this work.*

Subjob C.3. AMPHIBIANS

Project Leader: Brian Zarate

Key findings

- Eastern tiger salamander surveys were somewhat limited during this reporting period due to staff attrition and resulting transitions in staff species responsibilities. Staff also had limited time available due to State Wildlife Action Plan revision commitments, among other reasons. Reporting period priorities for the species were to advance habitat creation or improvement project which had already been designed or initiated, as well as to have new staff assess regional habitat and population conditions.
- *Head Starting*: The Department's head-starting project with the Cape May Zoo was not revisited by either party this reporting period. The Department is reviewing both the efficacy of head-starting for this species as well as the effectiveness of the arrangements made with the Cape May Zoo.
- *Lizard Tail Swamp WMA*: Surveys for breeding season use of previously constructed pools within Lizard tail Swamp were conducted from early December of 2014 through March of 2015. These surveys confirmed the limited presence of adult eastern tiger salamanders, paedomorphic larvae (i.e. remnant larvae from the prior breeding season) and/or egg masses. Additional water level monitoring was conducted throughout the remainder of the reporting period. Both of the pool complexes originally created appear to feature permanent ponding, which was not the intent of original design and does best not suit eastern tiger salamander breeding requirements. Additionally, the "northern" pool complex was observed to host a naturally reproducing fish population. Though permanently ponded, the "southern" pools appear to remain fish-free, and this is where the vast majority of sightings and reproductive activity occurred. Re-configuration of the ponds (return of some previously excavated fill materials) is being planned to raise the pond inverts, using other successful "ephemeral" ponds onsite or in the immediate region as elevation reference sites. This work is planned to occur during the 2016 summer months.
- *Mechanic Street*: ENSP and CWF staff continued surveying pools on and adjacent to USFWS Refuge land. Adults and recently deposited eggs were observed in the pools as early as December 12, 2014. A joint DEP/CWF/USFWS survey conducted on March 10, 2015 detected approximately 164 egg masses in the most productive pond, indicating a particularly productive season.
- ENSP staff assisted the Department's Division of Land Use Regulation in putting approximately 4 acres of eastern tiger salamander and Cope's gray treefrog habitat into a conservation easement in association with a required mitigation plan. The site contains a breeding pond where treefrogs have been confirmed and where eastern tiger salamanders are likely. This site will be monitored by the Program to investigate eastern tiger salamander presence and to monitor the required re-forestation of approximately 1 acre of barren habitat.
- Submissions to ENSP on vernal pool data were catalogued but no entry into the database was completed until the database undergoes revision.

- Staff provided match for awarded RCN project to help collect additional information on the newly described frog *Rana kauffeldi*, the Atlantic Coast Leopard Frog. The RCN project ends December 31, 2015.

Conclusions

- ENSP's management efforts for tiger salamanders continue to focus on suitable habitat within the species range and on protected land, outside of areas at risk to sea-level rise. This focus may hold the most value to maintain the long term persistence of tiger salamanders in New Jersey in the face of habitat threats.
- Identification and remediation of threats to eastern tiger salamander populations remains important, especially those sites at lowest risk to sea-level rise. Maintaining or improving upon the connectivity of existing populations is a priority.
- The head-starting of eastern tiger salamanders was been temporarily suspended this reporting period, while the Department reviews both the efficacy of head-starting for this species as well as the effectiveness of the arrangements made with the Cape May Zoo. The Department's past coordination with the Cape May Zoo appears to have confirmed that - under proper conditions - higher survival from egg mass to metamorph/subadult could be achieved compared to natural conditions. However, it was also found that the scale at which such efforts would likely need to be carried out to positively affect local populations likely exceeds the available facilities and capacities of this partner. Despite efforts to develop a standard protocol for head-starting, data collection and documentation necessary to confirm adherence to protocols necessary for maximum success and minimum disease risk were also found to be a challenge. The Cape May Zoo was very successful with the public education components of the head-starting project. The Zoo has used this project as an educational opportunity to engage the public in the efforts to protect and mitigate threats to this vernal pool species. If the Cape May Zoo staff re-engage with the Department, this aspect of the project will likely be re-instituted. The Cape May Zoo developed a very effective display that allows the public to identify with a species they likely did not realize existed and totally depends on their regional communities to persist.
- Long-term genetic monitoring will help identify the source populations of surviving populations. Genetic testing of salamanders at our study ponds can be done in the future and compared with stored genetic samples. However, genetic testing comes at a financial cost that this project cannot afford at this time.

Recommendations

- Re-establish the egg enclosure project in newly created ponds; explore possibility of expanding use of egg enclosures to existing ponds that do not appear to have a robust breeding population (e.g., Belleplain).
- Develop a strategy to protect breeding pools from off-road vehicles, particularly on public lands.
- Continue to work with partners and trusted volunteers to monitor pools and encourage amateur herpetologists to submit sightings.
- Develop plan to update existing vernal pool database and/or explore new options for cataloging vernal habitat data.

JOB D. INVERTEBRATE CONSERVATION AND MANAGEMENT
Subjob D.1. Mollusks

Project Leader: Jeanette Bowers-Altman

Objective: To document occurrences, monitor populations, and create conservation strategies to aid in the recovery of listed freshwater mussel species throughout New Jersey. Listed species include the Dwarf wedgemussel, Brook floater, Green floater, Yellow lampmussel, Eastern lampmussel, Eastern pondmussel, Tidewater mucket and Triangle floater.

Key Findings**:**

- We conducted timed searches at nine stream sites in six counties for listed freshwater mussels. Surveys were conducted at historic locations, monitoring areas, and/or previously unsurveyed suitable habitats. Commitments to the State Wildlife Action Plan update and other projects, combined with high rainfall in June, limited time available for survey activities.
- We performed habitat assessments and/or preliminary searches at seven additional sites (including two lakes) in five counties to determine if larger surveys were warranted.
- EPA Habitat Assessment Field Data Sheet scores (high and low gradient combined) ranged from 99 (Lamington River, Sussex County) to 168 (South Branch Raritan River, Hunterdon County), out of a possible 200. Previous ENSP studies have shown that mussels occur in a habitat score range of 68-173. All sites surveyed scored within the preferred habitat range.
- We completed an analysis of freshwater mussel data collected between 2000-2014. By comparing individual habitat characteristic scores from EPA Habitat Assessment Field Data sheets (including but not limited to epifaunal substrate/available cover, sediment deposition, bank stability, and riparian width) with freshwater mussel abundance and diversity.
- Findings of the above-mentioned analysis include, but are not limited to, the following: 1) maximum abundance is associated with a total habitat score of 121 out of 200; maximum diversity is associated with a total habitat score of 136 2) maximum abundance is associated with three species (diversity ranged from 0 to seven species) 3) maximum abundance is associated with an embeddedness score of 8.7; diversity is distributed among almost all embeddedness scores 4) maximum abundance is associated with a pH of 7.6; maximum diversity is associated with a pH of 7.5 5) maximum diversity is associated with a pooled total bank stability score of 16.5 out of 20 6) maximum abundance is associated with total vegetative cover scores between 12.5 to 16.5 out of 20, maximum diversity is associated with scores that are > 12.5 (Fig 1.) 7) maximum abundance is associated with a pooled riparian score width of 17.5 out of 20; diversity increased at pooled riparian width scores of 10.5 remained high and variable through scores of 18.5.
- Water quality values were as follows: pH ranged from 7.0 to 7.6, water temperatures ranged from 20 to 28.5 Celsius, dissolved oxygen ranged from 8.1 to 10 ppm.
- Catch per unit effort (CPUE) for all species combined during timed searches was highest in the South Branch Rancocas Creek, Burlington County, with 0.41 live mussels/minute.
- The ENSP and volunteers found six species of freshwater mussels during field activities, including the Triangle floater, Eastern elliptio, Eastern floater, Alewife floater, Paper pondshell, and Creeper.
- The Eastern elliptio was the most prevalent and widespread mussel species documented. Species richness was highest in Salem Creek, Salem County, and the Millstone River, Somerset County, with four species recorded at each location. Significant findings included one fresh Triangle floater shell and one fresh Creeper shell in the Stony Brook, Mercer County; one fresh Triangle floater shell in the Millstone River, Somerset County (new location), and three Triangle floater shells (one fresh) in Salem Creek, Salem County.
- Habitat at one SB Rancocas Creek site (a campground) in Medford, Burlington County, had significantly changed since previous ENSP surveys (1998). Sandy/cobble substrate and shallow water habitat that had once supported a healthy Eastern elliptio population had been replaced with deeper water and a mucky/mud bottom. According to a passing kayaker, severe flooding in 2004 had transport much of the sand downstream to Kirby Mill; the information was verified by the camp director. We verified the

presence of suitable sandy substrate and a healthy Eastern elliptio population at Kirby's Mill, approximately 550 m downstream of the campground. According to the National Oceanic and Atmospheric Administration (NOAA) website, the creek crested at 4.19 ft on 14 July 2004, the third highest crest since at least 1938 (NOAA website accessed Nov 2015).

- We continued searches for the Chinese pond mussel in Wickecheoke Creek. In 2010, we documented the first North American occurrence of the highly invasive Chinese pond mussel (*Sinanodonta woodiana*) from ponds owned by the NJ Conservation Foundation (NJCF) (Bogan *et al*. 2011). The ponds had formerly been used as part of a fish farm operation for holding bighead carp and other fish species. Genetic testing by Dr. Arthur Bogan and staff of the North Carolina Natural History Museum confirmed the species identification. Despite a rotenone treatment and lowering of all the ponds on site over the winter, there are still Chinese pond mussels living in the ponds.
- In 2015, we trained representatives from the NJ Invasive Species Strike Team (NJISST) and NJ Conservation Foundation (NJCF) to identify Chinese pond mussels and other freshwater mussel species. Since this time, NJISST volunteers have been conducting searches in Wickecheoke Creek to assist in determining if the mussels are spreading downstream towards the Delaware River. In addition, NJISST staff is identifying additional ponds within the watershed that may harbor populations of the invasive mussel. Finally, NJISST, in coordination with ENSP biologists, is determining the best chemical-based method for eradicating Chinese pond mussels from all occupied pond sites.
- To date, NJISST volunteers have identified one privately owned pond adjacent to the NJCF preserve that contains live Chinese pond mussels. In addition, despite numerous river miles searched, Chinese pond mussels have not been found outside the NJCF preserve or in the adjacent, privately owned pond.
- Wildlife Conservation Corp (WCC) volunteers continued surveys in Mercer and Hunterdon counties. Areas searched included sections of the Stony Brook and Musconetcong River.
- All new locations found to have federal and/or state listed freshwater mussels from surveys covered in this report and others (e.g. private consultants, USGS, nonprofit organizations, etc.) have been/ are in the process of being incorporated into the Biotics database. These locations, along with sightings from previous surveys, will be used in the next version of the Landscape Project mapping to identify critical areas for listed mussel populations.
- We provided text, images, and video clips to the Conserve Wildlife Foundation of NJ (CWF) to be used in their "Freshwater Mussels of New Jersey" story map. The story map will be available online through the CWF and DFW websites, and will include the following sections: Introduction, Ecology and Life History, Status and Threats, Conservation and Management, Survey Methods, Identification, Dichotomous Key to NJ species, Species Profiles (with images of species and habitats), Zebra Mussels, Health Advisories and Regulations, and Data Sheet. The story map will include printable sections that can be used by ENSP volunteers during mussel surveys. The target date for project completion is November 16, 2015.

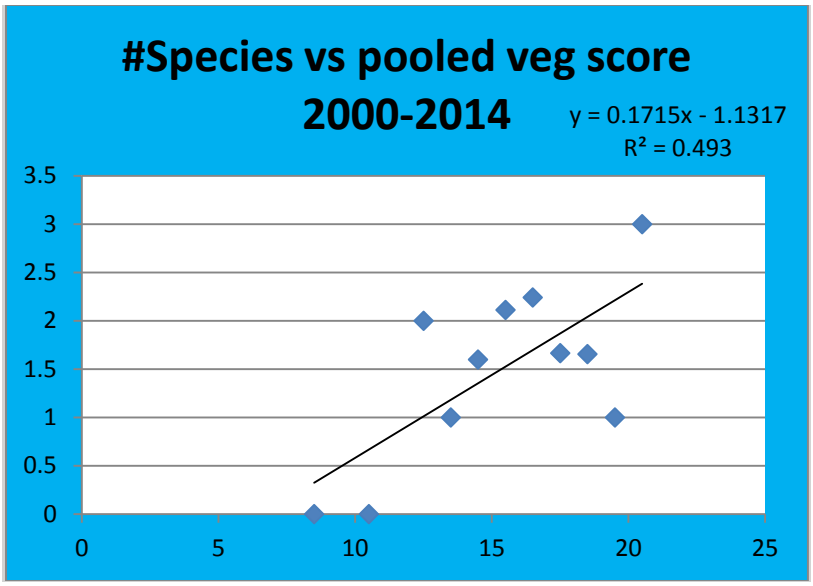


Fig. 1. Freshwater mussel diversity vs. pooled vegetative cover scores, 2000-2014.

Conclusions:

- Based on habitat suitability assessments and preliminary searches, six out of seven sites warrant further survey work to determine freshwater mussel species composition and abundance.
- Our analysis of 2000-2014 data indicates that vegetative cover is critical to freshwater mussel diversity and to a lesser extent, abundance. In addition, generally there is an increase in diversity and abundance as riparian width score increases, and an increase in diversity as bank stability score increases. This analysis does not include factors that aren't characterized by the data sheets, including presence of host fishes, stream size, substrate types, current, microhabitat conditions, etc.
- Transport of mussel habitat in Rancocas Creek underscores the need for stream and riparian area resiliency/protection due to projected increases in flooding and extreme weather events.
- The Chinese pond mussel may have escaped from the fish farm ponds into Wickecheoke Creek. This creek, although intermittent and fairly unsuitable to support freshwater mussel populations, contains pockets of deeper, stagnant pools, a preferred Chinese pond mussel habitat type. Despite ongoing efforts of NJISST volunteers, it is too soon to determine whether or not the species is living in the creek, and/or has been washed down (or carried via hosts fishes) to the Delaware River or D & R canal.

Recommendations:

- Continue surveys for listed species in previously unsurveyed suitable habitats to document distribution; monitor populations in known locations.
- Publish habitat analysis results and develop protocol that will apply findings to stream restoration techniques to help manage for listed mussels and prepare for extreme weather impacts.
- Continue working with the NJISST to monitor Chinese pond mussel spread and assist with developing methodology for eradicating populations in ponds.
- Provide link to CWF story map to DFW webmaster. Solicit assistance from additional WCC volunteers; train volunteers to identify and survey for mussels; assign specific areas for survey work where data are lacking. Provide volunteers with printable sections of the mussel story map to be used in the field.

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Subjob D.2. Macroinvertebrates

Lepidoptera

Project Leader: Robert Somes

OBJECTIVE: To identify, survey, protect, and manage for listed Lepidoptera populations and habitats in New Jersey. Species include but are not limited to Arogos Skipper, Mitchell's Satyr, Bronze Copper, Appalachian Grizzled Skipper, Checkered White, Silver-bordered Fritillary, Hoary Elfin, Harris' Checkerspot, Hessell's Hairstreak, and Frosted Elfin.

Key Findings:

- The 2015 butterfly season was a highly challenging one marked by a cool late spring and wet June, leading to very depressed butterfly numbers for the first half of the summer. An unseasonably cold winter followed by a late spring caused the emergence of many insects to be delayed by almost a month. Staff shortages and commitments to the State Wildlife Action Plan update and other projects limited time available for survey and management activities. Surveys were conducted for a wide range of listed species throughout NJ and in a wide variety of habitats by staff and with help from the North American Butterfly Club-North Jersey Chapter and the South Jersey Butterfly Blog contributors.
- A Delphi Technique status assessment was conducted for all of the rare butterflies of New Jersey. This allowed us to update or clarify the listed status of many of New Jersey's rare butterflies and to better target our conservation and management activities. The species were assigned statuses of Endangered (E), Threatened (T), Special Concern (SC), Stable (S), Undetermined (U, {unknown status, insufficient data}), or Not Applicable (NA, {historic, extirpated, out of range, etc}).

Scientific Name	Common Name	Current status	ENSP adopted status effective 2015
Boloria selene	Silver-bordered Fritillary	T	E
Calephelis borealis	Northern Metalmark	SC	E
Lycaena hyllus	Bronze Copper	E	E
Atrytone arogos	Arogos Skipper	E	E
Neonympha m. mitchellii	Mitchell's Satyr	E	E
Pyrgus centaureae wyandot	Appalachian Grizzled Skipper	E	E
Satyrium acadica	Acadian Hairstreak	U	E
Amblyscirtes hegon	Pepper and Salt Skipper	U	T
Amblyscirtes vialis	Common Roadside Skipper	U	T
Callophrys irus	Frosted Elfin	T	T
Callophrys polios	Hoary Elfin	SC	T
Euphyes bimacula	Two-spotted Skipper	SC	T
Hesperia attalus	Dotted Skipper	SC	T
Hesperia leonardus	Leonard's Skipper	SC	T

Scientific Name	Common Name	Current status	ENSP adopted status effective 2015
Neonympha helicta	Georgia (Helicta) Satyr	SC	T
Polygonia progne	Gray Comma	U	T
Atrytonopsis hiana	Dusted Skipper	U	SC
Callophrys hesseli	Hessel's Hairstreak	SC	SC
Chlosyne harrisii	Harris' Checkerspot	SC	SC
Danaus plexippus	Monarch	U	SC
Erynnis brizo	Sleepy Duskywing	U	SC
Euphydryas phaeton	Baltimore Checkerspot	U	SC
Nymphalis vaualbum	Compton Tortoiseshell	U	SC
Pontia protodice	Checkered White	T	T
Problema bulenta	Rare Skipper	U	SC
Satyrium caryaevorus	Hickory Hairstreak	U	SC
Satyrium favonius ontario	Northern Oak Hairstreak	U	SC
Satyrodes eurydice	Eyed Brown	U	SC
Anthocharis midea	Falcate Orangetip	U	S
Euphyes dion	Dion Skipper	U	S
Fenisica tarquinius	Harvester	U	S
Lycaena epixanthe	Bog Copper	U	S
Papilio cresphontes	Giant Swallowtail	U	S
Parrhasius m-album	White-M Hairstreak	U	S
Satyrium edwardsii	Edwards' Hairstreak	U	S
Satyrium titus	Coral Hairstreak	U	S
Staphylus hayhurstii	Hayhurst's Scallopwing	U	S
Carterocephalus palaemon	Arctic Skipper	U	U
Celastrina neglectamajor	Appalachian Azure	U	U
Chlosyne nycteis	Silvery Checkerspot	U	U
Erynnis lucilius	Columbine Duskywing	U	U
Speyeria aphrodite	Aphrodite Fritillary	U	U
Atlides halesus	Great Purple Hairstreak	U	NA
Autochton cellus	Golden Banded Skipper	U	NA
Erora laeta	Early Hairstreak	U	NA
Erynnis martialis	Mottled Duskywing	U	NA
Erynnis persius	Persius Duskywing	U	NA
Nymphalis milberti	Milbert's Tortoiseshell	U	NA
Pieris oleracea	Mustard (Eastern veined) White	U	NA
Pieris virginiensis	West Virginia White	U	NA
Speyeria idalia	Regal Fritillary	U	NA

- Staff developed a partnership with the NJ State Forestry Service and NJ State Park Service to create a statewide program of butterfly/pollinator gardens and meadows and to create management and maintenance guidelines beneficial to pollinators on State Park land. This program had two primary goals.

- The first goal was to reduce the acreages mowed during the spring and summer and to better target invasive species control on state park lands. Many parks have suitable pollinator habitat that could be greatly enhanced by improved mowing schedules and decreasing the overall areas mowed.
- The second portion of the project focused on the direct creation of butterfly/pollinator gardens and meadows on state park land. The State Forestry Service's NJ Forest Nursery provided staff and resources to propagate 450 Common Milkweed, Swamp Milkweed, and Orange Butterfly Milkweed plants. These seedlings were distributed to a subset of parks and used in the creation or enhancement of six butterfly/pollinator gardens and two large (~2 acre) butterfly meadows.

- Endangered and Nongame Species Program biologists worked extensively with the Division's Bureau of Lands Management to develop means of incorporating management activities beneficial to listed butterfly species and pollinators. This collaboration resulted in the development of a new Quail Project seed mix based on the Xerces Society's pollinator mixes. It included a mix of butterfly food plants (Little Blue stem) and a variety of nectar sources. This mix would meet the requirements of the Quail Project and be highly beneficial to native pollinators. Twenty two acres of this mix was planted in southern New Jersey in the vicinity of several know Dotted Skipper sites and germinated and grew exceptionally well.
- Surveys for Leonard's Skipper were conducted at four known sites and three potential sites in northern New Jersey. The species was present at all known locations with numbers ranging from five to eight individuals. During the course of these surveys two new locations were discovered in the vicinity of known fields.
- Surveys for Georgia Satyr were conducted on Penn State Forest over the course of two days with two individuals observed at one known site.
- Surveys for Silver Bordered-Fritillary were conducted at seven known locations over the course of five days. There were no Silver-bordered Fritillaries observed for the third consecutive year. There has not been a Silver-bordered Fritillary observed in NJ since 2012.
- Follow-up monitoring for Frosted Elfin was conducted at the three sites where habitat management was conducted in 2012-2013. We found large numbers of elfins at all three sites ranging in number from 8 to 20 individuals. The management areas continue to sustain large patches of *Baptisia tinctoria* and ovipositing was observed on two occasions.
- Habitat management for Northern Metalmark continued at the White Lake Wildlife Management Area, where 0.5 acres of invasive brush and shrubs were removed during the winter of 2015. Meetings were held with Kittatinny Valley State Park staff to develop a management plan for the park and to install nectar source plantings around the food plant areas. White Lake and KVSP sites appear to be the remaining meta-populations in NJ, with each site having a large core area with several satellite sites around it.
- Surveys for Arogos Skipper in northern New Jersey were conducted at five known sites and two potential sites over the course of three days with two and seven individuals observed at two known locations. Endangered and Nongame Species Program biologists met with Division of Land Use Regulation staff to develop a restoration plan for a site adjacent to one of the known Arogos Skipper sites in northern NJ. The two acre site is currently overgrown with invasive vegetation and serves little value to Arogos Skipper or any other native butterflies. Through the Land Use Regulation Permitting/mitigation program, the site will be restored to valuable habitat using a native pollinator seed mix that will provide both foodplants and nectar for the nearby Arogos Skipper populations.
- Surveys for Arogos Skipper in southern New Jersey were conducted on the Penn State Forest sites (three separate historic locations) over the course of two days with no Arogos Skippers observed. Several meetings were held with the New Jersey Forest Fire Service (NJFFS) to discuss conducting controlled burns of several areas of Arogos Skipper habitat in Penn State Forest. These areas have had fire excluded for >20 years, resulting in declining suitability for the species. The NJFFS is planning to

include 2,000 acres of habitat in this area in their 2015/2016 burn plans that would greatly benefit this species.
- No survey work was conducted for moths in the 2014-2015 field season due to insufficient staff time and resources. However, we continued to develop a Rare Moth Species List of NJ with assistance from Lepidoptera and moth experts and will be included in the State Wildlife Action Plan update. New Jersey is home to at least 56 species of rare and endangered moths that are of conservation concern, and this list will help us to include them in our management planning.

Conclusions:
- The Delphi Review of the rare butterflies of New Jersey added a large number of species to New Jersey's rare species list and shows that there are many more species of butterflies in the State that are in need of further research and conservation.
- The partnership with the State Park Service and the State Forest Service to propagate milkweed and to create butterfly gardens and meadows was a huge success and has the potential to be greatly expanded.
- The Bureau of Land Management actively manages hundreds of acres of land each year including extensive mowing and seeding. By working together, we will greatly enhance large sections of Wildlife Management Areas for the benefit of rare butterflies and pollinators through improved mowing regimes and through changing the seed mixes that we use for planting to include more plants suitable as food plants and as nectar sources for our native butterflies and pollinators.
- Surveys of potential rare butterfly species habitat continue to yield discoveries of new colonies for many species. There are still large areas of suitable habitat that remain unsurveyed.
- Silver-border Fritillary appears to be the butterfly species in the most danger of becoming extirpated from NJ. This year marked the third year where Silver-bordered Fritillary could not be found at any known sites despite an intensive survey effort. Habitat at most sites appears to be unchanged, so the nature and causes behind the species' decline are poorly understood.
- After a difficult 2014 season surveying for Arogos Skippers in northern New Jersey staff were relieved to find this species still present at two known sites.
- Arogos Skipper appears to have been extirpated from the historic Penn State Forest sites though many areas are inaccessible and further surveying efforts are needed.
- We discovered several new colonies of Leonard's Skipper in northern New Jersey this season. This species appears to be relatively stable in the northern half of the State but appears to have declined in the south.

Recommendations:
- Future survey efforts should target species that were recently added to New Jersey's rare species list. Many of these species have very limited data for New Jersey, therefore it is critical that we develop a better understanding of their distribution, life history requirements, and threats.
- The milkweed propagation and butterfly garden/meadow creation project should be expanded within the State Park and Forest Service lands; we should strive to expand the number of seedlings we're able to distribute throughout the State.
- The partnership with Lands Management should be expanded to create larger areas of habitat suitable to our rare butterflies and native pollinators.
- Habitat management for Northern Metalmark should be expanded to insure the persistence of our current colonies and allow them to expand into former sites that have become overgrown and unsuitable. Continue working with land managers to maintain existing Northern Metalmark habitats. Work to increase connectivity between sites by maintaining natural corridors and creating suitable habitat by thinning invasive shrubs and trees. Work together with the NJ Park Service to develop a maintenance plan for Northern Metalmark sites found on KVSP.
- Surveys for Silver Bordered-Fritillary should continue to be a priority during 2016. Surveys for potential new or undiscovered colonies need to be conducted to determine whether the species is truly extirpated or if it is shifting from site to site as conditions change.

- Surveys for Leonard's and Dotted skippers should be a high priority in southern New Jersey.
- Targeted mowings of overgrown areas of Frosted Elfin habitat is a very effective means of maintaining areas of the food plant, wild indigo. Several large areas of wild indigo sprouted from the soil seedbank within a year of mowing the overgrown areas of the sites. Several of these areas had very low Frosted Elfin numbers during the previous years but were rapidly recolonized when areas of the food plant resprouted.
- Continue working with land managers to maintain existing Frosted Elfin habitats. Work together with land managers to create suitable habitat adjacent to existing to Right of Ways (ROW) to insure there is refugia for the species independent of ROW maintenance activities.
- Arogos Skipper should be surveyed in 2016 in order to determine if the known colonies are still in existence. Areas of suitable/potential habitat should be surveyed as well. If the Penn State Forest controlled burns are completed, follow-up surveys should be conducted to assess the impacts of the fire on the habitat.
- Work together with the New Jersey Forest Service and Forest Fire Service to encourage management activities beneficial to Arogos Skipper on the known Penn State Forest sites. Develop a management plan for the Penn State Forest Arogos Skipper habitats that can be incorporated into the large forest management plans that are being developed.
- The updated State Wildlife Action Plan is going to have an extensive Species of Greatest Conservation Need moth list for New Jersey. Moth surveys and research should target the newly listed species so that we can greater incorporate moth conservation in to our Lands Management planning and better understand the life history requirements of these species.

Odonata

Project Leader: Robert Somes, Senior Zoologist

OBJECTIVE: To monitor populations and create conservation plans and strategies to aid in the recovery of state-listed species found throughout New Jersey, including but not limited to the Gray Petaltail, Superb Jewelwing, Brook Snaketail, Robust Baskettail, Banner Clubtail, Harpoon Clubtail, and Kennedy's Emerald. To locate new populations of these species in areas not yet surveyed. To periodically re-visit known population to assess status and update the element occurrence.

Key Findings:

- Due to insufficient staff and other project priorities (particularly the State Wildlife Action Plan update and the butterfly Delphi review) there was limited resources available to focus on dragonflies and damselflies.
- Surveys for Gray Petaltail were conducted at four known sites over the course of two days, with no Petaltails observed.
- Surveys for Brook and Maine snaketails were conducted at two known locations and at three potential sites. We observed two individuals at the one known site. Surveys were hampered by poor weather and high water levels throughout the survey season. Many Odonata populations emerged late and there were much lower population numbers for even common species.
- Surveys were conducted at the single southern New Jersey Tiger Spiketail site and two adjacent sites that contained suitable habitat during the course of one day. A single Tiger Spiketail exuviae was found at one new site in Camden County. Three areas of suitable Tiger Spiketail habitat were discovered in Monmouth County and surveyed over the course of two days with no Spiketails observed.
- Staff worked together with Trout Unlimited to incorporate beneficial designs into one of their stream restoration projects that spanned a stretch of the Musconetcong River that contained a Brook Snaketail colony. Most of this stream area had been heavily altered by Hurricanes Irene and Sandy and no longer contained suitable substrate for snaketails along most of the stretch. An exclusion area was

created around the Brook Snaketail site and design elements were included to help create sandy bar areas suitable for snaketail larvae.

- Surveys for Banner Clubtail were conducted along the Mullica and Batsto rivers in southern New Jersey. A total of 20 locations were surveyed for this species and three new sites were discovered with a total of seven individuals observed along the Batsto River. Females were observed ovipositing at two locations. These were the first observations of this species along this river system.
- Surveys along the Batsto and Mullica rivers also discovered Allegheny River Cruiser at three new locations with a total of five individuals observed.

Conclusions/Recommendations:

- There appears to be a great opportunity for joint management and restoration of stream habitats for the benefit of multiple species including fish, freshwater mussels and aquatic invertebrates. This highlights the need to monitor the invertebrate community's response and colonization of new habitat created by stream restoration projects.
- Follow-up surveys should be conducted along the Musconetcong River restoration site to monitor whether suitable habitat is created and if it is colonized by Brook Snaketails.
- Survey potential Tiger Spiketail habitat in central and southern New Jersey in order to locate new colonies to fill in the range gap between Hunterdon and Camden counties.
- Surveys for other listed Odonata species should continue and be expanded during 2016 to fill in knowledge gaps for many species and to gain a better understanding of the distribution of these species within New Jersey.

Subjob D.3. Impact of Dam Removals on Macroinvertebrates

Project Leader: Jeanette Bowers-Altman

OBJECTIVE:
Identify and monitor rare freshwater mussels and Odonata that occur up and downstream of dams in the Musconetcong and Raritan rivers, and potentially other watersheds throughout New Jersey to 1) document short and long-term impacts of dam removal to populations 2) determine whether there are safe alternatives to current dam removal methods and 3) develop strategies to mitigate short-term impacts of dam removal to minimize injury and/or mortality to individuals. Stream segments adjacent to dams planned for removal within the next two years will be emphasized.

Key Findings: This job was inactive during 2014-2015 period due to funding and staff constraints.

JOB E. MARINE WILDLIFE

Subjob E.1. Identify and Mitigate Threats to Sea Turtles in NJ Waters

Project Leader: Jeanette Bowers-Altman

Objective: To identify and address major threats to sea turtles associated with power plant impingements.

Key Findings:

- Conserve Wildlife Foundation of NJ (CWF) staff continued entering sea turtle impingement/sightings data received from the Oyster Creek Nuclear Generating Station (OCNGS) into the ENSP's Biotics database. The ENSP receives copies of all incidental "takes" reported to the National Marine Fisheries Service (NMFS) by AmerGen Energy. Data included date and time of impingement/take, species, carapace length, weight, condition (live vs. dead), intake of impingement (circulation water system vs. dilution water system), number of pumps running (CWS vs. DWS) and water temperature. CWF staff have now compiled and/or entered data for three sea turtle species (Atlantic Green, Atlantic Loggerhead, and Kemp's Ridley) impinged at the OCNGS between 1992 and 2015.
- We completed the preliminary analysis of sea turtle impingements recorded at the OCNGS and weather/meteorological factors with the goal of developing a predictive model that would determine when captures are most likely to occur at the power plant. Data from 2015 were compared to the existing 1992 – 2014 dataset to determine whether factors during takes were consistent with factors associated with takes during previous years. We used Microsoft Excel graphing and regression software to analyze data and identify trends.
- The following factors were used during the 1992-2013 analyses in comparison to available capture data from the OCNGS: 1) wind speed and direction; 2) air temperature parameters, including mean daily temperature, maximum daily temperature, minimum daily temperature, daily Delta T (max minus min), daily Delta T from two days prior to capture; 3) thermal minima and maxima effects (i.e., cold shock, heat shock); 4) hurricanes; 5) nor'easter storms; 6) intervals of vulnerability (i.e., periods of abundance); 7) direct human interaction (i.e. boating effects); and 8) moon phase (2012-2013 only). Parameters used to compare sea turtle captures reported in 2014 with captures in the 1992-2013 dataset included 1) maximum air temperature; 2) maximum wind gusts, weighted means by 5 mph increments; 3) wind direction; 4) average air temperature; and 5) wind direction and speed by month of take.
- Sea turtle takes reported at OCNGS from 1992 to 2015 were collated in several Excel files. Each sea turtle capture was compared to weather parameters as recorded by www.wunderground.com at the Atlantic City airport, the only consistent source of weather information in the area. Air temperature was used in the analysis because sea surface temperature was not available. It is presumed that air temperature is indicative of either sea surface temperature, or an indirect measure of surface coastal water transport through Barnegat Inlet, or bay water transport toward the Forked River intake canal through which cooling waters are channeled.
- Minimum/maximum and average daily air temperatures were used to derive daily and two day lagged Delta-T air temperatures (max-min, and max from two days earlier-min). Wind characteristics including high sustained speeds, average wind speed, and gusts (mph) were also used. These parameters were then plotted against turtle takes during months of turtle presence at the OCNGS's DWS and CWS. An effort was made to check for trends between each year, since turtle presence at OCNGS is directly related to the presence of turtles in the adjoining coastal areas. An effort was made to assess trends between the above stated parameters and to identify any conditions that may contribute to turtle takes.
- Previous reviews of takes of sea turtles at OCNGS justified the approach of stratifying data into months; it appears as if the forces that make sea turtles vulnerable to impingement on the CWS and DWS racks were either random or different effects were affecting takes at different times during the seasons of sea turtle takes. This is an effort to assess what those forces may be.
- Sea turtles were taken at OCNGS from May through October throughout the reported time period; May 31 was the first take in 2015. No May takes were reported prior to this.
- Sixteen takes were reported for the month of June during the interval. The first report was in 1992, on 25 June, then again in 1994 on 19 June. Takes became more prevalent after the new millennium began. The

takes began earlier in June, the earliest being 2 June 2011. The maximum of three takes for June was reported in 2010. June is generally a month of rising air and water temperatures.

- Thirty-three takes were reported during all Julys beginning in 1994. The first few years of occurrence were loosely associated with the 4 July holiday period; turtles hit by recreational boaters could be identified by carapace damage, but beginning in 2004 the period of reported takes began to extend to mid- and late-July. No takes were reported during 2006, 2007, and 2011. Four takes were reported during 2004, 2008, 2013, and 2015. July is generally a month of high, or rising water temperatures.
- Seventeen takes were reported for all Augusts, beginning in 1998. Takes occur throughout the month. Maximum take of five turtles occurred in 2011, otherwise, only one or two takes were reported. August is generally a month of high air and water temperatures. This month could be expected to have heat shock be a contributing factor for turtle takes at OCNGS.
- Twenty-four takes were reported for all Septembers, beginning in 1992. Maximum takes of four turtles were reported in 2009 and 2012. Takes were reported throughout the month. September is generally a month of high temperatures that start to drop later in the month, but could be expected to exhibit conditions leading to heat shock.
- Ten takes were reported for all Octobers since 1992. A maximum take of three turtles was reported during 2010. October is a month of varying air and water temperatures, but generally temperatures are falling throughout the month. It is during this month one could expect cold shock to be a contributing factor to turtle impingement on the DWS and CWS racks.

Conclusions:

Air temperature Effects

- Only one sea turtle take occurred in May. The take was related to the highest air temperature of the month, 69F.
- Takes in June were generally associated with maximum air temperatures, maxima ranged from 76 to 102 F during periods of turtle takes.
- July takes were associated with either the July 4th holiday, or were associated with maximum air temperatures; these ranged from 70 to 97 F during periods of turtle takes.
- August turtle takes were associated with minimum air temperatures; these ranged from 58 to 74 F. August is generally the hottest month, and this association, if significant could be related to thermal shock, low temperatures may have slightly impeded the ability of turtles to swim, or it may have disoriented them.
- September turtle takes were associated with maximum air temperatures; these maxima ranged from 69 to 92 F. September generally is the start of temperature decline in Barnegat Bay waters, but this will change from year to year.
- October turtle takes are associated with minimum air temperatures; these ranged from 28 to 57 F. This association is in line with cold shock. October is the month of rapidly declining temperatures.

Wind effects

- Wind can affect the presence of sea turtles at OCNGS. Impingement studies from years past showed the effects of strong easterly winds on the presence of fish and crabs at the intake (Tathem 1977). Winds move the surface waters in a shallow bay. Although sea turtles are renowned divers, the bay is too shallow to allow such dives, and if a turtle stays at the surface, it will be moved along with the water. This is in addition to the upstream flow in the Forked River, induced by the OCNGS pumps. Three measures of wind speed were used in this effort: maximum sustained wind speed, average daily wind speed, and maximum speed of wind gusts.
- During May, 2015, one sea turtle take occurred at OCNGS; it appeared during a day that had a 29mph gust from the south. The previous day, the wind clocked (went clockwise) from north through east to south. This simply shows that prior day wind history can affect the presence of turtles at OCNGS.
- There were no obvious wind related associations with sea turtle takes at OCNGS during June. Takes were apparently distributed in a more or less random fashion.
- July takes were apparently related to several factors. Temporal proximity to July 4th holiday is apparent, but not generally wind related. Wind factors include rapid changes in wind direction that exhibit passage

through the east. Some takes are associated with barometric lows, or immediately thereafter. Other takes are associated with the convergence of average air temperature and dew point temperature. Increased wind gust speeds are also associated with takes.

- August takes appear to be associated with several wind parameters. The most obvious is hurricane effect of 27-28 August, 2011, during which gusts reached 63 mph. Other factors include: the convergence of dew point and air temperature, low barometric pressure, winds that veer (counter clockwise) through the east, sudden rise of air temperature (possible heat shock), and higher wind gusts.
- September is a period of lowering temperatures (at least near the end of the month) and since temperature drives the wind, east winds and minimum daily air temperatures tend to be associated with turtle takes at OCNGS. Strong nor'easters are also associated with sea turtles taken (as in 2009). Low barometric pressure is also associated with takes.
- October takes are not associated with wind speeds. Falling barometric pressure, dew point convergence with air temperature, cold shock (2003), a nor'easter (2006), and easterly winds are all associated with October sea turtle takes at OCNGS.
- We have identified possible parameters affecting sea turtle occurrence at OCNGS; however, it should be noted that catch at the plant is primarily affected by local abundance and distribution. Sea turtles must be in the waters adjacent to the facility in order to be impinged on the racks. There are many times when one or all of the parameters are met, yet no takes are reported. We need to obtain information regarding the presence/absence of sea turtles near Barnegat Inlet during June through October. Gusty east winds, especially during storms, may drive turtles into the intake canal, but there are many more instances where despite such winds, no turtles are captured, presumably because they are not the area at that time.
- According to Tatham et al. (1977), northeast winds (particularly storm conditions) coincided with greater impingement at the plant. These findings, specific to finfish and macroinvertebrates, concur with the findings of this project; whether turtles are pushed along with wind-blown currents, or whether they are following prey items into the intake canal (or a combination of the two) has yet to be determined. Another possibility is that it may be extremely difficult for plant personnel to actually spot turtles during certain conditions (e.g. during increased turbidity and/or high influxes of detritus such as eelgrass or sea lettuce that can be blown in from the bay during storms and/or east winds).
- The OCNGS will remain in operation until 2019. Given the remaining life of the plant, combined with increased catches of sea turtles, strategies to help further reduce take could potentially prevent injury/mortality to >30 individuals. In addition, application of our methods at the Salem plant and other coastal energy facilities with water intakes may be feasible and worth further investigation.

Recommendations:

- Gather information to determine if increased captures is a reflection of increasing abundance or increasing range, or is due to other factors such as climate change or location of the Gulf Stream and its associated gyres. According to the National Marine Fisheries Service (NMFS), nesting numbers for many sea turtle species in the southeast are up (J. Crocker, NMFS, 2013, pers. comm.). In addition, there are recent reports of attempted nesting by sea turtles along mid-Atlantic beaches, including in NJ and DE.
- Meet with appropriate OCGNS personnel to present preliminary results and discuss protocols that could be easily implemented during predicted times of likely sea turtle occurrence. Possible protocols aimed at minimizing sea turtle impingements may include a) increased inspection and cleaning of the trash racks at dilution water and circulatory water intakes; b) increased inspection of canals by boat; c) inspection of intake and discharge canals from bridges along Route 9; and d) video camera surveillance of the intake canal. In addition, in order to further predict periods of likely occurrences, recommend that sea turtle surveys in Barnegat Bay by conducted between May and October.

Literature Cited

Tathem, T.R., Danila, D.J., and D.L. Thomas and Associates. 1977. Ecological Studies for the Oyster Creek Generating Station: Progress Report for the Period September 1975–August 1976. Volume One, Fin and Shellfish. Report for Jersey Central Power and Light Company. Ichthyological Associates, Inc. 354 pp.

JOB F. THREAT ASSESSMENT: Emerging Diseases

Subjob E.1. Emerging Diseases

Project Leader: Kris Schantz and Brian Zarate

Objective: Emerging threats including wildlife diseases can rapidly deteriorate both local and regional wildlife populations of both SGCN and non-SGCN. Participation in actions to identify causes and vectors of wildlife disease and illness allows resource managers to implement steps to reduce species loss

Key Findings:

- ENSP biologist and assistants conducted all work pertaining Snake Fungal Disease (SFD) under the Comp-SWG job (Conserving Snake Species of Greatest Conservation Need Threatened by an Emerging Fungal Skin Disease).
- Staff finished participation at the end of 2014 on the Ranavirus RCN-funded project, detecting the extent of mortality events from Ranavirus in amphibians of the Northeastern U.S. Results will be available in published reports and papers.
- Staff began collaboration with a Montclair State University graduate student studying the health of state-threatened wood turtles in New Jersey and some other northeast states. Involvement related to assisting with site selection.

Conclusions and Recommendations:

- Snakes continue to be identified and confirmed positive for SFD in multiple counties of NJ. All information is provided in the report for the Comp-SWG job (Conserving Snake Species of Greatest Conservation Need Threatened by an Emerging Fungal Skin Disease).
- Continue to participate in the multi-state Comp-SWG project (Conserving Snake Species of Greatest Conservation Need Threatened by an Emerging Fungal Skin Disease) through its conclusion.
- Any additional work on wood turtle health assessments will be under a Comp-SWG funded study, Conservation Planning and Implementation for the Wood Turtle (*Glyptemys insculpta*) and Associated Riparian Species of Greatest Conservation Need from Maine to Virginia.
- ENSP is still awaiting final results from Montclair State University on past Chytrid sampling.

Performance Report

Project: **2. Habitat Management and Planning**
Federal Aid Project: T-1-7 (State Wildlife Grants)
Segment dates: September 1, 2013 to August 31, 2014

JOB A. Strategic Habitat Conservation

Project leader: Sharon Petzinger, Brian Zarate and John Heilferty

Objectives: Enhance, create or restore habitat to support species of greatest conservation need.

Key Findings:

- ENSP met occasionally during the year with biologists, foresters and planners from within DEP to discuss management priorities and management challenges on state lands. The primary focus was in the Skylands region because outside funding was available in that region to conduct forest inventories within the majority of state lands (WMAs, parks, and forests).
- ENSP staff took responsibility of overseeing forestry activities and habitat planning on Sparta Mountain, Rockaway River, and Weldon Brook WMAs after the retirement of the Division's northern region habitat planner.
    - Staff met with botanists from the Natural Heritage Program to discuss concerns of potential impacts of forest management on rare plants in Sparta Mountain WMA.
    - Staff revised the Sparta Mountain WMA Forest Stewardship Plan, which is awaiting internal approval prior to being sent out for stakeholder and public comment.
    - Staff worked with foresters from NJ Audubon and the Ruffed Grouse Society to have volunteers conduct forestry activities on Sparta Mountain WMA this fall/winter.
- Staff conducted post-treatment bird surveys on Sparta Mountain and Weldon Brook WMAs.
- Staff collaborated with Montclair State University to conduct extensive pre-treatment surveys on Rockaway River WMA.

Conclusions and Recommendations:

- ENSP will take advantage of opportunities to create habitat management plans and improve habitats, but does not have the staff needed to pursue habitat planning as a full time job. In 2015 ENSP staff worked on specific jobs where non-federal funding was available for habitat improvements, as noted in the jobs below.

JOB B1. Forest Habitat Management

Key Findings:

- In 2015, surveys for all bird species, including golden-winged warblers (GWWA), were conducted to evaluate the success of Working Lands for Wildlife in terms of the number of bird species and presence of golden-winged warblers.
    - Under separate funding (NFWF and NJ Audubon), staff conducted eleven visits to private landowners interested in Working Lands for Wildlife – seven involved potential new contracts. Of those, four were contracted by NRCS through Working Lands for Wildlife to manage forests for golden-winged warblers in 2015. All landowners under contract with WLFW allow property access to conduct bird surveys, which was done using both SWG and NFWF funds.
        - A total 87 points were surveyed for all bird species: 13 WLFW, 36 Management, 17 Natural, and 21 Other.

        - WLFW points: Under NFWF, 13 survey points were on private lands enrolled in WLFW for GWWA, part of a multi-state effort to monitor GWWA and other bird species responses to habitat management (CEAP), involving two visits in the spring.
        - Management points: Under NFWF, 19 points were part of a collaborative effort with Palisades Interstate Park Commission in NY to monitor GWWA response to *Phragmites* manipulation, requiring two visits in the spring. Seventeen points were in areas that had silvicultural treatment done within the last ten years.
        - Natural points: 17 points were adjacent to wetland forest with a mix of herbaceous and shrub wetlands.
        - Other points: 21 points were in areas that had been previously occupied by GWWA.
    - In 2015, WLFW sites had a significantly higher number of species than all other sites (Fig. 1). Although the Other points had a greater proportion of GWWA, BWWA, and hybrids observed, based on the chi-squared goodness-of-fit test, the presence of GWWA, BWWA, and Hybrids was not significantly different among sites (Table 1).
    - When comparing the sites that were also surveyed in 2014, WLFW sites had a significant change in species richness between 2014 and 2015, while the Management, Natural, and Other sites were not significant (Figure 2).
- Staff collaborated with NJ Audubon and PSEG to create management prescriptions for each span on the utility ROW maintained by PSEG that is part of the 1.5-mile stretch containing about half of NJ's GWWA population. Maintenance on these spans were delayed in 2014/15 and will be limited to parts of these spans beginning fall 2015 to maintain powerline reliability while not decimating GWWA breeding habitat.
- Staff collaborated with NJ Conservation Foundation to manage forested areas in Tranquility Ridge County Park for golden-winged warblers and timber rattlesnakes. Management included selective tree girdling/felling and chemical control of exotic invasive plant species.

Conclusions

- Even in its early stages, young forest management on private properties has benefited a number of early-successional songbird species and attracted a greater diversity of bird species than other managed and natural sites. However, the forest stands are still too young to attract golden-winged warblers.

Recommendations

- Continue to provide technical assistance pertaining to forest management for golden-winged warblers and other wildlife habitat needs on private and public lands, including WLFW.
- Continue to work with utility companies, NJ Division of Parks and Forestry, NJ Division of Fish and Wildlife's Bureau of Land Management, Morris County Park Commission, and The Nature Conservancy-New Jersey Chapter to manage the last remaining active golden-winged warbler breeding areas.

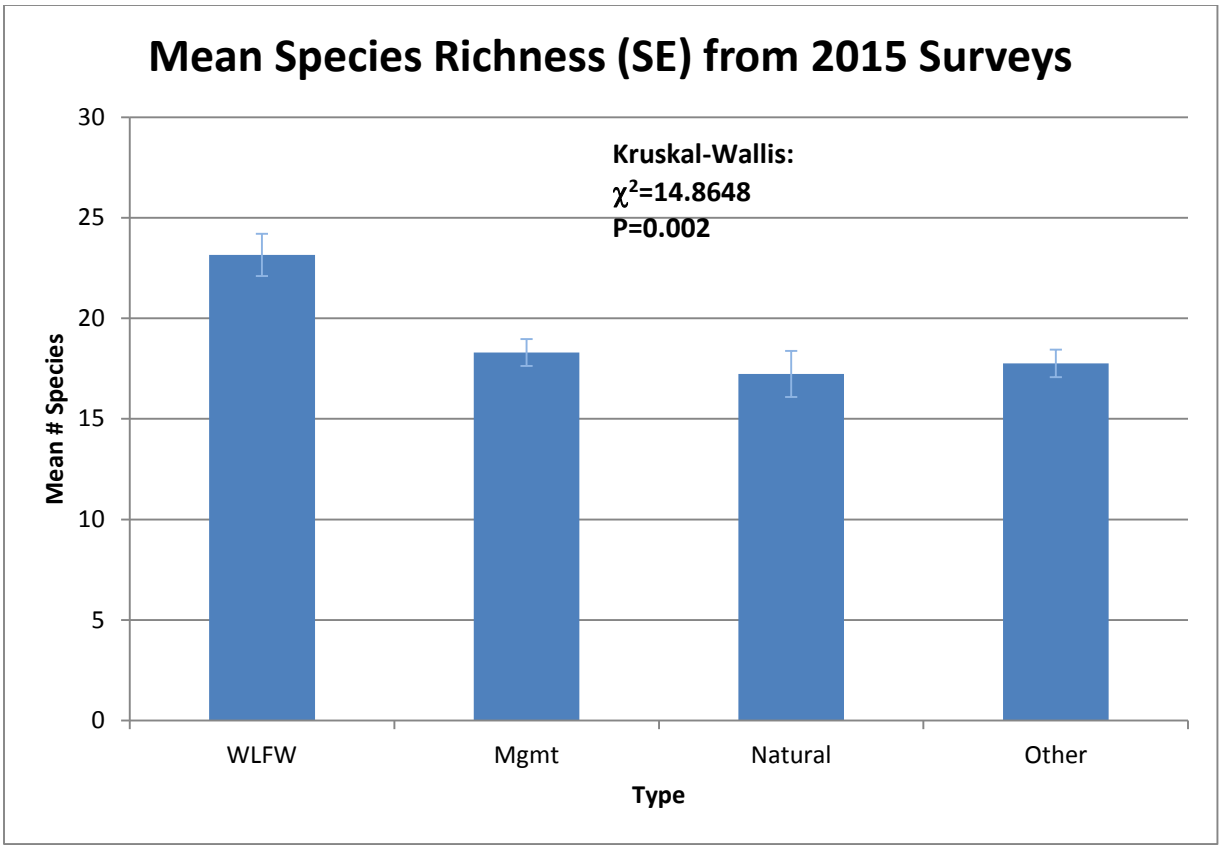

Figure 1. Mean species richness with SE from the 2015 surveys to evaluate WLFW sites. See Table 1 for sample size.

Table 1. Mean species richness and proportion of sites containing GWWA, BWWA, and Hybrids from the 2015 surveys. NS = not statistically significant.

			Proportion of Sites			
Type	**Mean Richness**	**SE**	**GWWA**	**BWWA**	**Hybrid**	**N**
WLFW	23.1538	1.06	0.00	0.33	0.00	13
Mgmt	18.3056	0.67	0.17	0.56	0.08	36
Natural	17.2353	1.15	0.12	0.35	0.06	17
Other	17.7619	0.69	0.33	0.67	0.24	21
Stats	χ^2=14.8648 P=0.002		NS	NS	NS	

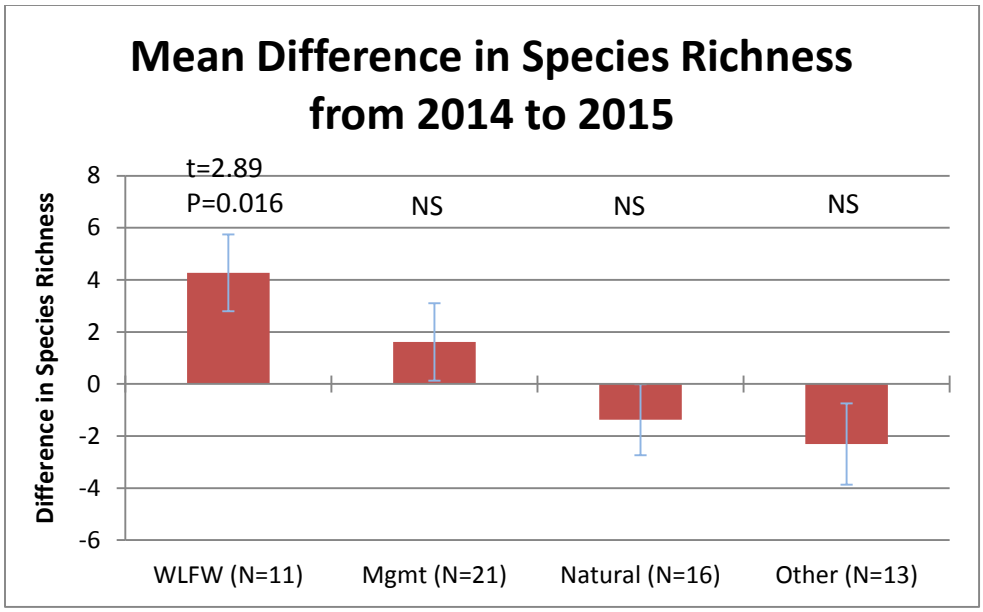

Figure 2. The difference in mean species richness (with SE) from 2014 to 2015. Based on a paired t-test, WLFW sites had a significantly greater number of species in 2015 than in 2014.

JOB B2. Habitat Connectivity and Management

Key Findings:

Habitat Enhancement and Restoration for Eastern Tiger Salamander

CWF and ENSP biologists identified a new location for vernal pool creation on Division of Fish and Wildlife lands. The new location fits into the long range plan to secure eastern tiger salamander habitats in the face of sea level rise that is projected to affect many parts of Cape May County, the current stronghold for this species in NJ.

- The proposed creation of two eastern tiger salamander breeding pools in a utility right-of-way transecting the Beaver Swamp Wildlife Management Area and adjacent Lizard Tail Swamp was abandoned due to the discovery of rare plant species occurrences within the right-of-way. ENSP staff revised the proposal to a location adjacent to the right-of-way, and retained a consultant to perform a rare plant survey of the new project footprint. The plant survey was submitted for approval, and the new schedule would allow work to commence in summer of 2016. The funding for this project is anticipated to be mostly non-federal.

ENSP and CWF biologists continued to coordinate on the design of a wetland mitigation restoration and enhancement site Rio Grande, Cape May County (Fig. 1). The site has been severely degraded over time by ATV traffic and dumping. The proposed restoration work will likely commence in 2016. The mitigation company would undertake the restoration at no cost to the state, in exchange for NJ DEP wetland creation credits.

Figure1. Map of proposed activities for restoration and enhancement of Rio Grande E. Tiger Salamander pond.

<u>BMPs for in-stream and near stream restoration to benefit Odonates</u>

- The Musconetcong River-Point Mountain Stream restoration project was completed and biologists will be conducting follow-up monitoring for odonates during the 2016 field season.
- ENSP staff will be meeting with DEP Division of Land Use Regulation staff to develop regulatory BMPs and guidelines to ensure the protection of rare odonate sites that come through the DEP permitting process.

Recommendations:

- The jobs under this Habitat project are adaptive in nature, aimed at using best management practices and taking advantage of opportunities to enhance habitat wherever they can be found. Thus this is a project that should continue with all staff ready to participate and fuel projects that will directly benefit SGCN wildlife. Monitoring for results should be built into all projects.