Interim Report
State Wildlife Grants
T-1-7
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Endangered, Threatened and Rare Wildlife Conservation Projects

Interim Report for Project Year
September 1, 2013 – August 31, 2014

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 2014, 154 eagle nests were monitored during some or all of the season, of which 144 were active (exhibiting incubation), and 10 were territorial (maintaining a nest area); 20 more nest territories remain on our list but were unknown (pair or nest could not be found, or we lacked observation effort). Twenty-three pairs were new or newly found in 2014.
    - During the 2014 nesting season, 114 of 144 known-outcome nests were successful in producing 199 young, for a productivity rate of 1.37 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 80%, above the average of 75%. These results reflect a continuing growing population.
    - Twenty-three new eagle nests were discovered this season, a 22% increase from last year's known nesting population. Just one of the state's 21 counties lacked a known nest.
    - We documented 29 (20%) 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 2014 we banded 18 eaglets at 9 nests. We took blood from 15 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. The survey transects were no longer representing the 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 will be partnering with 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 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 produced two new brochures (for landowners and volunteers) 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 Atlantic County and one in Cumberland County. The transmitters have resulted in new data on post-fledging movements 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 2013 were GPS'd using a Trimble unit 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:

- After no increase in the number of known-active eagle nests in 2013, we saw an increase of 22% in 2014, and 23 new pairs were found. 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. As in 2013, about 10% of all known pairs changed nest trees, and it can be difficult for observers to find the new nest locations. In 2014, the number of pairs with "unknown" status remained at 20, about 11% of the total.
- 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 certain nests, especially those most visible. 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.
- Replace the Mid-winter Eagle Survey effort with surveys to identify winter roosts and concentration areas. 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 2014 New Jersey peregrine falcon population remained relatively stable with 29 known pairs (27 active) occupying suitable nesting habitat across the state. There was good nesting success overall with 20 pairs successful in producing 49 young, for a productivity rate of 1.88 young per active nest and a success rate of 71% (Table 1). A brief summary of data collected during the 2014 nesting season follows.
  - ✓ Sixteen pairs utilizing towers and buildings continued to be the core of the nesting population, producing 32 young, for a productivity rate of 1.67 young per active nest. This is slightly down from normal, and we saw failures at two sites we attribute to fly infestation (that kills hatchlings), and failure to lay eggs at two sites related to older-aged females. We treated <2-week old hatchlings with bird lice spray at two tower sites (Sea Isle, Barnegat) to reduce infestations of parasitic flies (*Carnus hemapterus*). These flies have caused mortality of young hatchlings in recent years. We did not get to two sites (Swan Bay, Tuckahoe) in the critical 1-5 day post-hatching period and no chicks survived there.

- ✓ Four pairs were known to occupy territories in natural cliff habitat in northeastern NJ. Hatching was confirmed at two sites, but chicks were lost at one site at 2.5 weeks of age. Just one of the four pairs was successful in fledging three young. The remaining two pairs exhibited territorial behavior, but no evidence of young was observed in June or July.
- ✓ Seven pairs of falcons were known to nest on bridges this year. Four of those bridges lie completely within the boundaries of NJ, while three span the Delaware River between NJ and PA and are monitored by NJ. All bridge pairs fledged a total of 14 young for a productivity rate of 2.33 young per active nest. As has been the case in previous years, 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.

- We fostered one nestling from a coastal site to the Jersey City site after that pair failed to lay eggs. The incubated fostered chicken eggs, then raised the fostered nestling successfully. The Jersey City site is on webcam and provides excellent educational opportunities for its followers.
- We banded 35 of the 49 young produced this year, using both a federal band and an auxiliary, bicolor band with an alpha-numeric code following Bird Banding Lab protocol. Twelve nestlings on bridges were inaccessible for banding, as were two young on a generating station building. We also banded one adult female during a nest visit to band her three young, on a sheltered building ledge in Paulsboro.
- Six addled eggs were collected from five different nest sites this season. They will be held for future contaminant analysis. We are awaiting results from such analyses of eggs collected 1990-2013 being conducted by Dr. Da Chen of Southern Illinois University, whose 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 18 breeding adults at 11 nest sites. An additional 16 adults were identified using optics. A minimum of 6 adults (12%) were unbanded. The oldest female identified was a 16-year old that nests in Atlantic City, a bird that failed to lay eggs a second consecutive year and may be beyond her reproductive age. The oldest known male was 11 years. The median age of both males and females was 6. 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. A male banded 15/AM in Atlantic City in 2012 was resighted twice in Stone Harbor and may be nesting in an unknown location in that area. A female banded A/06 in Ocean Gate in 2006 was found nesting in Rappahannock, VA in 2013 and 2014. A female banded 01/AE in Jersey City in 2010 was found nesting on a bridge in Westchester County, NY in 2014.
- The ENSP turned over operation of the Jersey City peregrine falcon nest webcam to the Conserve Wildlife Foundation of NJ, with whom we partnered many years.
- New sites were added to the Biotics database, along with an updated record of existing sites.

Conclusions:

- The peregrine population increased slightly in 2014, with average nest success and productivity. Across all sites – towers, buildings, bridges and cliffs – nest success was 71% and produced 1.88 young per active site, figures that are about 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 returned to a disappointing level, with the known loss of three chicks about 2.5 weeks of age to suspected avian predation. It continued to be difficult to get thorough observations and identify sources of failures; two sites could not be viewed directly at all. 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.

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, 2014

Site Name	Occupied	Active	Eggs	Young Hatched	Young @ Band Age	Young Fledged	Comments
101 Hudson, Jersey City	Y	N	0	--	--	0/1	We fostered 1 chick from Ocean Gate on 5/21
Atlantic City – North end water tower	Y	Y	U	U	U	U	No data
Bayside Prison Water Tower	Y	Y	3	1 (5/12)	1	1	Coll 1 whole,1 cracked egg
Drag Island	Y	Y	3	3 (5/27)	2	2	Tower built 2/2013
Egg Island WMA/Dividing Creek	Y	Y	4	3 (5/10)	3	3	4th egg on ground/cracked
Elizabeth-Union County Court House	Y	Y	3	3 (5/1)	3	3	
Forsythe NWR/Barnegat Tower	Y	Y	4	4 (5/12)	3	3	Likely 1 hatchling died (flies)
Forsythe NWR/Brigantine Tower	Y	Y	1	0	0	0	Collected 1 egg
Great Bay WMA/Water Tower	N	N	-	-	-	-	
Heislerville WMA Tower	Nest box removed (2012), box installed at Bayside water tower						
Hilton/The Grand Casino	Y	N	0	-	-	-	Female is 17 years old
Margate Marsh	N	N	-	-	-	-	
Marmora WMA/Sea Isle Tower	Y	Y	4	4 (5/12)	2	2	Likely 2 died (flies heavy)
Ocean Gate (AT&T) Tower	Y	Y	4	3 (5/11)	3	3/2	1 egg, 1 chick to J.C. foster
Paulsboro Refinery	Y	Y	4	3 (5/2)	3	3	
Sedge Island WMA Tower	Y	Y	U	2 (5/12)	2	2	
Sewaren Generating Station	Y	Y	U	2	2	2	Not banded; nest in duct.
Stone Harbor Marsh (new platform '14)	Y	Y	4	4 (5/21)	4	4	No flies.
Swan Bay WMA Tower	Y	Y	4	0	0	0	Flies caused mortality? 1 egg

Tuckahoe WMA Tower	Y	Y	4	0	0	0	Flies caused mortality? 1 egg
Wildwood Crest-Grand Condo	Y	Y	4	4	4	4	New site; flowerpot on balcony
SUBTOTAL: TOWERS & BUILDINGS	***18***	***16***	***>46***	***>36***	***32***	***32***	***Total of 4 eggs collected***
Delaware Water Gap (NJ Side)	U	U	-	-	-	-	
Natural Site C-1 (Alpine)	Y	Y	U	F (4/30)	0	0	Failed ~4/29-30 NE storm
Natural Site C-2 (Englewood)	Y	Y	U	3 (5/5)	3	3	Inc. 3/31
Natural Site C-3 (Carpenter Cir-Ross Dock)	N	N	-	-	-	-	
Natural Site C-4 (Bombay Hook area)	Y	Y	U	U	0	0	Heard only
Natural Site C-4 (Ruckman-State Line)	Y	Y	3	3 (5/6)	0	0	Failed 5/24-28
Natural Site C-5 (Tenafly-Greenbrook)	N	N	-	-	-	-	
SUBTOTAL: NATURAL SITES	***4***	***4***	***U***	***6***	***3***	***3***	
Ben Franklin Br. (Delaware River)*	Y	Y	4	4	4	4	PA side/PA monitored; 1 d PF
Betsy Ross Bridge (Delaware River)	Y	Y	U	0	0	0	1 egg coll. late
Brigantine Bridge (Atlantic City)	U	U	-	-	-	-	Rumor of pair on Harrah's
Burlington-Bristol Br. (Delaware River)	Y	Y	3	2	2	2	
Commodore Barry Br. (Delaware River)*	Y	Y	U	3	3	3	PA side/PA monitored
Geo. Washington Bridge (Hudson River)*	U	U	-	-	-	-	NY side/NY monitored
Great Egg Harbor-Parkway Bridge	Pair now nesting on the Drag Island tower						
Laurel Hill RR Bridge-Meadowlands	Y	Y	U	U	2	2	1 died post-fledging
Newark Bay Bridge (NJTP or Conrail)	U	U	-	-	-	-	
NJ-PA Turnpike Br. (Delaware River)*	Y	Y	5	5	5	5	PA side/PA monitored; 1in PF
Scudders Falls Bridge*	Y	N?	U				PA side/PA monitored
Ocean City-Longport Bridge	N	N					
Route 1 Br./Raritan-New Brunswick	Y	Y	U	4 (4/26)	4	4	Not banded; fledgling observed
Route 3 Br./Hackensack (NJDOT)	Y	Y	U	3	3	3	Not banded; nestlings observed
Route 35 Bridge/Belmar	U	U	-	-	-	-	
Route 46 Br./Little Ferry-Ridgefield Pk	Y	Y	U	3 (5/11)	3	3	Unable to band; didn't use box provided in Br Tenders Tower
Secaucus-Kearny NJTP Bridge	U	U	-	-	-	-	
Tacony-Palmyra Br. (Delaware River)	Y	Y	3	0	0	0	1 cracked egg coll. 6/2
Trenton RR Bridge	U	U	-	-	-	-	
Vince Lombardi – NJTP Bridge	U	U	-	-	-	-	
Walt Whitman Bridge (Delaware R.)	Y	U	U				NJ side? but no data.
SUBTOTAL: BRIDGES (NJ only)	***7***	***7***	***≥6***	***≥12***	***14***	***14***	
TOTALS (NJ Only)	**29**	**27**	**≥52**	**≥54**	**49**	**49**	**49 yng/26 known-outcome nests=1.88 young per nest**

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 conduct the statewide census every three to four years, and the 2013 census documented 542 nesting pairs. A total of 25 new nests were located during the 2014 nesting season between April 1 and August 31. We therefore estimate the current population size at

around 567 nesting pairs. Recent population growth has slowed from 18% in 2006-2009 to 10% in 2010-2013.

- This year approximately 62% of known nests were checked during ground surveys, which allowed for productivity estimates for the major colonies and the state as a whole (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 337 nests (Table 1). We grouped nests by watershed or water-body areas to which they were closest. Nest success averaged 2.03 young per active nest, which is up slightly from last year. Weather was favorable for high productivity with average temperatures and precipitation. There were no severe weather events that caused major nest failures. Nest productivity continued to vary by geographic area. Delaware Bay continued to have slightly higher productivity rates over Atlantic coastal colonies (2.32 vs. 1.98 young/active [known-outcome] nest).
- A total of 526 young were banded for future tracking. In addition, we began using an alpha-numeric color band on nestlings banded in Barnegat Bay nests. A total of 62 red auxiliary bands were deployed this summer. A re-sighting project will be implemented to determine nest site fidelity, foraging habitat, and to engage the public in osprey conservation.
- Fourteen 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.
- Our partner, Conserve Wildlife Foundation of NJ (CWF) fielded a biologist who, in the course of nest checks and banding, collected plastic debris from nests. The collection of debris will be used to help educate the public about the persistence of plastics in our coastal waters and their threats to local wildlife, including osprey.
- 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. Last year's statewide survey was partially accomplished by asking volunteers to document activity at known nest sites. Partnering with Osprey-Watch has been a valuable asset, and we received data on many nests in 2014 by Osprey waters who have adopted nests to watch and document success.
- No information was gathered on fisheries' (menhaden and flounder species') trends to identify a potential correlation with osprey population parameters.
- CWF organized volunteers to install five new nest platforms along the Atlantic Coast. CWF also works to maintain many of the existing platforms throughout New Jersey. Repairs were made to many additional nest structures.

Conclusions:

- This year's ground surveys by volunteers and cooperators documented one of the highest nest success rates for a population estimated at 567 pairs. Weather conditions during the nesting season were relatively mild, with no major storms to damage nests during incubation or chick-rearing. The high productivity suggests that fish resources were more than adequate as well.
- 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 years (next survey in 2017) 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 changes (e.g., Atlantic vs. Delaware Bay regions, and Atlantic subregional comparisons). Recruit and train additional volunteers to conduct nest checks.
- Design and implement an online 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 2014 in all NJ nesting areas. Productivity determined by aerial and ground surveys in May-July. Productivity rates in 2013-2010 provided for comparison.

						Previous Years			
Nesting Area	**# Nests**	**Known-Outcome Nests**	**# Young**	**# Banded**	**Productivity 2014**	**2013**	**2012**	**2011**	**2010**
Delaware River & N. Jersey	1			n/a	n/a	n/a	n/a	n/a	n/a
Hackensack – Hudson Rivers	6	5	6	0	1.20	1.50	2.33	2.67	n/a
Raritan Bay area (w/Cheesequake)	21	12	23	12	1.92	1.74	2.00	1.54	1.64
Monmouth County	10	4	8	0	2.00	2.00	2.20	2.00	1.86
Barnegat Bay	53	40	59	36	1.48	1.88	1.94	1.88	1.91
Sedge Islands WMA	25	20	21	21	1.05	2.00	2.10	2.38	1.29
Great Bay to Atlantic City	66	51	94	81	1.84	1.79	1.68	2.12	2.05
Great Egg Harbor/Ocean City	62	57	131	126	2.30	2.09	1.32	2.43	2.38
Sea Isle City	26	23	56	22	2.43	1.68	1.78	1.91	2.07
Avalon/Stone Harbor Bays	55	50	106	82	2.12	1.79	1.75	2.02	1.88
Wildwood Bays & Cape May	30	24	59	43	2.46	2.00	2.13	1.50	1.50
Maurice River & Estuary Marshes	55	47	108	95	2.30	2.12	2.09	2.06	2.10
Salem Co./ Artificial Island / Delaware	10	6	15	8	2.50	1.90	1.62	2.38	2.50
TOTAL of Study Areas	**420**	**339**	**686**	**526**	**2.02**	**1.92**	1.81	2.07	1.97
Atlantic Coast only	354	286	563	423	1.97	1.88	1.76	2.07	1.92
Delaware Bay only	66	53	123	103	2.32	2.09	2.00	2.10	2.18
Total Statewide		**339**	**686**	**526**		**542**			

American Kestrel

Project leader: Peter Winkler, GIS Specialist

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

Key Findings:

- ENSP selected 181 nest boxes for monitoring in 2014 to focus on the most productive boxes from our original study areas and add a subset of partners' boxes used by kestrels in the previous five seasons (Figure 1). The majority of the monitored nest boxes were from the original 275 boxes with 18 more from our study area in southern NJ, 11 from new areas in central NJ, 5 from Bergen County, 5 from Morris/Sussex counties, and 2 in landowner-installed boxes. The new study areas expand the nest box program to important habitat areas for kestrels while maintaining some representation within all previous study areas (Clinton, Amwell Valley, Assunpink, and Southern NJ). Boxes not identified for monitoring included those that were in suboptimal locations, where volunteer help was lacking, where landowner support was lacking, or where nest boxes failed (box broke or the supporting structure fell down). New Study Areas will be reassessed for continued monitoring in four years based on kestrel activity (or lack thereof) and partner/monitor support.
    - Six new volunteer monitors were recruited and trained in 2014. ENSP also partnered with Bergen County Audubon, Bergen County Parks and Recreation, Delaware and Raritan (D&R) Greenway Land Trust, and several private landowners. Through a collaborative effort, 39 additional nest boxes were placed throughout the state, including a new area in an urban park in northern NJ where kestrels have been observed.
    - A total of 180 nest boxes were monitored every 12-15 days from April through August 2014: Twelve volunteers monitored 105 nest boxes while staff monitored 75 boxes.
        - Of the 180 actively monitored nest boxes, 37 (21%) were occupied by American kestrels. One additional nest was discovered in an unmonitored (landowner installed) nest box visible during a check.
        - Of the total nesting attempts (n= 38), 29 (76%) were successful, defined by a nesting attempt resulting in nestlings that reached bandable age of 14-22 days, nine nesting attempts (24%) failed, and we documented one female attempting to renest in a new box (~2.8 miles away) following an early failure; her second nesting attempt also failed.
        - All data collected was continuously entered online through a Google documents online interface following each nest check.
    - Nesting success was higher in 2014 (76%) than 2013 (66%), despite fewer nesting attempts (38 vs. 48). Although the number of active nests was down in 2014 (the highest number of successful boxes, 40, was documented in 2012), average productivity per successful nest (4.07) and productivity for all occupied nests nests (3.11), were the highest since project inception.
- 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.
- 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.
- The 2014 banding season resulted in the following:
    - 149 kestrels were banded in total: 118 young (55 female, 63 male) and 29 adults (25 female, 4 male) were banded at 22 nest boxes. The number of banded young was second highest to 2012 (n= 152). All banding data was supplied to the Bird Banding Lab via BandIt.
        - Three adult (≥1 yr.) females were trapped using a bal-chatri trap baited with live, domesticated mice (*Mus musculus*).
        - Fourteen previously banded adults were recaptured (10 female, 4 male): Two (1 female, 1 male) were banded outside of our nest box program; the foreign recaptured female was

found dead in the nest box when we attempted to band. The remaining kestrels were either banded by ENSP or previously caught by ENSP prior to the 2014 season.

- Of the 15 light-sensing geolocators placed on female American kestrels in 2013, four were recovered from females nesting in ENSP-monitored boxes and one was discovered by a citizen on a dead kestrel.
  - Preliminary downloads from geolocators indicated two of the females remained in the northeast, one remained in and proximal to the occupied breeding territory in 2013, and one showed a fall migration route south to the Georgia/Florida border region, with a return route leading to the exact same nest box (within 6 km accuracy) she nested in 2013 (Figure 2). The kestrel that was discovered dead traveled to and remained in northeastern Pennsylvania until her death.

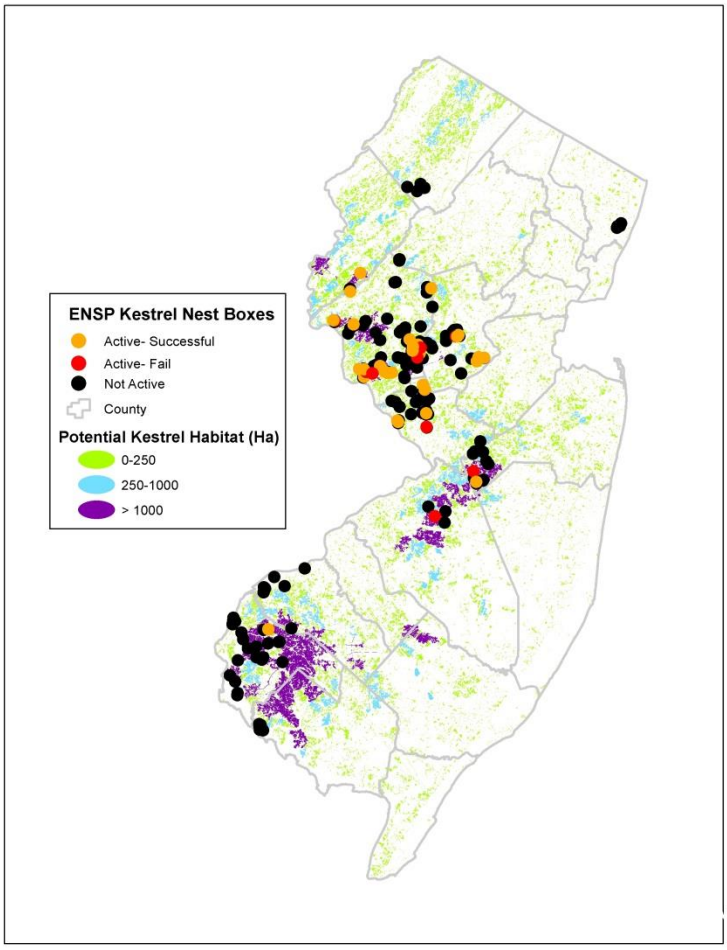


Figure 1. American kestrel nest boxes monitored by ENSP in 2014

- GIS data has been compiled to investigate use of and potential loss of kestrel migration habitat in New Jersey and nationwide. The National Land Cover Database will be used to evaluate habitat along the four major North American flyways. The 2011 NLCD was released in 2014, making three eras of NLCD data directly comparable (2001, 2006 and 2011).
- ENSP requested and obtained American kestrel encounter data from the USGS Bird Banding Lab. The encounter data is being used to develop migration route maps for evaluating potential habitat loss and for comparison to location data obtained from the geolocators.
- Due to lack of staff time a nest box manual was not created.

- The Peregrine Fund did not hold an annual meeting in 2014, thus no staff attended.

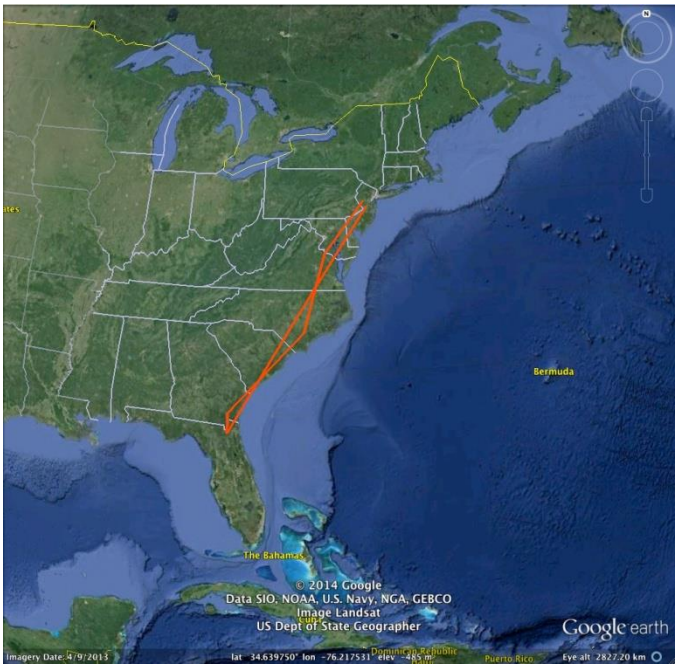


Figure 2. Preliminary map of geolocator-logged migration route. The fall migration south is indicated by two stopover areas, whereas the spring migration appears to be a straight route back north.

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. 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.
- ENSP monitored fewer nest boxes in our historic project areas but maintained a higher success rate despite the reduced number of breeding pairs by concentrating on the most productive areas identified in previous years. This change allowed us to maximize staff and volunteer time as well as the number of pairs monitored. We will continue to make further refinements to monitored boxes based on 2014 occupancy data.
- Through partnerships in new, urban areas of the state we hope to attract and learn more about urban kestrel nesting attempts. Kestrels have been documented to intermittently nest in cornices but due to the difficulty in finding nests and later accessing the nests in order to observe and band young, it is difficult to gather baseline data. So far, despite kestrels being present during the installations of the nest boxes in our new urban study area (Bergen County), there were no known nesting attempts.
- ENSP partnered with a researcher to get a geolocator project up and running in CT modeled after ENSP's geolocator project in 2013. We now have a device recovery figure and migration data in which to compare to Connecticut's in 2015 when they retrieve their devices. Geolocator technology may be the best technique to determine kestrel non-breeding and wintering habits, which may offer insight into their population declines in the eastern U.S.

Recommendations:

- Identify a sample of nest boxes in the most productive areas in ENSP study sites to determine occupancy (by kestrels and competitors), kestrel productivity, and causes of mortality and nest failures. Attempt to quantify starling nesting competition.
- Remove unoccupied nest boxes in unsuitable habitat and relocate to locations in the largest patch size categories and on properties that are permanently protected from development to maximize use by kestrels. Look at historical data to find nest boxes in apparently suitable areas that have never been occupied or never successfully fledged young and remove boxes from that area.
- Continue to evaluate effectiveness of nest box program to improve kestrel reproductive success.
- Update kestrel habitat loss model using the same three patch size classifications (0-250, 250-1000, and >1000) based on new 2012 land cover data and identify any significant changes to areas surrounding kestrel boxes.
- 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 framework and funding to investigate use of and potential loss of kestrel migration habitat using geolocator data as examples.
- Draft update to comprehensive report and create a preliminary geolocator report with current findings to add to Raptor Webpage.
- Maintain relationship with Connecticut researcher to compare migration data as well as device recovery rates.

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:

- Staff has not completed the analysis of historic population survey data due to other time constraints. The preliminary analysis suggested that the long-term, repeated survey of transects was not reliable enough to provide trends due to changes made in routes in response to habitat loss. Staff will be revisiting the data analyses and considering them in the context of regional population survey protocols and the particular landscape of New Jersey, to devise the best surveys for the woodland raptors.
- Other work on habitat use of 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 126 points (114 points in northwestern NJ and 12 points in southern NY) in the spring 2014 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.
  - 53 of the 126 points surveyed were new (not surveyed any year between 2008 and 2013) and 73 were repeated (surveyed at least once between 2008 and 2013).
  - 41 of the 126 points were surveyed only to monitor sites previously occupied by golden-winged warblers, including those associated with Cornell's Atlas Project (GOWAP).
  - NJ Audubon surveyed additional points, using a similar protocol, within select spans of PSEG's utility ROW and provided ENSP with the five locations where golden-winged warblers were observed. No other data (other spp., habitat) were provided so only those five points were used.
  - Out of the 126 locations surveyed in 2014, 26 golden-winged warblers (in 22 locations), seven hybrids, and 63 blue-winged warblers were observed (in 58 locations): 19 golden-winged, 56 blue-winged, and all seven hybrid (6 Brewster's, 1 Lawrence's) observations were in NJ. Overall, in NJ we observed six confirmed breeding pairs, 12 likely breeding pairs, and one transient golden-winged warbler.
  - Based on 2009-2014 surveys, NJ's golden-winged warbler population is still stable but has declined from 2013, blue-winged warblers are decreasing slightly, and hybrids are increasing slightly (Fig. 1).
    - Less than ten percent (5/53) of new (non-repeated) survey locations in 2014 were occupied by golden-winged warblers, 45% by blue-winged warblers, and 4% by a hybrid.
    - About 38% (10) of the 26 NJ locations occupied by golden-winged warblers in 2013 were not occupied in 2014, and 4% (2) of the 48 locations without golden-winged warbler observations in 2013 were recolonized in 2014.
- General habitat data were collected at 120 survey points in 2014 – 20 out of 22 locations where golden-winged warblers were observed. Approximately 32% of the survey points and half the observed golden-winged warblers were in predominately wetland habitat, and 38% of the points and 25% of golden-winged warblers were in predominately upland habitat, and 30% of the survey points and golden-winged warblers observed were in areas with both upland and wetland habitat. About 80% of the survey points and almost all (95%) of the observed golden-winged warblers were within 150 meters of wet ground, stream, or open water (Fig. 2).
  - The majority of the survey points were evenly distributed between utility ROWs, upland shrubby fields, wetland forests, wetland forest/shrub mix, shrub wetlands, and upland seed tree harvests. The remaining habitat categories ranged from 2.5-7.5% of the points surveyed. Eight golden-wings (40%) were observed in utility ROWs, six (30%) in wetland forest or wetland forest/other wetland mix, two (10%) in beaver wetlands, and two (10%) in wetland shrubby areas (Fig. 3).
  - Most of the survey points contained <50% tree cover, <50% herbaceous cover <50% shrub and <25% dead vegetative cover (Fig. 4). Most (90%) of the golden-winged warblers were observed in areas with 25-50% tree cover, all were in areas with <50% herbaceous cover, most (80%) in areas with 25-50% shrub cover, and all were in areas with <25% dead vegetation cover (Fig. 4)

- Survey points were equally distributed among vegetation heights at categories but was slightly skewed towards >3 meters in height. Half of the golden-winged warblers observed occurred in areas where the average vegetation was 2-3 m in height (Fig. 5).

- Only three of the 14 golden-winged warbler males banded in 2012 or 2013 were observed in 2014. One of the three banded males occupied the same territory in 2014 where they were observed in 2013. Observations of the remaining two banded males in 2014 were 525-550 meters from where they were last observed.
  - Two male and two female golden-winged warblers were mist-netted and color-banded in 2014.
- 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 Bald Eagle State Park, PA from August 18-20, 2014.
- An outline for the golden-winged warbler status assessment and recovery plan has been created and includes a list of known threats (1st and 2nd level), the level of impact on the population, and related stressors. Data are being compiled for analyses.

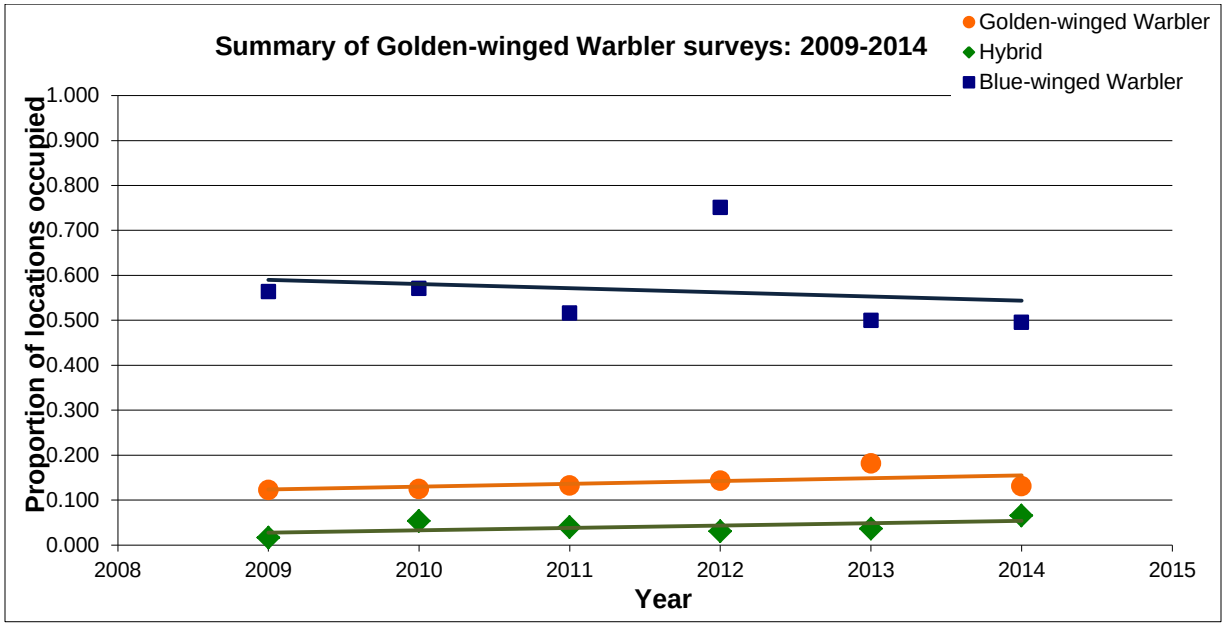


Figure 1. Proportion of golden-winged warblers, blue-winged warblers, and hybrids observed per survey location during the 2009 (n=179), 2010 (n=117), 2011 (n=151), 2012 (n=161), 2013 (n=110), and 2014 (n=107) surveys.

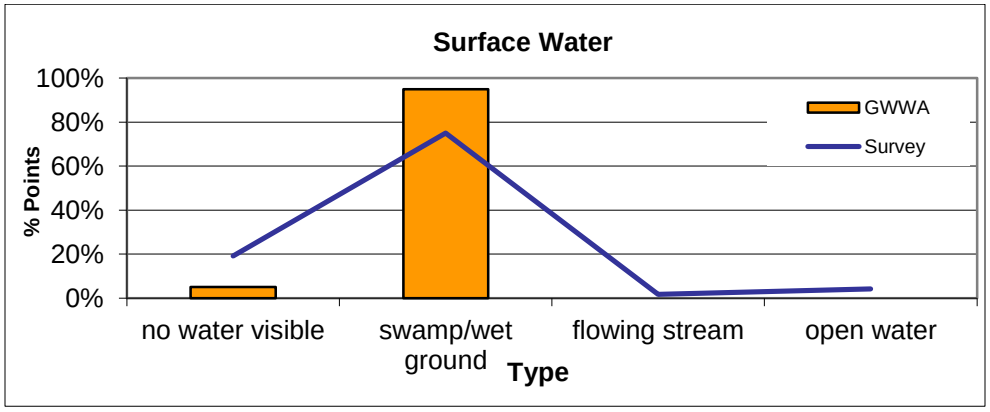


Figure 2. Percentage of points, by surface water category, used by golden-winged warblers and that which was available at all the survey locations in 2014.

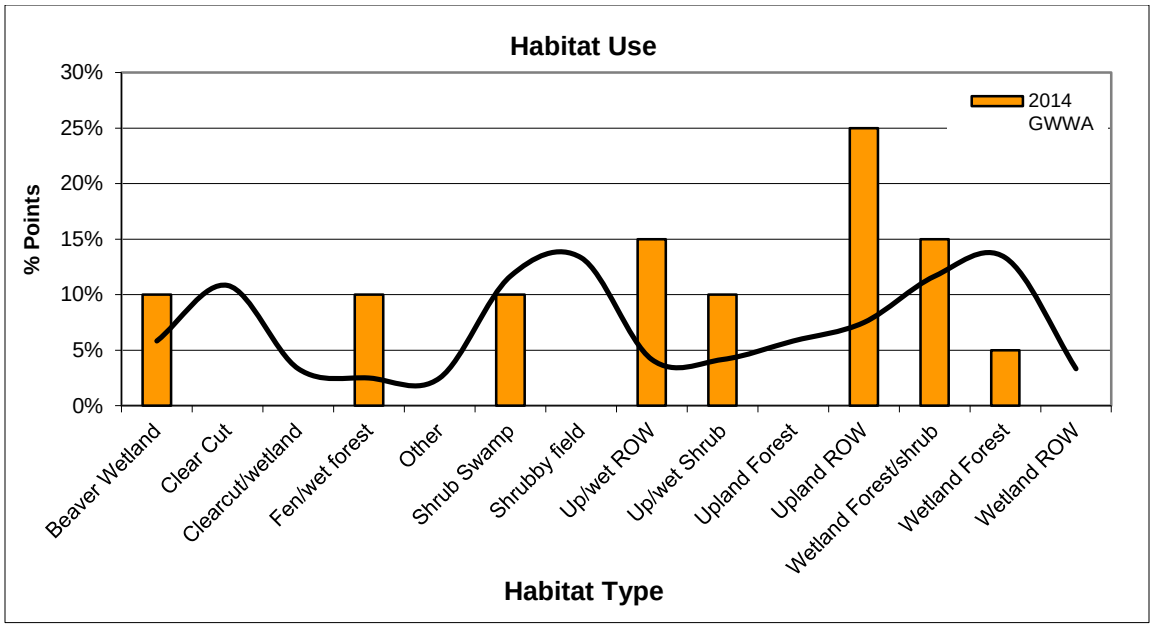


Figure 3. Percentage of survey points, by general habitat category, used by golden-winged warblers and that which was available at all the survey locations in 2014.

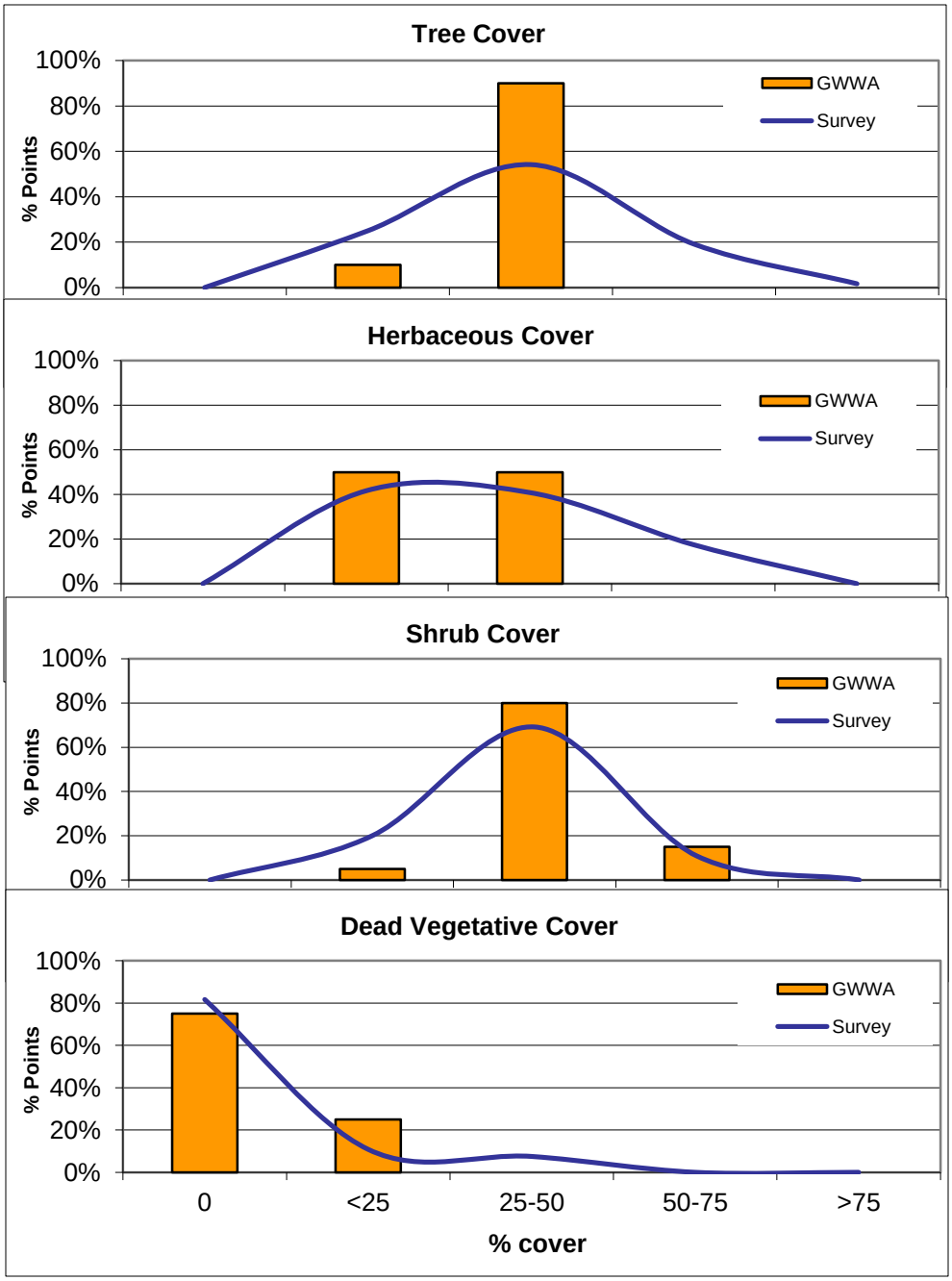


Figure 4. Percentage survey points, by amount of habitat cover, used by golden-winged warblers and that which was available at all the survey locations in 2014.

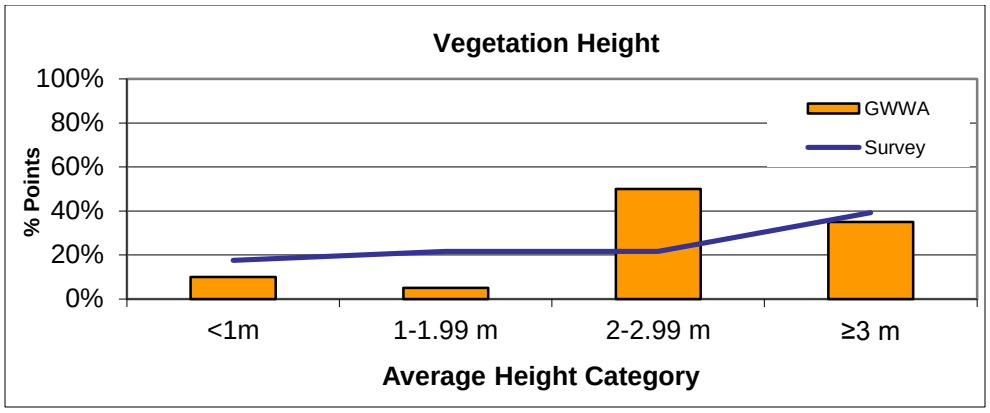


Figure 5. Percentage survey points, by vegetation height, used by golden-winged warblers and that which was available at all the survey locations in 2014.

Conclusions:

- The number of breeding golden-winged warblers observed in NJ has been relatively stable since 2009 with a net gain of approximately 21-25% (previously vacant sites recolonized + occupied sites discovered - previously occupied sites lost), but in 2014 we detected a net loss of 6 individuals (30% of known occurrences). Furthermore, about half of NJ's observed golden-winged warbler breeding population was located on a 1.5-miles stretch of utility right-of-way scheduled to be cleared in the fall 2015.
- Of the habitat utilized by breeding golden-winged warblers in NJ, the strongest affinity of this species in 2014 was towards utility ROWs (P*occ* = 2.67). Golden-winged warblers had a slight preference towards forested or shrub wetlands (P*occ* = 1.21), and forested or shrub uplands were not selected in 2014.
- In 2014, breeding golden-winged warblers in NJ selected areas with 25-50% tree cover (P*occ* = 1.67), 25-50% herbaceous cover (P*occ* = 1.21), 25-75% shrub cover (P*occ* = 1.19). Locations with 1-25% dead vegetation cover (P*occ* = 2.31) were selected over sites with no dead vegetation cover (P*occ* = 0.92). The distribution of vegetation cover correlates with the vegetation height of 2-3 meters that golden-winged warblers are most likely to occupy (P*occ* = 2.30); three meters is the threshold in distinguishing between tree and shrub cover. Furthermore, the presence of swamp or wet ground, separate from streams, ponds, and/or lakes, within or adjacent to an occupied site is most likely to be occupied by golden-winged warblers (P*occ* = 1.27).

Recommendations:

- Create a publishable version of management recommendations for golden-winged warbler habitat based on the analyses of 2003-7 and 2008-2014 data and in coordination with the Golden-winged Warbler Working Group.
- 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 colonization 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 Leaders: Kim Korth and 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:

- Staff completed the evaluation of the effectiveness of management techniques (WSG, CSG, MIX.) on properties enrolled in LIP for grassland birds. Bobolinks and eastern meadowlarks were most abundant in cool-season grasses and least abundant in warm-season grasses. Horned larks were more abundant in both warm-season grasses and mixed warm-season and cool-season grass fields and least abundant in cool-season grasses.
- An assessment of landscape variables was done for each survey location on properties enrolled in LIP. Those properties with warm-season grass treatments tended to be larger in size and farther from a forest, urban, wetland, and roadside edge. Properties with cool-season grasses were smaller and the closest to roads and urban edges (Table 1).
- Due to staff departures, predictive models, habitat management guidelines, and a status assessment for grassland bird species were not completed.

Table 1. Summary of landscape variables for each treatment within properties enrolled in LIP.

	Cool Season Grasses (N=71)		Mixed Grasses (N=21)		Warm-season Grasses (N=52)	
Landscape Variable	Mean	SE	Mean	SE	Mean	SE
Distance to Forest (ft)	370.88	25.60	370.12	38.09	465.20	44.59
Distance to Urban (ft)	545.98	38.77	641.35	83.55	712.67	64.39
Distance to Wetland (ft)	572.45	43.33	466.21	79.97	781.68	103.01
Distance to Major Rd (ft)	1983.35	201.24	2570.35	621.07	2312.94	343.22
Distance to Center (ft)	732.00	48.14	782.66	93.11	820.19	68.89
Area (acres)	864.88	113.10	947.20	243.06	1365.50	175.04
Area/Edge (acres/ft)	258.90	6.97	291.67	16.11	321.17	11.52
Core Area (acres)	227.41	36.41	327.18	102.77	484.67	68.82

Conclusions:

- LIP was beneficial for a subset of grassland bird species, depending on the treatment within the LIP property.

Recommendations:

- Further data analyses should be done to contribute to 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 worked 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. ENSP biologists pushed for the installation of an upland dike to prevent loss of ~100 ac of freshwater wetlands in the process of restoring the inlet and flow to Pond Creek. The plans for the restoration (including the upland dike) were adopted by DEP and funding was secured from the DEP Office of Natural Resource Restoration. Pre-construction surveys for bird use were conducted in September-October 2013, and post-restoration surveys are planned.
- In a related project, ENSP biologists worked with DFW Bureau of Land Management biologists to restore 100 ac of upland habitat next to Pond Creek. This site, known for its history as a Magnesite-extraction industry, has remnant Magnesite spoil areas. One part of the site had been restored with dredge material but had become dominated by mugwort (*Artemisia vulgaris*); another section has yet to be restored. ENSP assisted with the planning for restoring the entire site and funding was secured from a state CBT source. Work will take place beginning in October 2014.

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.

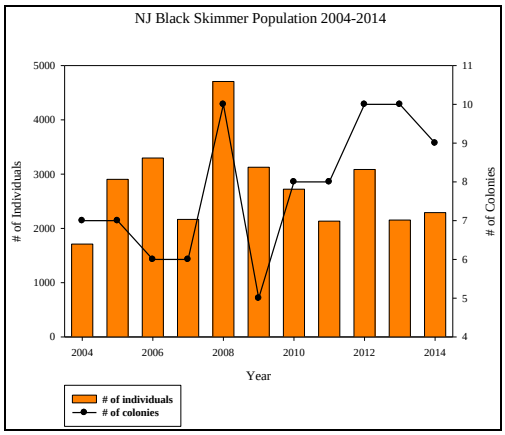
Subjob A.3. SHORE AND MARSH BIRDS

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

Project Leaders: Christina Davis and Dave Jenkins
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.

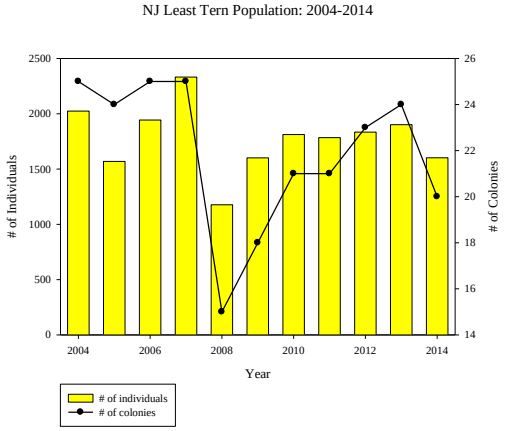
Key Findings:

<u>Black Skimmer</u>



- Black skimmer breeding surveys were conducted approximately every two weeks from mid-May until the end of August on barrier island beaches along the entire Atlantic coast and marsh islands from Barnegat Bay south. Surveys took place at 19 sites and active nesting (at least one nest with eggs) was observed at 9 nesting sites. Observations were made at these locations for the duration of the nesting season. A total of 2,165 adults were present at the active sites (based on a cumulative total of peak counts that occurred in the 1-15 August survey period). As has been the case in recent years, the majority (81%) of the state's known population was present at just one site during the peak count survey period, which was located at Seaview Harbor Marina (1,757).
- A peak count of 405 adult black skimmers was observed incubating. The incubation number was lower than might be expected given the number of adults present and was probably lower than what actually nested. As is generally the case, the vegetation at the largest colony often blocks observers from garnering an accurate count of these ground nesters. However, the predator pressure was so intense that it was not worth increasing the vulnerability of the colony by walking through it to count nests (which in any case ENSP has never found to be an effective method to get an accurate total).
- Black skimmer productivity was moderate, with 677 fledglings produced statewide, or 1.67 chicks per pair (note: as detailed in previous bullet, the incubating number employed to make this calculation was likely an underestimate which would make the productivity rate lower than 1.67 and possibly closer to 0.60-0.70 given the number of adults present in the state). Only four sites fledged young, with almost all the young (95%) produced at one site, Seaview Harbor Marina. Predation was the primary factor responsible for poor reproductive success at other beach strand sites. For the marsh nesting birds, flooding was the primary factor in their failure.
- 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.

<u>Least Tern</u>

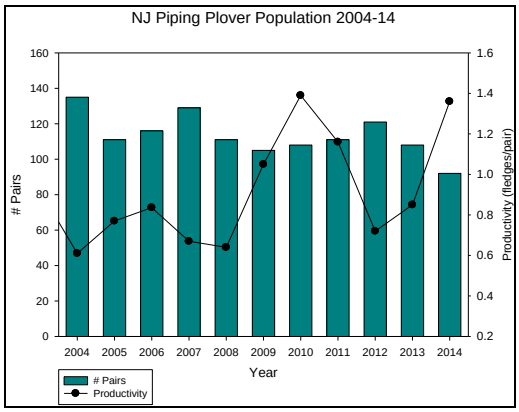


- Least tern breeding surveys were conducted approximately every two weeks from mid-May until the end of August at beaches along the entire Atlantic coast. Colonies were located at 20 nesting sites and observations were made at these locations for the duration of the nesting season. A total of 984 adults were present at these sites (based on a cumulative total of peak counts that occurred in the 16-30 June survey period). The population was distributed fairly evenly throughout the state and six colonies had >100 adults with one colony >300. The largest colony was located in Seaview Harbor Marina, with 305 adults on its peak count followed closely behind by Cape May City – Poverty Beach with 273 adults at its peak. The adult numbers were down slightly from 2013, with notable decreases of individuals nesting at the Sandy Hook sites and the loss of the Strathmere colony (site became unsuitable due to severe erosion) likely contributing to this trend.
- A peak total of 426 adult least terns were observed incubating. Productivity was low for least terns with 173 fledglings produced statewide (0.41 chicks per pair, based on the peak number of incubating

adults). Most colonies fared exceptionally poorly but successful colonies were located at Holgate, Little Beach and Seaview Harbor Marina, which housed 20% of the state's adults but 69% of its fledges. The primary limiting factor was predation, as has become the norm in recent years.

- The least tern colony was inactive Newark Airport in 2014. The biologists who manage this site increased efforts to discourage nesting birds (there are often airstrikes of adults) by removing any available nesting substrate (small patches of grass in the tarmac), placing a tarp over certain attractive areas and flying streamers to "spook" the birds. Although ENSP very rarely condones efforts to discourage endangered species from nesting, in this case it was the best option for both the safety of people and especially that of the adult terns.

Piping Plover (*Full Piping Plover reporting can be found in NJ E-1-36*)



- Ninety-two (92) pairs of piping plovers nested in New Jersey in 2015, an 15% decrease from 2013 (108 pairs, which was already a 15% drop from 2012's 121). Alarmingly, the 2014 population marked an all-time low in number of pairs since federal listing, well below the average of that period (118 pairs) and far below the peak of 144 pairs in 2003.
- The total number of adults recorded for the entire nesting season (186) was nearly the same as during the date-restricted survey conducted 1-9 June (184) and the number of pairs tallied during the entire nesting season (92) was slightly higher than those counted during the date-restricted survey (86), which is a typical comparative survey result in New Jersey. In the past, there has been a greater discrepancy between the census period and the final tally, but a more intensive and comprehensive survey at Holgate and Little Beach in 2014 corrected this to a large degree.
- Pairs nested at 21 sites, same as 2013 but below the peak count of 30 sites recorded in both 2004 and 2005. 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 12 of the active nesting sites (57% of the sites statewide), accounting for 19 nesting pairs (27% of the nesting pairs statewide). This continued downward shift in the percentage of pairs monitored is the result of multiple variables (including degraded habitat at some of the sites and the sharp jump in pairs at Sandy Hook, monitored by the National Park Service) some of which must be addressed (continued low productivity at almost all ENSP-monitored sites).
- Statewide pair-nest success (the percentage of pairs that successfully hatch at least one nest) increased in 2014 compared to 2013 (75% vs. 67%, respectively), and above-average for the period since federal listing (67%). Looking at just ENSP-monitored sites, 2014 pair-nest success was lower than the state-wide tally, 2013 and 2012 (47% vs. 59% and 56% respectively) and lower than the period since federal listing (66%).

- The statewide fledgling rate, which incorporates data collected by all the state cooperators was 1.36 fledges per pair, a marked increase from 2013 (0.85 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 (0.74 fledges/pair for 19 pairs) was low but above the 2013 metric (0.69 fledges/pair).

- The final season of a two-year research project on flight behavior of breeding piping plovers (which was partially funded by ESA Section 6 monies) was completed in 2013. The results are reported in 2014 NJ-E-36-1 as it are not a state wildlife grant project, but of note was the continued tracking of the plovers that were banded in Strathmere, Avalon and Stone Harbor Point. These individuals were followed on a daily basis (as a separate initiative from the flight behavior study) to determine arrival (March-April) and departure dates (July – October) from breeding grounds. The data on this project is ongoing, but some interesting results include:
    - In NJ, the resight rate appears to be somewhat lower than that noted in banding projects elsewhere in the range. Of the 42 birds banded, 26 (67%) have been observed on the breeding or wintering grounds (and sometimes both). However, there have been confirmed banded birds nesting in Delaware and New York, suggesting that some of the "missing" 33% may be attributed to the birds being in locations where observers are not keenly looking for them (the upper leg band scheme can easily lead to this).
    - The return dates of the breeding birds, many in March, validates the March 1st activity restriction date that was put into practice in the early 2010s to protect the birds from disturbance and maintain the integrity of habitat prior to nesting (examples of restricted activities include beach replenishments and beach raking).
    - In 2012, one particular banded bird was last observed in October 2012, and was resighted in March 2013, which challenges some established notions of how long Piping Plovers are present on their breeding grounds (another example was a bird first observed in March 2014 and stayed until October 2014).
    - In 2014, there were four chicks that fledged in 2013 to resight – one was never seen, and two nested in NJ while one just prospected but miles from their natal sites (range: 30-95 miles). The 2012 cohort of chicks (of which there were four) who were now 2 years old followed this outcome: three were not seen (including two that were seen last year) and one was observed on the wintering grounds post-season but not observed during the breeding season.

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. Biologists were not too alarmed, though, as site fidelity and the movements of skimmers from nesting areas year to year (particularly across among state boundaries) may play an important role in the fluctuation observed in New Jersey population trends. However, now that there is a second year of depressed numbers, biologists are slightly more concerned that this may be the beginning of a longer term trend, which would certainly not be unlikely given the poor productivity of many recent years.
- Black skimmer productivity continued to be on the low side this year, though much improved over last year's dismal showing (0.25 fledges/pair versus 1.67 fledges/pair, both of which are likely overestimates and 2014 may be closer to 0.60-0.70 fledges/pair). The increase is at least partially attributed to a focused predator removal effort at some key sites. This issue must remain at the forefront of management and increase if skimmers are to be successful statewide.
- 2014 continued the trend of more black skimmer colonies in the state than during record lows of the 2000s as staff observed active nesting at 9 sites and some breeding behavior activity at 19 sites.

Hurricane Sandy continued to pay dividends in the suitable habitat realm as Holgate's overwash was added to the active site list. Many of the sites where nesting was never confirmed were the marsh island sites. These are visited less than their beach strand counterparts (just once every two weeks, whereas the beach strand sites are on a regular rotation of multiple times/week due to monitoring of other species). This makes it difficult to conclude why these sites were not active or even to confirm that they definitely were not (ie birds may have laid eggs and were predated/flooded in between two surveys).

- ENSP staff was able to continue to monitor the marsh islands by the boat surveys in 2014 (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 were fewer piping plovers than years past, staff was able to adhere to a workable schedule. If the plover population increases as desired, it may be more difficult to fit in these surveys in future years.
- The statewide **least tern** breeding population was the lowest it has been since 2009 and remains low with respect to the long-term trend. Productivity in 2014 (0.41 chicks per pair) was low and the major culprit was predation. It was concerning that a disproportionately high percentage of the fledged chicks came from one site (Seaview Harbor Marina) but encouraging that this was a site where intense predator removal took place, highlighting the importance of this management technique. As for the non-successful sites, the predator issue continues to require even more active management if additional positive gains are to be seen.
- The number of active least tern colonies (20) was a decrease over 2013 (24). 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.
- Seaview Harbor Marina's importance to all beach nesting species continued 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 again). The aftermath of Hurricane Sandy continued to be good news for beach nesting bird species. All three benefitted from the new habitat that was created and there is some speculation that the storm raised the overall profile of many sites just enough to prevent catastrophic flooding, which for the second year was not a factor in nest or chick loss for any species on the beach (this was not the case in the marsh). A study spearheaded by Rutgers University (unrelated to this grant) seeks to quantify storm-created available habitat so ENSP's understanding of these patterns will grow as that project unfolds.
- After an encouraging increase in the **piping plover** population in 2012, poor productivity and other unknown factors continued the decline started in 2013, marking 2014 with the lowest pair number ever recorded since listing. As is starting to become the norm, the larger federally managed sites (Sandy Hook, Holgate and Little Beach) held the majority (79%) of the state's pairs (up from 72% in 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 were realized in 2014 in terms of exceptional statewide reproductive success, one of the highest recorded since listing. 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.
- Predator exclosures have been used in the state for many years (in 2013, 59% of nesting attempts were exclosed) but recent research has shown that more judicious use may be necessary as they increase the likelihood of abandonment and adult mortality. After meetings in the winter of 2013-14, ENSP managers took a closer look at this issue and used a step-wise approach (ie factored in a site's history

with abandonment with an informal assessment of predator activity near the nest) to deciding whether to use exclosures at nests on sites they monitor. In 2014 only 35% of nesting attempts were exclosed (statewide was 71%). Of the nests not exclosed, 71% were lost to predation, a not unexpected outcome. Further exacerbating this was that the exclosed hatch rate was also lower than normal (44%) due to an increase in abandoned exclosed nests (compared to 2013). The lowered rate of exclosure use did not lead to higher reproductive success on ENSP sites. This outcome confirmed the difficulty in determining when to utilize exclosures and highlighted a continued need for more intense predator control. The increase in abandonment may also indicate that some predators were increasingly savvy when patrolling sites for potential prey (as abandonments can be linked to adult mortality).

- Hurricane Sandy was detrimental to many locations around the state but for beach nesting birds, the overall net impact to their habitat was extremely positive. Cape May County saw little discernible difference in habitat, Ocean County (particularly areas of Island Beach State Park and Holgate NWR) saw gains and although Monmouth County experienced terrible erosion, the worst areas were not in active nest site locations. Although the habitat, much as in 2013, did not lead to an upward tick in pairs in the state (not enough birds in the system continues to be the leading theory on why), it likely played a large role in the increased reproductive success as it provided improved foraging habitat for nesting birds and their young. This second field season post-storm followed the trend seen elsewhere – in "year one" post-storm, returning birds don't seem to have the ability to quickly adapt to new nesting areas (perhaps they want to monitor for a year before shifting) but in "year two" post-storm, that shift was apparent by looking at the coordinates of nests in 2013 vs 2014. Given this was also the second year of near-record low number of flooding events on the beach strand (but not the back bay, where flooding played a central role in colony destruction) 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.

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.
- Continue to make every effort to allow Seaview Harbor Marina's beach nesting bird 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 region partners, through in-person meetings and conference calls to ensure that NJ is making the best decisions possible when it comes to predator exclsoures. 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 raise piping plover nests in areas that are susceptible to flooding. Determine through LIDAR (and other tools) whether Hurricane Sandy increased the elevation of the berm and is the reason that flooding rates are low.
- Continue to follow the piping plovers that were banded in 2012-13. 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 and Dave Jenkins

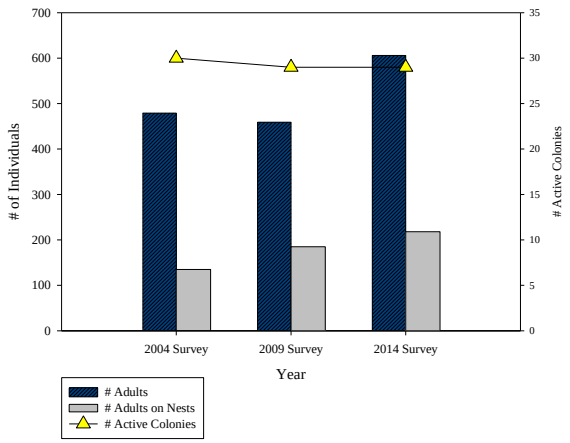
Aerial Survey was inactive in T-1-7. It is active in PR grant, NJ W-70-R-1
Ground Survey – Inland Night-herons inactive in 2014 (active in 2015)

Key Findings:
- In the five years since the great blue heron survey was last completed, advances have been made with respect to online resources and social media in ways that directly impact this project. Along with the JerseyBirds listserv (pivotal to garnering new colony locations and securing volunteers) the growth of eBird, which at its most basic level is an online checklist for birders, to a fully functional site used by many people, particularly in this region, has provided another tool to employ when planning this survey. Since there are features that allow users to view and explore all the data within it, it also acts as an excellent resource for species managers to obtain spatial and temporal data. The combination of JerseyBirds (especially helpful in finding volunteers) and eBird (useful in looking at great blue heron sightings in the years since the last survey) provide a strong foundation on which to build this survey.
- The original plan also called for a survey of inland night-heron sites but it was not as successful in being fully carried out as the great blue heron survey. It was decided to postpone it until 2015, when it will not compete with the great blue survey for volunteer bodies. Beyond many of them already having already committed to great blue sites, it was harder to find volunteers for the inland night-heron survey for a few reasons. One, the colonies were not as large and interesting to observe (there may be 1-2 nests versus 60+). Two, the colonies were often in residential areas which can require special permission to view (if they are in a back yard, for example). Finally, they do not provide the "back to nature" sense that many volunteers seek (great blue heronries are often in the woods, away from dense human development). Nonetheless, this survey is critical as many yellow-crowned night-herons that once nested in the marsh islands (and were therefore counted on the aerial survey) seem to have shifted to these new locations. To comprehensively understand the state's night-heron population, these colonies must be surveyed. There was some data collected in 2014, which will help shape the 2015 survey.
- The nature of this survey makes it ideal for volunteers. The species involved is easy to identify and the survey protocol does not require a large commitment of time per survey. Due to these factors, and the inherent charismatic nature of the focal species, recruiting volunteers was not a difficult task. Requests for volunteers through the Division's volunteer listserv as well as the JerseyBirds listserv yielded 22 observers. In addition to volunteers, 6 ENSP and CWF staff participated in the survey.
- 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.

- The total number of great blue heron sites slated for survey was 65. Sixty (60) colonies were assigned to staff and volunteers, five were not (there were no observers found for them). Of the 60 assigned, there were 12 in which no data was sent in from volunteers (all colonies surveyed by staff were completed).Of the 48 colonies that were surveyed, 29 were active and 19 were not. At the 29 active colonies, 606 adults were counted, 456 adults were observed on nests and 218 fledges were counted (the post-season nest count period is outside the scope of this grant year and will be reported in 2015).
- The 2014 survey compared favorably to the 2004 and 2009 survey numbers. The number of fledges is notoriously difficult to obtain (leaves on nest trees make it exceedingly difficult to count them and the number observed can also depend on when in the nesting cycle the second survey takes place) and are an unreliable indicator of success so are not included. See table below for data from the three surveys since the protocol detailed above was put into practice:

NJ Great Blue Heron Population: 2004-2014



Conclusions:

- The birding community in New Jersey was an excellent resource for both information about where herons were distributed and also for recruiting volunteers.
- The survey protocol worked well, allowing biologists to compile enough data to monitor the population without requiring an overly intensive survey protocol that volunteers may struggle to maintain.
- The surveyed population appears to be stable, which is especially interesting given that on any given year there is variability in how many and which colonies are surveyed. The northwestern part of the state continues to harbor the largest population of herons, while the southern areas are much less utilized and the northeastern portion is the least used.
- Although this species makes for a good candidate for a volunteer based survey, one issue that crops up is observer fatigue. Although it requires only 3 actual surveys, they take place over 8 months and that can make it difficult for volunteers to stay focused. In addition, when volunteers do not survey the sites they have committed to, data from that year is lost as there is not enough time or resources for mangers to make other arrangements. In 2014, ENSP increased efforts to solicit updates from observers after each survey and this seemed to increase volunteer response.

Recommendations:

- Continue to use the protocol that was developed for these surveys in future years.
- 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 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.
- Restrict the number of colonies a new, untested volunteer may sign up for to 1-2. In 2014, a new observer committed to 5 colonies and did not report on any of them. That one observer was responsible for nearly half of the "assigned but no data sent" colony category and the impact could have been minimized if he was restricted to one or two.
- In 2009, ENSP thought it was close to an online data submittal process. It is five years later and while some progress has been made, other projects have taken priority and this option is still not available. In 2015, 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.
- 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

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*.

Key Findings:

- As in 2013, a majority of red knots and ruddy turnstones used New Jersey beaches through the main stopover period (May 20–28, 2014; Table 1). This may be a consequence of NJ's beach closures, which prevent disturbance to shorebirds. Given average surface densities of horseshoe crab eggs are 2 to 7 times higher in DE than NJ, it is likely that disturbance on DE beaches has reduced or precluded shorebird foraging and contributes to greater egg depletion (lower egg densities) in NJ.

Table 1. Baywide Aerial Survey 2014

2014 Aerial Survey					
Date	Species	NJ (N=48)*	n** (%)	DE (N=33)*	n** (%)
25-May	Red Knot	19,765	27 (56)	5,215	11 (33)
	Ruddy Turnstone	9,018	23 (48)	7,095	18 (55)
		28,783		12,310	
28-May	Red Knot	13,136	17 (35)	1,920	12 (36)
	Ruddy Turnstone	15,701	28 (58)	3,460	18 (55)
		28,837		5,380	
*Aerial survey includes 81 beach segments (NJ N= 48; DE N=33)					
** n = number of beaches where birds were counted					

- The peak count of red knot on Delaware Bay in 2014 was 24,980 individuals. This abundance was consistent with peak numbers from aerial and ground surveys in three of the last five years indicating the stopover population may be stable.
- Delaware Bay stopover population estimate of red knot using mark-and-resighting method (Lyons et al. 2014) is new and promising (Table 2), but relies on a marked population.

Table 2. Comparison of stopover population estimates from aerial or ground survey and mark-and-resightings estimate (Lyons et al. 2014).

Red knot population estimates (Male & Female)				
Method	2011	95% CI	2012	95% CI
Aerial or Ground Survey	12,804 (aerial)		25,458 (ground)	
Mark-and-Resighting	25,390		28,970	
M-&-R w/ turnover (95% CI)	43,570	(40,880 - 46,570)	44,100	(41,860 - 46,790)

- The peak count of ruddy turnstones on Delaware Bay in 2014 was 19,161 individuals. This abundance is consistent with lower counts typical of the last six years.
- A comparison of turnstone counts from the Delaware Bay stopover, recent (2011 and 2013) winter area counts of turnstones in northern Brazil (D. Mizrahi and R.I.G. Morrison, pers. comm.) and historic (1982-1985) winter area counts in northern Brazil (Morrison and Ross 1989) strongly indicate this species is in severe decline. Shorebird species that rely on horseshoe crab eggs for rapid weight gains are affected in the same way as red knot in that inadequate weight gain just prior to Arctic breeding leads to reduced adult survival and productivity.

- In 2014, 53% of red knots achieved weights $\geq$180 grams, the threshold necessary to successfully migrate and breed (Figure 1). This is the third consecutive year of improved weight gains. While this is good news, optimism must be tempered by the fact that the red knot stopover population is still low (~¼ of its historic size).

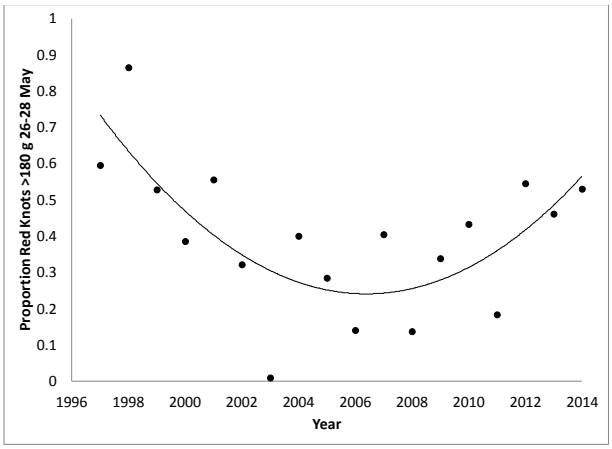


Figure 1. Proportion of Red Knots in the >180 g body-mass category in Delaware Bay near the usual departure time each year (26-28 May), 1997–2014. The line shows a significant quadratic trend over 1997-2014 (the trend line ±95% confidence intervals in respect of the line was fitted using binary logistic regression of body mass >180g (1 = yes, 0 = no) on year (negative, $p<0.001$) and year^2 (positive, $p<0.001$).

- The proportion of red knots reaching threshold departure weight (≥ 180 grams) (Fig. 2) is statistically correlated to NJ and DE egg densities during the main stopover period (May 14 through May 28), (Fig. 4). The horseshoe crab egg survey was funded in 2014 by USFWS Section 6 E-1-36.

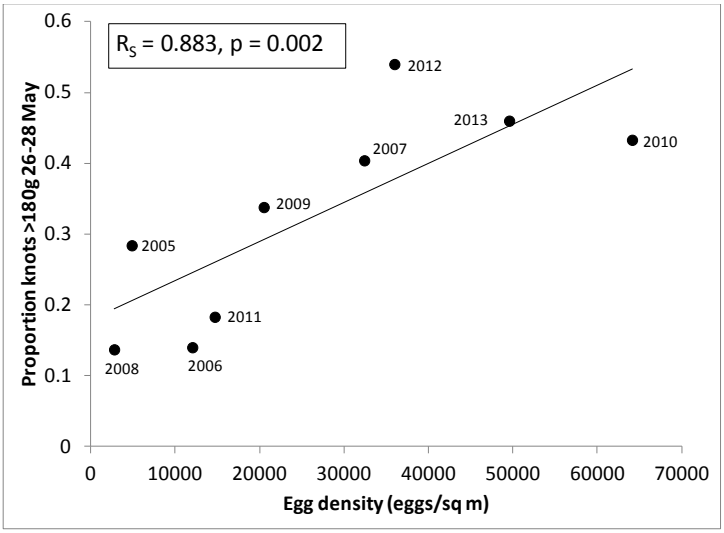


Fig. 2. Proportion of Red Knots in the >180 g body-mass category in Delaware Bay during 26-28 May plotted against the median horseshoe crab egg density during 14-27 May 2005-2013 for Delaware and New Jersey (R_s = 0.883, p = 0.002). Note: Delaware discontinued participation in the baywide egg survey after 2013.

Conclusions:

- After habitat destruction, human disturbance is a major factor implicated in causing habitat unsuitability and leading to shorebird population declines (Pfister et al. 1992, Stillman et al. 2007). The need to address human disturbance, in Delaware Bay and elsewhere, is key to recovering red knot and other shorebird populations. Repeated human disturbance on Delaware Bay impacts the ability of shorebirds to forage, rest and roost (Burger & Gochfeld 1983, Burger et al. 2004, Burger et al. 2007); chronic disturbance can cause shorebirds to abandon use of otherwise suitable habitats even

when people are not present (Burger and Gochfeld 1983). A credible body of literature exists on the impacts of disturbance in Delaware Bay, the NJ Atlantic Coast (Burger and Niles 2012, 2013) and many other locations worldwide (Sutherland 1995, Piersma et al. 2000).

- A recent update of shorebird population status (US Shorebird Conservation Partnership 2014) indicates four of six species that rely on Delaware Bay are in need of management action (red knot, ruddy turnstone, semipalmated sandpiper, short-billed dowitcher) and long-term planning/responsibility (dunlin, sanderling). The data are limited for the latter two species.
- A coast-wide moratorium on crab harvest, and implementation of practices that reduce crab mortality from lysate bleeding, would quickly improve crab population size and egg resources for red knots and migrant shorebirds. All surveys of crab population trends (trawls, spawning surveys) show no substantive sign of improvement after >10 years of harvest reductions.
- Loss of the Atlantic Coast Benthic Trawl survey will damage efforts to monitor horseshoe crab populations and to set harvest quotas that consider impact to red knot. Especially, as male crab harvest was increased via ARM Model quotas and Offset Allowances, it is important to understand the impact of this harvest on males, which is derived from the Benthic Trawl survey.

Recommendations:

- Creating protection on a larger number of DE beaches would likely improve conditions for red knots by offering a greater array of foraging sites, reduced competition for egg resources, and reduced disturbance from aerial predators and human recreation.
- Federal funds should be found to reinstate the Atlantic Coast Benthic Trawl carried out by Virginia Tech.

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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, 2013 (woody vegetation treatment and invasive species) and spring, 2014 (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, CWF, or under NJ E-1-36). Development of management plans followed the bog turtle biological opinion on habitat restoration practices and contracts were developed and executed when restoration work was done using Section 6 funds.
- ENSP developed contracts to survey 26 bog turtle populations in 2014. Ten sites were surveyed following regional protocols and 16 sites were surveyed using a modified protocol. In addition, three sites were intensively monitoring using radio-telemetry. This work was done by ENSP and volunteers.
- One kilometer wood turtle stream transect surveys following the regional RCN protocols were completed in fall, 2013 through volunteer coordination. The RCN project is now complete, but a Comp SWG wood turtle project, continuing with work done in the RCN, is beginning in spring 2015 so additional surveys following the protocols will continue into the future. In spring, 2014 ENSP staff ground-truthed "optimal" wood turtle stream segments identified by the RCN NJ species distribution model.
- 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 and other state partners to collect information on the harvest of snapping turtles in NJ and surrounding states. A presentation will be made to various committees and panels seeking input and recommendations on the future of the turtle harvest.

RECOMMENDATIONS:

- ENSP zoologist Zarate will prioritize his 2014 field time for training conservation partners in survey techniques and habitat assessments to benefit the project implementation and monitoring components of USDA-NRCS WLFW and WRP projects.

Subjob C.2. SNAKES

Project Leader: Kris Schantz

Key Findings:

- ENSP continued to recruit, train and manage the Venomous Snake Response Team (VSRT) and respond to telephone inquiries regarding potential venomous snake presence on private lands.
    - Held 9 trainings throughout the State for 52 people; 34 of whom were trained for the first time; 43 were employees with the NJ DEP's Division of Parks and Forestry and Park Police.
    - Response team members verbally reported responding to venomous snake calls but did not submit their reports in writing.
- ENSP reviewed rare species observations for potential entry into the NJ DEP's Biotics database (Biotics).
    - During this reporting period, the following sightings were entered into Biotics:
        - 109 Timber Rattlesnake sightings, a number of which were likely the result of snake monitors (construction monitors) documenting observations at major construction sites

        - 11 Northern Copperhead sightings
        - Data not available for Northern Pine Snake sightings
        - 0 Corn Snake sightings
        - 2 Eastern King 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:
        - 23 Timber Rattlesnake sightings
        - 9 Northern Copperhead sightings
        - 78 Northern Pine Snake sightings
        - 0 Corn Snake sightings
        - 2 Eastern King 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). Additional habitat assessments, management and monitoring were conducted and supported through non-federal funds dedicated under a mitigation agreement.
    - Met with Wharton State Forest Superintendent and conservation partner (NJ Conservation Foundation) to discuss management strategies to improve Timber Rattlesnake gestation and general basking habitat within documented Timber Rattlesnake and Northern Pine Snake range in the Pinelands, and identify suitable areas for management.
    - Met with Wharton State Forest Superintendent to discuss potential changes to campground and trail closures for both camper/hiker and rattlesnake safety.
    - Held field site meeting with experienced snake researchers and ecologists, Dr. H. Reinert, R. Zappalorti, P. Mooney, E. DeVito (NJ Conservation Foundation), NJ DFW's Bureau of Land Management in Greenwood Wildlife Management Area to identify areas for management and discuss strategies to improve Timber Rattlesnake gestation and general basking habitat within documented Timber Rattlesnake range, and to minimize road kills and illegal collection.
- ENSP biologists gathered information for the Timber Rattlesnake status assessment and recovery plan development. In October 2013, ENSP coordinated a conference call between Vermont (D. Blodgett) and Pennsylvania Fish and Boat Commission (C. Urban and J. Chestney) to discuss population sustainability and how we might derive information for recovery planning. ENSP also reached out to Dr. H. Reinert for guidance on developing parameters for a sustainable population.
- ENSP biologists began work on the Northern Pine Snake status assessment and recovery plan. Staff developed an outline for the recovery plan and identified specific information in need of expert opinion; identified portions of the Status Assessment (2009) in need of updating; recruited a panel of experts to participate in the development of the recovery plan; and developed a timeline of events to complete the document by summer, 2015.
- ENSP continued to partner with Drexel University staff on the *Northern Pine Snake Landscape Genetics Project*: During this segment, Drexel staff:
    - Surveyed for new genetic samples and obtained four tissue samples from dead-on-road encounters; found four neonatal shed skins at Edwin B Forsythe Preserve east of Garden State Parkway; and obtained numerous neonatal sheds from Franklin Parker Preserve.
    - Extracted DNA from ~75% of all genetic samples in catalog.
    - Selected markers and began PCR on extracted samples; analysis will begin fall, 2014.
- 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, which was conducted under Comp-SWG project.
- Herpetological Associates, Inc. (HA; a consulting firm in NJ) volunteered to radio-track a Northern Copperhead they had located in an area without confirmed observations. In fall, 2013, HA located a previously undocumented den and observed multiple copperheads on site. The transmitter was

removed in spring, 2014, by WCS staff. No additional telemetry was conducted by ENSP due to limited resources.

Conclusions:

- 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. Although all members were to continue to submit time/mileage sheets in addition to observations, there was confusion and consequently, many team members did not document such information. The reporting we received indicated the team continues to provide the necessary services to protect NJ's venomous snakes and citizens.
- It is the consensus of the small group of experienced Timber Rattlesnake and Northern Pine Snake researchers and ecologists that met with the ENSP biologist that habitat management is a critical component in snake conservation efforts. In particular, the need for suitable basking, gestation/birthing (Timber Rattlesnakes) and nesting (Northern Pine Snakes) habitats.

Recommendations:

- The VSRT will continue to transition in 2015 as ENSP looks to develop a structure to maintain and expand the team while decreasing ENSP responsibilities and time required. ENSP must work with the team members so they understand what is required of them as volunteers covered or not by the WCC.
- 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 genetics work; analyze blood and tissue samples to elucidate differences in population genetic structure. Use analyses to identify genetic bottlenecks and where barriers (e.g., roads) maybe limiting gene-flow.
- 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.
- Conduct opportunistic radio-telemetry on rare snakes when resources are available in areas not associated with a known den to identify undocumented den locations and develop/implement protective management. This is especially important in areas with limited data and/or current or future activities that may damage the habitat or harm the snakes.

Subjob C.3. AMPHIBIANS

Project Leader: Brian Zarate

Key findings

- Water level and salinity measurements were taken every 4 months at sites most susceptible to sea-level rise. Monitoring pre- and post- Superstorm Sandy did not show an increase in salinity levels but water levels were elevated after the storm.
- Surveys were minimal during this reporting period due to limited staff time and high water levels.
- Surveys by volunteers and/or partners resulted in 2 new eastern tiger salamander sightings. These were added to the Department's Biotics database and will be included in the Landscape Project's 2014 update.

- Two egg masses were collected for the head-starting project from a single site (MS-large) with >100 egg masses. Staff collected masses that were considered at greatest risk of desiccation (i.e., masses deposited high in the water column unlikely to survive water and temperature fluctuations during development, or masses laid in shallow ruts along the road) or at greatest risk of failure (i.e., egg masses laid directly on the bottom of pond).
- *Lizard Tail Swamp WMA*: In January 2014 tiger salamander egg masses were surveyed in the constructed ponds. Possibly related to extremely high water levels, no egg masses were detected. Later in the season, larvae were detected in many of the ponds, indicating that successful breeding had occurred. One adult male tiger salamander was also found in the ponds.
- *Mechanic Street*: CWF and ENSP staff continued surveying pools on and adjacent to USFWS Refuge land. Surveys detected >70 egg masses but due to high water levels this may be conservative.
- *Head-starting:* Two small egg masses were provided to Cape May Zoo (the Zoo) to continue the head-starting project. ENSP staff is waiting on a final report from the Cape May Zoo.

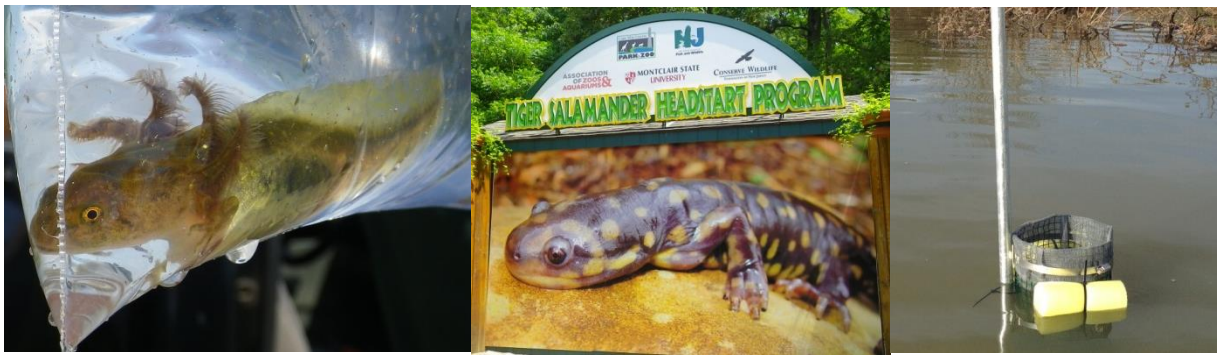

Figure 2. Left to right: head-started larva, educational head-starting display at Zoo, floating egg enclosure cage

  - Protocol: After mixed results last year, ENSP, CWF and Zoo staff changed the protocol to decrease the number of individuals in each tank and increase amount of food provided. Although we established different treatments (size of tank and number of larvae in each tank), staff at the Zoo were unable to adequately record data due to limited resources and therefore we were unable to draw conclusions about treatment differences.
    - Due to the increasing concern of disease, ENSP used a decision tree for biosecurity risk assessment (Pessier & Mendelson 2010) and recommended that the Zoo isolate the native eastern tiger salamanders from non-native captive species. The goal of this recommendation is to minimize the risk of transmission of infectious disease between non-native and native captive species and introduction of non-native disease into the environment. The Zoo followed these procedures.

- Submissions to ENSP on vernal pool data were catalogued but no entry into the database was completed until the database undergoes revision.

<u>Conclusions</u>

- ENSP's management efforts for tiger salamanders are focused on suitable habitat within the species range on protected land and 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.
- Head-starting results in higher survival from egg mass to metamorph/subadult compared to natural conditions and produces very robust larvae prior to release into ponds. Large food supply

appears to be key in robust development of larvae, so addition of tadpoles as a food source likely increased growth rates.

- Because head-starting E. tiger salamanders requires many large tanks and space was limited, we were only able to release a relative few individuals. Therefore, head-starting alone may not be an effective method to secure and increase populations. The public education component of this project is an important benefit: 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 species. This project allows the public to identify with a species they likely did not realize existed and totally depends on the region 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

- 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).
- Begin working with a Master's student to conduct a mark-recapture study to assess use of newly created pools. Population monitoring using drift fence technique during the winter and minnow traps in late spring may help elucidate meta-population dynamics; implement protocol that ensures no harm to adults or metamorphs.
- Continue working with CWF on vernal pool construction on Division of Fish and Wildlife lands anticipated to begin in late fall 2014. Explore options to build additional ponds on public lands and restore degraded ponds.
- Continue to work with partners and trusted volunteers to monitor pools and encourage amateur herpetologists to submit sightings.

Literature Cited

Pessier AP and JR Mendelson (eds.). 2010. A Manual for Control of Infectious Diseases in Amphibian Survival Assurance Colonies and Reintroduction Programs. IUCN/SSC Conservation Breeding Specialist Group: Apple Valley, MN.

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 surveyed 12 stream sites in seven counties for listed freshwater mussels. Timed searches for mussels were conducted at historic locations and/or previously unsurveyed suitable habitats. In addition, five sites were surveyed in Wickecheoke Creek, Hunterdon County for evidence of the invasive Chinese pond mussel.
- We performed habitat assessments and/or preliminary searches at four additional sites to determine if larger surveys were warranted.
- EPA Habitat Assessment Field Data Sheet scores (high and low gradient combined, excluding Wickecheoke Creek sites) ranged from 117 (Rancocas Creek, Burlington County) to 168 (Lamington River, Somerset 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 conducted an analysis of freshwater mussel data collected during the 2013 season. 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 species richness, we found that abundance was most associated with available cover. There was also a strong association of abundance with riparian zone width. During previous analyses, we found that 1) abundance was most closely associated with total habitat score and total bank stability score 2) species richness was most closely associated with total bank stability, total vegetative cover, and total mean riparian width score. We will incorporate 2014 data into the multi-year analysis and 2000-2013 dataset.
- Water quality values recorded at survey sites were as follows: pH ranged from 7.2 to 8.3, water temperatures ranged from 14 to 25.5 Celsius, dissolved oxygen ranged from 7.5 - to 11.2 ppm.
- Catch per unit effort (CPUE) for all species combined during time searches was highest in Barton Run, Burlington County, with 2.04 live mussels/minute.
- ENSP biologists and volunteers found eleven species of freshwater mussels during field activities, including the Dwarf wedgemussel, Brook floater, Triangle floater, Eastern elliptio, Eastern floater, Alewife floater, Paper pondshell, Eastern lampmussel, Dwarf wedgemussel, Creeper and Lilliput.
- The Eastern elliptio was by far the most prevalent and widespread mussel species documented. Species richness was highest in Salem Creek, Salem County, with five species recorded. Significant findings included a live Triangle floater, live Creeper and a fresh Dwarf wedgemussel shell in the Pequest River, Sussex County; seven live Yellow lampmussels and six shells in the Delaware River, Hunterdon County; one fresh Brook floater shell in the Stony Brook, Mercer County, and numerous Triangle floater shells in Salem Creek, Salem County.
- 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). 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 one winter, there are still Chinese pond mussels living in the ponds. We surveyed five monitoring locations downstream of the ponds and found no live Chinese pond mussels or shells.

- We found one fresh Lilliput shell in Salem Creek. The species appears to be limited in NJ to this particular site. Despite numerous survey efforts above and below the known location, we have been unable to find live individuals or shells outside of a small stretch (200 m) of the creek.
- Wildlife Conservation Corp (WCC) volunteers conducted surveys in portions of the Stony Brook, Mercer County. Only common species were found.
- All new locations with federal and/or state listed freshwater mussels from these surveys and others (e.g. private consultants, USGS, 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 next version of the Landscape Project mapping to identify critical areas for listed mussel populations.

Conclusions:

- Based on habitat suitability assessments at four newly evaluated sites, three of the four warrant further survey work to determine freshwater mussel species composition and abundance.
- Although we have documented the Lilliput from a small stretch of Salem Creek, it may be possible that there are individuals in Memorial Lake, just upstream of the known occurrence. We have surveyed upstream of the lake and downstream of the extant Lilliput site. SCUBA surveys in the lake would be needed to further determine population boundaries.
- 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. In addition, there are a number of privately owned ponds that feed into the creek that could contain Chinese pond mussel populations. It is undetermined whether the species is living in the creek, and if so, 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.
- Finalize habitat analysis for all years (2000-2014) to compare rare species abundance with individual habitat parameters. Develop protocol that will apply findings to stream restoration efforts.
- Enlist volunteers from the New Jersey Invasive Species Strike Team to assist with efforts to eradicate Chinese pond mussels and prevent the spread of this invasive species.
- Finalize and publish field guide to freshwater mussels online.

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 2014 butterfly season was a highly challenging one. An unseasonably cold winter followed by a late spring caused the emergence of many insects to be delayed by almost a month. Butterfly numbers in general appeared to be very low. Surveys were conducted for wide range of listed species throughout NJ and in a wide variety of habitats, with help from the North American Butterfly Club-North Jersey Chapter and the South Jersey Butterfly Blog contributors.

- Surveys for Hessell's Hairstreak were conducted at three known locations and one potential site, and all four sits were positive. The potential site yielded a new colony that is disjunct from all our known colonies.
- Surveys for Leonard's Skipper were conducted at four known sites in northern New Jersey. The species was present at all locations and with numbers ranging from two to eight individuals.
- Surveys for Georgia Satyr were conducted on Ft. Dix over the course of two days at four sites with none observed.
- Surveys for Silver Bordered-Fritillary were conducted at seven known locations over the course of 10 days. None were observed at any sites for the second 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 the elfins had recolonized all of the managed areas that had previously been unsuitable for the species, with 30+ individuals observed at all locations. An extensive survey was conducted with the assistance of volunteers at 12 historic sites; Frosted Elfin was found to still be present at four sites. Surveys of potential habitat yielded two new colonies with eight and 14 individuals observed.
- Northern Metalmark surveys were conducted at eight known sites and four potential sites. Two new colonies were discovered adjacent to known colonies. Twenty-two and 40 individuals were observed at the two largest colonies and three to eight individuals were observed at the satellite colonies.
- Habitat management for Northern Metalmark continued at the White Lake Wildlife Management Area and Kittatinny Valley State Park (KVSP) sites with 1 and 0.5 ac of invasive brush and shrubs removed, respectively. Meetings were held with KVSP 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 none observed at any location. Surveys for Arogos Skipper in southern New Jersey were conducted on the Ft. Dix military base with the help of Department of Defense (DoD) staff over the course of two days. Six areas were surveyed for Arogos Skipper with three individuals observed at three different sites.
- The DoD conducted controlled burns for habitat management on 300 acres of habitat during the winter of 2013-2014. 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 ac of habitat in this area in their 2014/2015 burn plans.

- For Moths, no survey work was conducted in the 2013-2014 field season due to insufficient staff time and resources. However, we created 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.

- During January 2014, a status assessment was initiated to reevaluate the listing status for all of New Jersey's rare butterfly species. A panel of seven experts has been conducting review using the Delphi technique (Clark et al. 2006). The review will conclude during the fall of 2014.

Conclusions:

- Surveys of potential rare butterfly species habitat continue to yield discoveries of new colonies for many species. This season, several new Frosted Elfin and Hessell's Hairstreak colonies were discovered in suitable habitat.
- Silver-border Fritillary appears to be the butterfly species in the most danger of becoming extirpated from NJ. This year marked the second 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.
- Arogos Skipper continues to be difficult to survey for in northern NJ; this season, none were observed. Many sites never have more than two to three individuals present on a given survey day making it easy to miss them.
- Arogos Skipper continues to occur on the Ft. Dix military base. There are extensive areas of habitat that cannot be surveyed for safety purposes. It is likely that there are large numbers of Arogos Skippers on Ft. Dix than surveys would indicate.

Recommendations:

- The Butterfly Species status assessment will conclude during the fall of 2014. This will likely bring about recommended changes in status for many species and add other species to our rare species list. Work will need to be focused on these new species in order to better understand their distributions, habitat requirements, and management needs.
- Surveys for Silver Bordered-Fritillary should be a priority during 2015. 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 all listed species need to continue. The better distribution data we have for all species, the better we will be able to develop management plans for them. The new Hessell's Hairstreak site is actually located in a park where we were just finishing up a forest management plan that did not take this species into account. The new data for this site will allow us to better plan our management decisions for the Atlantic White Cedar stands at the site.
- 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.
- 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.
- Arogos Skipper should be surveyed in 2015 in order to determine if the known colonies are still in existence. Areas of suitable/potential habitat should be surveyed as well.
- 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.

Odonata

Project Leader: Robert Somes

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:

- Surveys for Gray Petaltail were conducted at three historic locations and at four potential locations. One individual was observed at one historic site and two individuals were observed at a single new site over the course of three days of surveying. There are large areas of suitable habitat near the known colonies of this species and there is the potential to find more colonies with a greater survey effort. A minimal survey of suitable habitat discovered a new colony of Grey Petaltails in the nearby Ringwood State Park.
- Surveys for Brook and Maine Snaketails were conducted at three known locations and one potential site. We observed three individuals at 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.

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.

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:

- We continued working with NJDEP's Bureau of Dam Safety and Flood Control (BDSFC) to identify dams (large and small) slated for removal within the next two years. Staff at BDSFC indicated that there were no permit applications into their office at this time, although one Musconetcong River dam was about to be "in the pipeline."
- Both the Roberts Street and Nevius Street dams along the Raritan River were removed during the last several years (2013, 2012, respectively). These dams were immediately adjacent to each other in the same section of river. Last year, we conducted several Odonata surveys and found there to be decreased numbers of the common pond species of dragonfly (Common White-tail, Blue Dasher, etc.) and increased numbers of stream species (Stream Bluet, Powdered Dancer, etc.). The site now also contains more suitable habitat for a wider variety of stream dragonfly species that occur along the more natural stretches of the river in this area.
- We surveyed stretches of the Raritan River adjacent to the Roberts Street dam site for freshwater mussels during the project period. Timed searches were conducted just upstream of the former

Roberts Street dam in two habitat segments, totaling 135 minutes of search time. Although there were some small patches of sand in the survey area, we found much of the habitat to be unsuitable for mussels. We located two live Eastern elliptio and numerous (>36) spent shells.

- We also surveyed the Raritan River upstream of the Nevius Street dam site near River Road Bridge, totaling 225 minutes of search time. We found nine live Eastern elliptio and seven Eastern elliptio shells, along with nine live Eastern floaters and nine Eastern floater shells. Suitable habitat was present closer to the banks, whereas bedrock was prevalent towards the middle of the river. Since the Eastern floaters were the largest we had recorded in NJ, digital images of live individuals and shells were sent to Dr. Arthur Bogan, NC Natural History Museum, for species confirmation.
- We continued surveys in Barton Run to determine if Eastern pondmussels occur in other locations throughout the stream, or if removal of the Kenilworth Lake dam eliminated the only population of this threatened species within the system. Despite surveying three separate sites (near Lion Lake, Voorhees Township – one site, downstream of Jennings Lake, Evesham Township - two sites) downstream of Kenilworth Lake (which is no longer a lake), no Eastern pondmussels were found.

Conclusions:

- It remains undetermined whether the presence of numerous spent Eastern elliptio shells found at the Roberts Street, Raritan River site was the result of dam removal activities at the Roberts Street site.
- According to Dr. Bogan, who confirmed the identification of Eastern floaters found at the Nevius Street site, the mussels were consistent with "lake effects" individuals living in deeper water, growing extremely large and having few predators. Since we located the mussels in shallower water and just upstream from where the dam once stood, it is presumed that removal activities reduced the overall stream height and/or eliminated the existing impoundment. Although removing the dam may have exposed common mussels to changes in habitat and water quality parameters, and introduced additional sources of predation, eliminating barriers to host fishes and restoring connectivity may ultimately allow for the dispersal of rare species into this section of the river.
- Removal of the dam in Evesham Township may have contributed to the mortality of an Eastern pondmussel population in Kenilworth Lake. More surveys are needed to determine whether the species occurs elsewhere in the system, especially within several hydrologically connected lakes. The suspected loss of this Threatened species population underscores the need for long-term research into the effects of dam removal on mussels using deeper water habitats above dam sites.

Recommendations:

- Monitor the Finesville dam site (last surveyed in 2013) as well as the restoration area to thoroughly document changes to Brook snaketail and other Odonata populations. In addition, conduct freshwater mussel surveys in recently created habitat to document and monitor mussel populations over time.
- Continue monitoring of Odonata and freshwater mussels at the Nevius and Roberts streets dam removal sites in the Raritan River.
- Continue surveys conducted in 2011 in Barton Run to determine if Eastern pondmussels occur in other locations throughout the stream, or if removal of the Kenilworth Lake dam eliminated the only population of this Threatened species within the system.
- Work with the BDSFC to determine up-to-date schedule of dam removals.
- Continue monitoring dam removal sites over time to document changes in species diversity and abundance. Monitoring will continue for at least five years.

- Investigate methods to mitigate dam removal impacts on freshwater mussels, Odonata, and other macroinvertebrates (e.g., crayfish). Mitigation methods may include, for example, relocating rare mussels to suitable areas outside the direct zone of impact where individuals may be smothered or exposed to excessive sedimentation.

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 (CWF) staff continued entering sea turtle impingement/sightings data 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 intake vs. dilution water intake), number of pumps running (cwi vs. dwi) and water temperature. Conserve Wildlife Foundation staff have now compiled and entered data for three sea turtle species (Atlantic Green, Atlantic Loggerhead, and Kemp's Ridley) impinged at the OCNGS between 1992 and 2014.
- We continued analysis of sea turtle impingements recorded at the OCNGS versus 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 2014 were analyzed and then compared to the existing 1992 – 2013 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).
- We identified factors associated with each sea turtle capture. Each sea turtle capture was compared to weather parameters as recorded by www.wunderground.com at the Atlantic City airport. Air temperature was used in the analysis because sea surface temperature was not available. It is presumed that air temperature is indicative either of 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.
- Parameters used to compare sea turtle captures reported in 2014 at OCNGS 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.

Conclusions

- There were eight sea turtles taken at OCNGS (one Atlantic Loggerhead and seven Kemp's Ridley) during 2014, bringing the total number of turtles in our records to 91 taken between the dates of June 1992 and September 2014. There may be additional records from OCNGS for which the ENSP did not receive reports, especially from the 1990's. We made every attempt to compile all available data. Multiple catches (> 1 turtle/day) were reported on three dates throughout the interval, resulting in a total of 94 turtles taken at the plant.
- Factors affecting sea turtle takes at OCNGS during 2014 included the following: 1) easterly winds – two takes; 2) winds shifting to the east – three takes; 3) high wind gusts – two takes; 4) rapid drop of barometric pressure - one take; 5) July 4th effect – one possible take; 6) low wind speed – two takes; 7) max air temperature 92F – two takes; 8) drop of air maximum air temperature from 91F to 75F over two days – one take; and 9) unexplained – two takes.

- The most striking aspect of 2014 is that air temperatures never went below 67F during the period of takes, whereas 1992-2013 data showed minima down to 46F. Maximum air temperatures for turtle takes from 1992-2013 ranged from 55F to 102F. Maximum air temperatures in 2014 ranged from 75F to 92F during periods of sea turtle takes.
- In general, data from 2014 are consistent with data from 1992-2013 for wind speed and wind direction. Maximum take occurred at wind speeds 12-27 mph (1992-2013), and 17-27 mph (2014). Forty-five percent of sea turtle takes occurred during east wind events (1992-2013) and 50% in 2014; in 2014, most of the remaining 50% were associated with a westerly wind.

General

- East winds were associated with almost 50% of all sea turtle takes at OCNGS, and all takes occurred after maximum daily air temperatures reached 55F.
- 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. 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 in the area. Further, high wind gusts were associated with takes, others were captured at 5-9 mph winds.
- There were eight sea turtle takes reported this year making 2014 the one of the highest years for sea turtle takes at the plant. In addition, there were four sea turtle takes at the Salem Nuclear Power Plant in southern NJ, whereas prior to 2013 none had been seen since 2001. The combined numbers may indicate increasing sea turtle abundance, but more research is needed to determine if captures reflect increasing abundance or range, or is due to other factors such as climate change or location of the Gulf Stream. 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.
- 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:

- Meet with OCGNS staff to present results and discuss protocols that could be implemented during predicted times of likely sea turtle occurrence that would minimize impingements. Possible protocols to minimize 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

Morreale, S.J. and E.A. Standora. 1998. Early life stage ecology of sea turtles in northeastern U.S. waters. NOAA Technical Memorandum NMFS-SEFSC-413, 49 pp.

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, Snakes:

- ENSP biologists participated in conference calls, helped develop and refine survey techniques and reporting system, transported snakes to/from Wildlife Conservation Society (WCS) for testing and treatment/release, and prepared materials for field surveys. Actual snake testing and treatment were funded under NJ T-1-6 until a new project was approved under Competitive SWG beginning in December 2013. The current job under T-1-7 allows for additional work not funded by the Comp-SWG job (Conserving Snake Species of Greatest Conservation Need Threatened by an Emerging Fungal Skin Disease).
  - Participated on 8 conference calls.
  - Conducted 18 round-trips to transport snakes to or from WCS. Remained at WCS to assist in assessment and documentation of information on 3 occasions.
  - No radio-telemetry was conducted to monitor treated or untreated snakes due to a lack of resources. Monitoring depended on the relocation of PIT-tagged individuals *or* those individuals that were transmittered as part of another research study.

Conclusions:

- NJ's portion of the Comp-SWG was not budgeted properly to support all the activities required to complete the necessary tasks, requiring us to split time between Comp-SWG and SWG tasks.
- Participation on the conference calls was critical as ENSP was able to contribute information that assisted in the design of the survey method and effort, and in understanding the needs of the laboratories.

Recommendations:

- Continue to participate in meetings and on conference calls pertaining to the snake fungal disease.
- ENSP will review the COMP SWG budget and proposal and discuss possible amendments with the USFWS so that all activities associated with the project are supported by Comp-SWG.
- Continue to survey for, collect samples from and test potentially infected snakes to contribute data regarding the distribution of the snake fungal disease. When possible, use alternate funding sources to accomplish this work such as Comp-SWG and/or mitigation funds.

Key Findings, Turtles and Amphibians:

- All emerging disease studies on behalf of freshwater turtles and amphibians were completed using outside funding sources, including FWS-Section 6 and RCN grants and reports will be filed accordingly.
- No additional studies on Ranavirus impact on freshwater turtles or amphibians were started outside of FWS or RCN funded projects.
- 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 and Brian Zarate

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

Key Findings:

ENSP met regularly 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 the Pinelands region lands (Greenwood WMA, Wharton State Forest and Brendan T. Byrne State Forest) where rare wildlife and forestry/prescribed burning are regular topics for managers. Our focus did not proceed further to create management priorities for specific state lands, as we intended. The project leader (K. Korth) departed ENSP in June.

Conclusions/Recommendations:

ENSP needs to reassign the duties of this job to another biologist, or scale-back the project. We recommend the duties of this job (planning and conservation design, implementation and evaluation) be scaled back and incorporated into the remaining two jobs (Forest Management and Habitat Connectivity), for which staff are already assigned.

JOB B1. Forest Habitat Management

Key Findings:

- Public and private landowners within prioritized parcels in the Skylands region of NJ have been solicited for management for golden-winged warblers, a focal species that utilizes young forest within a forested landscape within the Skylands.
  - Staff conducted visits to seven private landowners interested in Working Lands for Wildlife. Of those, two were contracted by NRCS through Working Lands for Wildlife to manage forests for golden-winged warblers in 2014.
  - A third set of modified seed tree harvest for golden-winged warblers on Sparta Mountain WMA was completed later winter 2014 and plans for a shelterwood harvest are underway.
  - The 2013/14 forestry practice plan for Weldon Brook WMA was finalized. Work was done late winter of 2013-2014 but was not completed due to the harsh winter. The remaining silviculture activities will be completed by winter 2015.
- Twenty-seven points were surveyed on public or NGO lands that had a silvicultural treatment done within the last ten years, and 29 points were adjacent to wetland forest with a mix of herbaceous and shrub wetlands. Under separate funding (NFWF and NJ Audubon), private lands enrolled in habitat management for golden-winged warblers were surveyed for all birds species in 2014.

<u>Conclusions</u>

- Even in its early stages, young forest management on private properties has benefited a number of early-successional songbird species. 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 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.

JOB B2. Habitat Connectivity and Management

Key Findings:

Habitat Enhancement and Restoration for Eastern Tiger Salamander

ENSP biologists worked with U.S. Fish and Wildlife Service biologists, and partnered with Atlantic Electric Company and the Cape May County Department of Mosquito Control, to create habitat for eastern tiger salamander. The locations were targeted to improve long-term connectivity of suitable habitats.

- The creation of vernal pools along Atlantic City Electric (ACE) right-of-way on and near USFWS refuge property was completed in May 2014. Conserve Wildlife Foundation (CWF) staff coordinated the creation and execution of a Memorandum of Understanding which was signed by Atlantic City Electric (ACE), Division of Fish and Wildlife and USFWS Refuge to create and manage a series of vernal pools on the ACE right-of-way on Refuge property.

In a separate project, 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.

- Excavation of a new vernal pool on Beaver Swamp WMA is scheduled for late fall 2014. This will be funded by a private grant awarded to CWF.

ENSP and CWF biologists met with a wetland mitigation company to discuss restoration and enhancement of an extant pond in Rio Grande, Cape May County (Fig. 1). The site has been severely degraded over time by ATV traffic and dumping. Staff proposed a restoration plan and we expect an answer from the company sometime in late 2014. 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>

- ENSP biologist met with Trout Unlimited, Division of Fish and Wildlife's Bureau of Land Management, and The Nature Conservancy staff to plan stream restoration projects on the Musconetcong River around several extant Brook Snaketail sites. We helped design the work to insure no negative impacts to the Brook Snaketail colonies that already occur on the sites, and to restore natural structure to the stream and enhance substrate for the nearby snaketail colonies. We plan to conduct preliminary monitoring at the proposed stream restoration sites.
- Staff will create monitoring protocols to assist land managers with their stream restoration planning.

Recommendations:

- The jobs under this Habitat project are adaptive in nature, moving forward 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.