

**Report
State Wildlife Grants
T-1-5**

Endangered, Threatened and Rare Wildlife Conservation Projects

**Progress Report for Project Year
September 1, 2008 – August 31, 2009**

NJ Department of Environmental Protection

DIVISION OF FISH AND WILDLIFE

ENDANGERED AND NONGAME SPECIES PROGRAM



EXECUTIVE SUMMARY

Project:	Bird Conservation
Federal Aid Project:	T-1-5 (State Wildlife Grants)
Segment dates:	September 1, 2008 to August 31, 2009
Total Project Expenditures:	\$876,142 (\$438,071 Federal, \$438,071 State)

JOB 1: Federal and State Listed Bird Species

OBJECTIVE: To halt or reverse the decline of endangered and threatened species populations through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review.

JOB 1A: 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:

- ENSP biologists monitored all known nesting pairs, with the essential assistance of 65 eagle project volunteers (an increase of ten from last year). Nests were monitored approximately weekly from January through fledging in July.
- In 2009, 77 territorial eagle pairs were monitored, 69 of those were active (with eggs), eight were territorial (maintained a nest area), and six were not relocated when they moved (Figure 1).
- During the 2009 nesting season, 56 nests were successful in producing 99 young, for a productivity rate of 1.43 young per active nest. This productivity rate is more than the minimum necessary for a stable population, and is higher than the nine-year average of 1.28 for 2000-2008. This improvement is due in part to relatively good weather conditions in the incubation period. Nest success was good at 81%.
- Of 11 nest failures, one nest collapsed during incubation, three nests failed when nestlings were <1 month old; two, built in osprey nest structures, failed in incubation when ospreys harassed the eagles (ospreys were observed fighting with the eagles at one of these sites). The rest of the failures were by unknown cause.
- Eight new eagle nests were discovered: one in north Jersey in Sussex County, two in central Jersey (Middlesex and Ocean counties) and four in Salem, Gloucester, Cumberland and Cape May counties. Eagle nests have been documented from 20 of the state's 21 counties in recent years, although they are currently active in 18 counties.
- ENSP biologists visited a sample of nests to band young with federal and color leg bands and to take blood samples. In 2009 we banded 30 eaglets at 16 nests. We took blood from all 30 banded eaglets and stored it for future analyses.
- Most nests (47 of 77 total, 61%) were located on private land, with the balance on state, federal, county, and conservation-organization lands.
- 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.
- ENSP biologists coordinated the Midwinter Eagle Survey that took place January 10-11, 2009. A total of 282 bald eagles was counted by volunteers and staff, up 7% from 2008 and a new high count in New Jersey since the survey began in 1978 (Figure 2). Most eagles (240) were observed in southern New Jersey, primarily in the Delaware Bay region; northern New Jersey had 42 bald eagles on the Delaware River and on inland reservoirs. Surveyors recorded detailed data on eagle locations, and those data were compiled to

help document critical eagle wintering habitat. Total figures also were reported to the USDOJ Bureau of Land Management’s Raptor Research and Technical Assistance Center, which compiles national winter eagle counts.

- Staff used Midwinter Survey point-location data to identify important wintering habitats. Data from past surveys (2006-2007) were digitized, and polygons were digitized from those points. Continued surveys of these sites during annual Midwinter Surveys will help track their use over time. The condition of wintering habitats can be tracked as land use/land cover mapping is updated.
- All new nests 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.
- New nests in Pennsylvania within 2 km of the Delaware River (NJ border) were provided by PA Game Commission biologists, and were included in NJ mapping. NJ eagle habitat mapping can therefore represent important eagle habitat that spans the Delaware River but crosses the state line. This cooperation in 2009 helped reveal the relocation of nesting bald eagles from Philadelphia to NJ, and another pair of eagles from NJ to PA, further north.
- Staff participated in meetings and conference calls on the topics of the USFWS management guidelines and the post-delisting monitoring plan. In 2009, NJ continued our monitoring using the “list” method.
- No action was taken on comparing management practices for efficacy. Currently, management is designed for specific nest sites to address on-site issues in the context of site conditions (habitat and other).
- ENSP staff worked with Bureau of Law Enforcement to address specific problems at nest sites, and included Law Enforcement officers in the pre-season eagle project orientation meeting.

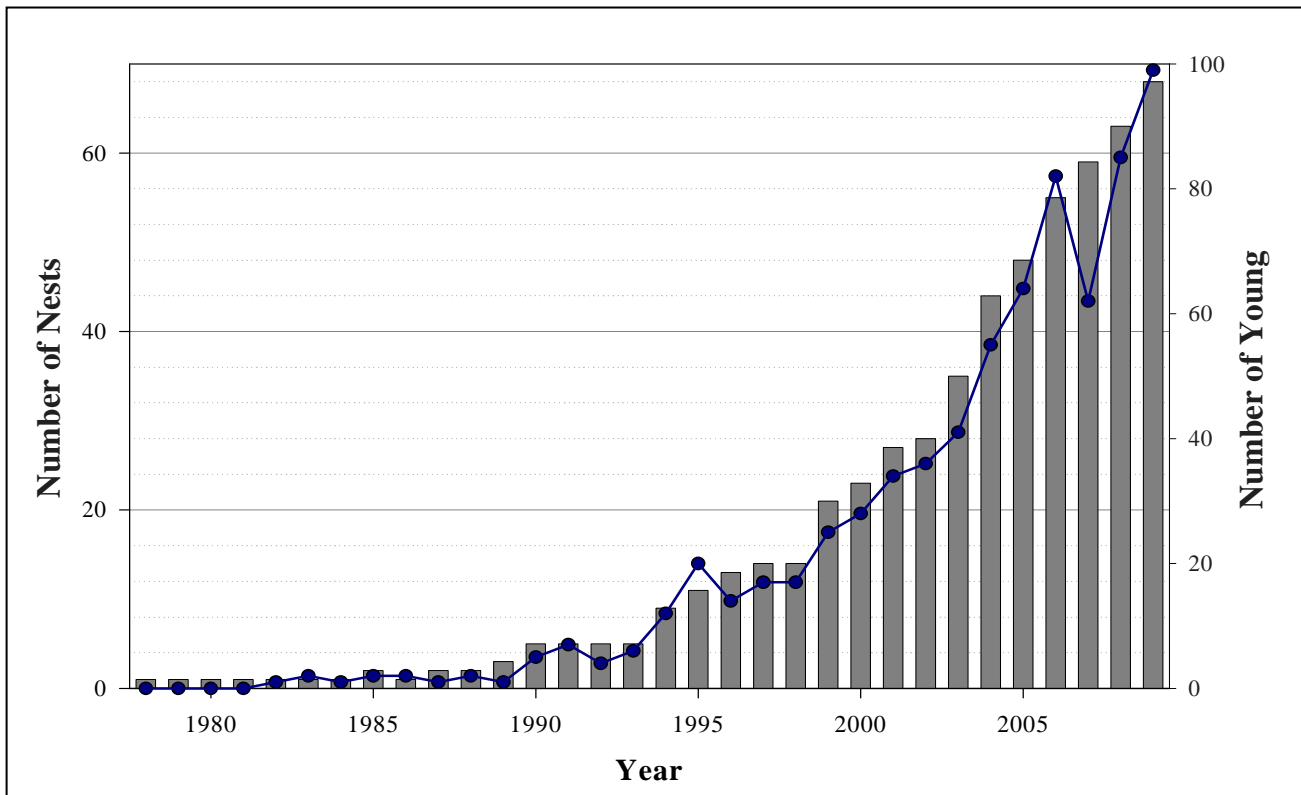


Figure 1. Number of bald eagle nests (bars) and young produced (line) in NJ, 1978-2009.

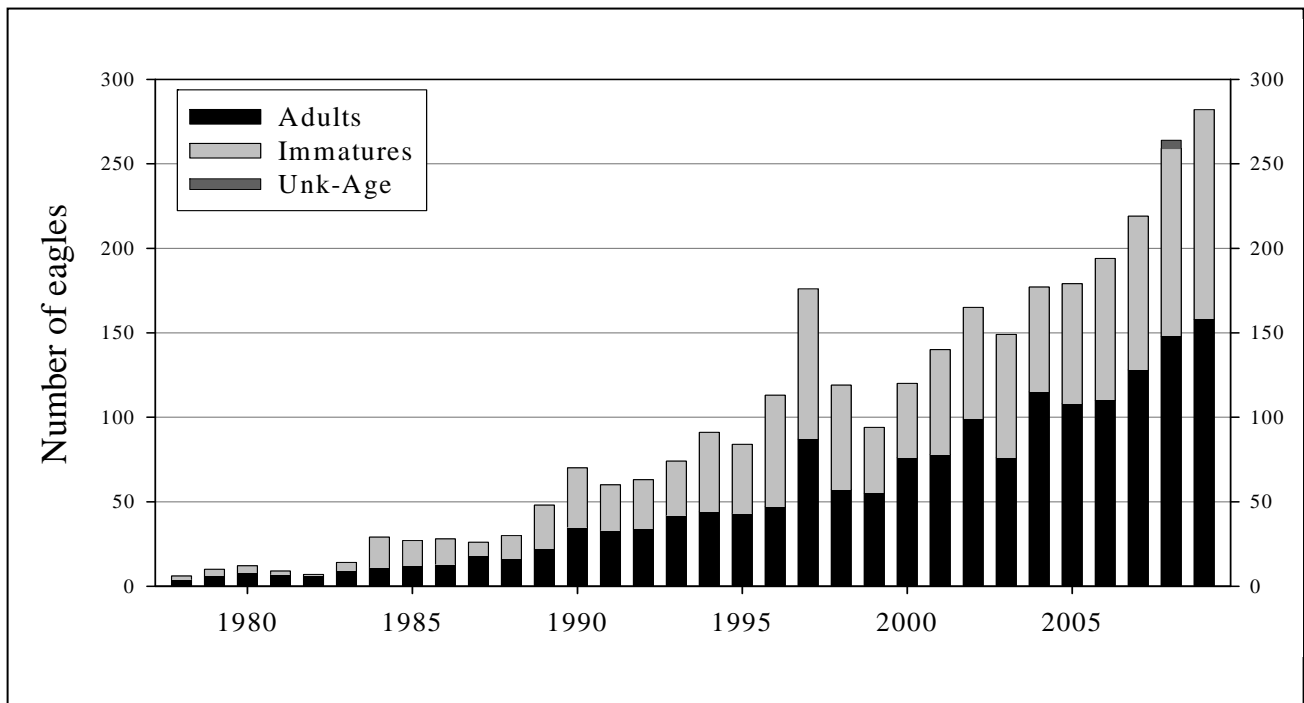


Figure 2. Number of bald eagles counted during the annual Midwinter Eagle Survey in NJ, 1978-2009.

Conclusions:

- The New Jersey bald eagle population has increased each year and continues to maintain nest productivity above the minimum necessary to maintain a stable population. The state’s eagle population has been increasing since the late 1980’s, when one nesting pair existed in the state, but population growth has been most substantial only since 2002. Management by biologists that includes nest-site protection in cooperation with landowners has been key to success in NJ. In 2009, eight new eagle nests were discovered, and expansion into unoccupied habitat is likely to continue in the next few years.
- While the strength of the current recovery is encouraging, most of the population growth is very recent and must be viewed with caution. Regulatory protection levels, nest site protection, and efforts by nest observers and landowners have been essential ingredients in the current recovery, and will be necessary to sustain it. With federal delisting and strengthening of the federal Bald and Golden Eagle Act, we anticipate a substantial level of coordination with the USFWS will be necessary to minimize disturbance and habitat loss due to development and other activities.
- As evidenced in recent years, harsh weather conditions during sensitive incubation and early hatching periods can significantly affect nest success. It remains important to continue close monitoring for the foreseeable future to measure nest occupancy and success to assess eagle recovery in the state.
- Disturbance is a major management issue at many nests, and posting and regular surveillance by staff and nest observers are essential to protecting nests and ensuring the chance of success.
- Contaminants may be affecting nest success at several nests in the lower Delaware River region at a localized level. Regular nest failures often cause eagles to relocate to an alternate nest, making site management and habitat protection more complex, especially in the face of development pressure. Planning is necessary to manage for long term recovery as well as development needs.
- The majority of nests are located on privately owned land, making landowners central partners in the maintenance of the eagle population. While many landowners have become staunch advocates for the eagles and work closely with the ENSP biologists, others may have other goals for their land that may threaten long-term habitat viability.

Recommendations:

- Continue to monitor population size, activity and productivity through weekly or bi-weekly observations of nests. 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.
- Continue to monitor the New Jersey wintering population through the annual Midwinter Eagle Survey in January, in coordination with regional and national efforts.
- 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.
- Monitor for environmental contaminants in the population by 1) annually taking blood samples from nestlings and 2) regularly testing eagle prey animals for contaminant exposure.
- 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.

JOB 1B: Piping Plover Conservation

Project Co-leaders: Christina Kisiel, Senior Environmental Specialist, and Dave Jenkins, Chief

This job is jointly supported by State Wildlife Grants and ESA Section Six funding.

OBJECTIVE 1: To determine statewide and site specific piping plover populations, including nesting success and productivity; and determine the nature and level of threats to populations and reproductive success. Reduce threats through implementation of various management strategies in order to advance species recovery both within the state and as part of the coordinated Atlantic coast recovery effort.

OBJECTIVE 2: To evaluate techniques for creating and maintaining supplemental foraging opportunities (foraging stations near the toe of the dune) for piping plover (*Charadrius melodus*) chicks in areas sheltered from human disturbance. This project is a continuation of work that was initiated in 2006.

OBJECTIVE 3: To evaluate techniques to identify mammalian predators of piping plovers and other beach nesting and colonial waterbird nests, including testing DNA residue left on egg remains.

Objective 1: Distribution, Threats and Management

Key Findings: (These can also be found in the Section 6 Report for E-1-33)

- One hundred five (105) pairs of piping plovers nested in New Jersey in 2009, a 5% decrease from 2008 (111 pairs). This is the lowest level since 1998 when just 93 pairs were present (which is the lowest level since federal listing). The 2009 population was also well below the average number of pairs in the years since federal listing (120 pairs).
- The total number of adults recorded for the entire nesting season (220) was nearly identical to the count during the date-restricted survey conducted June 1-9 (219). However, the number of pairs tallied during the entire nesting season (105) was somewhat higher than those counted during the date-restricted survey (97), which is a typical pattern. Slight variations in the methodologies used by the USFWS–Edwin B. Forsythe NWR in tabulating breeding pairs during the date-restricted survey account for most of the difference between the final season and the census pair counts.
- The northern Monmouth County region, especially Sandy Hook, remained a stronghold for nesting pairs (44 pairs region-wide or 42% of the statewide population). The region comprised of Holgate, Little Beach, and North Brigantine Natural Area recorded the most notable drop in pairs (23 in 2009 vs. 31 in 2008 and 39 in 2007). Within that region, the drop in 2009 was about evenly spread over all three sites. On a site-by-site basis, the number of pairs was fairly consistent with last year, with the only notable change being Stone Harbor Point increasing to 15 pairs compared to 11 in 2008. Of note, Cape May Meadows, with 11 pairs, was the same as in 2008, after having steadily increasing each year starting in 2002 with just 2 pairs.

- Pairs nested at 22 sites, nearly the same as in 2008 when 23 sites were active, but well below the peak count of 30 sites recorded in both 2004 and 2005. NJDFW monitored 13 of the active nesting sites (57% of the sites statewide), which accounted for 46 nesting pairs (44% of the nesting pairs statewide). This is exactly the same percentage of sites and pairs as last year. In addition to the 13 active sites, NJDFW regularly monitored 12 other potential breeding sites. Although no nests were located at those other sites, breeding activity was detected at four of the sites, including brief nesting behavior at two of the sites (Island Beach State Park–Oceanfront and USCG–Tracen) and chicks having moved to two of the sites (Monmouth Beach South and Sea Girt–NGTC) from the nearby sites where they had nested (Seven Presidents Park and Sea Girt–Wreck Pond, respectively).
- Pair-nest success (the percentage of pairs that successfully hatch at least one nest) for the state was up in 2009 as compared to 2008 (66% vs. 52%, respectively), and above the average for the period since federal listing (58%). Looking at just NJDFW-monitored sites, pair-nest success was nearly the same in 2009 compared to 2008 (52% vs. 55%, respectively).
- The statewide fledgling rate was 1.05 fledges per pair, significantly higher than 2008 (0.64 fledges per pair). Productivity at NJDFW-monitored sites (0.48 fledges/pair) was well below the statewide average and somewhat below last year's NJDFW level (0.61 fledges/pair). Statewide productivity in 2009 continued the recent trend of being below the minimum necessary for population maintenance and even further below the 1.50 fledges/pair recovery goal as indicated in the USFWS Recovery Plan (USFWS 1996).
- NJDFW determined nest outcome for all known attempts at NJDFW-monitored sites. Of 66 nesting attempts, 39 (59%) failed and 27 (41%) hatched. We determined the likely cause of 97% of the 39 failed nests: flooding was the leading cause of nest failure, destroying 24 nests. Abandonment (8 nests) and predation (6 nests) figured about equally as the other known causes of nest loss, with abandonment. The exact cause of nest failure was not determined for 1 nest. Of the 6 nests lost to predators, 3 were destroyed by mammalian predators, 2 by avian predators, and 1 was undetermined.
- Flooding causing nest failures tends to be a highly variable factor. Flooding was the primary cause of nest loss in 2005, 2007 and 2009, whereas predation was the leading cause in 2006 and 2008. Nest losses due to flooding were especially high in 2009 compared to the previous four years. Nest loss due to human disturbance was negligible in 2005-2009, attributable to the fencing, posting, and patrolling efforts in place.
- NJDFW employed more predator exclosures on nests in 2009 than the past two years (79% vs. 57% and 62% of nests, respectively), and especially compared to 2006 (47% of nests) when exclosure use was cut back due to concerns over abandonment at exclosed nests. Abandonment remains a concern, but it was not a primary cause of exclosed nest failure in 2009, and the benefits of exclosures still well outweigh the risks. In 2009, 26 of 52 exclosed nests hatched, which is lower than average but attributed to flooding losses. Far fewer unexclosed nests hatched (1 of 14 unexclosed nests), yet were affected by flooding at the same rate as exclosed nests (36%).

Conclusions and Recommendations:

- Because productivity has been especially low in New Jersey in recent years and there is a clear correlation between the number of fledglings produced in the state and its population trend, the drop in nesting pairs this year, although slight, was not unexpected. Persistent low productivity and its implications regarding the likelihood of long term recovery within the state have been the cause of ongoing concern. Productivity did rebound this year, however, more sustained results are necessary to produce any significant population growth. Although the 1.05 chicks fledged per pair in New Jersey in 2009 is still below the targets for a maintenance population or recovery (1.24 and 1.50 chicks fledged/pair, respectively) set by the USFWS in its Recovery Plan, productivity above 1.00 has generally resulted in population increases (or at least slowed decreases) in subsequent years in New Jersey. In fact, recent analysis of range wide (Atlantic Coast) population and productivity data collected since federal listing indicates there are likely regional differences in these thresholds. Among the U.S. recovery units, differences are apparent by latitude, with lower annual productivity levels being necessary to create a stationary population as you move from north to south (Hecht 2009, Melvin 2009). Data from New Jersey suggest a fledgling rate of 0.99 chicks per pair is sufficient to maintain a stationary population in this region (Melvin and Hecht, pers. communication). Unfortunately, New Jersey's piping plover productivity has failed to even reach these lower levels in many years, which

suggests more aggressive or innovative management may be necessary to achieve sustained population increases.

- Nest and brood depredation, as well as intense predator activity leading to nest abandonment have been major reasons for poor reproduction in many years. This was not the case in 2009, as flooding played a much larger role this year. However, the fact that predation was not the primary problem this year does not suggest that predators can be discounted moving forward. This year's figures resulted in part because nests were lost to flooding before predation became a factor. Achieving sustained higher productivity will still require minimizing the impacts of predators, and predator exclosures alone will not provide the solution. Intensive control of red fox by the National Park Service at Gateway N.R.A.–Sandy Hook dramatically increased piping plover success in 2009 (Pover 2009). Because Sandy Hook includes the highest concentration of piping plovers in the state, predator control was especially important, but it also improved nest success for other beach-nesting species at the site (i.e., least tern and American oystercatcher). New Jersey's piping plover population success cannot depend only on success at Sandy Hook; however, the success at Sandy Hook is instructive for land managers to address red fox problems elsewhere.
- The fact that flooding was particularly problematic in New Jersey this year does highlight that flooding is likely to increase in the future. Although we cannot attribute the severe flooding and numerous storms in the 2009 breeding season sea-level rise, this global issue obviously is a huge potential threat to coastal species, especially plovers that nest in low-lying beach habitat. Climate change could be particularly devastating for piping plovers in New Jersey as our coast is highly developed, already leaving little remaining suitable nesting habitat. Furthermore, the high degree of artificially stabilized beaches and armored inlets in New Jersey leaves little room for natural retreat or shift of our beach and dune systems. Any additional long-term loss of suitable habitat decreases the likelihood of sustaining or recovering the piping plover population in NJ. Localized impacts of, and solutions to, global warming are difficult to assess, and call for additional resources. The impacts on beach dependent species, especially piping plovers should be an important part of the climate change discussion and planning process.

Objective 2: Supplemental Foraging Opportunities

Key Findings:

- Experimental foraging plots (10' x 25') were lined with a thick plastic liner and then covered with approximately 6" of sand which proved effective for:
 - Preventing water from percolating through the sand and instead allowing it to pool.
 - Allowing a wet microhabitat to flourish and wetland consistent plants to grow at the perimeter.
 - Easy installation and removal.
- "Jetting," continued to be the best option for installing the wells. The wellpoints were made of PVC pipe and had a 4" diameter. Two sites were chosen, both of which were located in Ocean City. One was between 22nd and 23rd Streets (hereafter known as Ocean City–North) and the other was between 27th and 28th Streets (hereafter known as Ocean City–South). Unlike past years, both sites were located in the same city for a few reasons. First, we decided that expanding the experiment on a municipal site was a better test of the foraging area; municipal sites are heavily used by people and a fenced foraging area could significantly increase foraging opportunity than on a site with low human disturbance (such as the federal properties we used in the past). Now that the technical issues have been worked out, it can be deployed at sites where it is likely to garner the most benefit. The second reason was the ease of travel to deploy and monitor the sites – being located at one site meant that the biologist could spend more time working on the system and less time traveling between sites. There is a third unit (unmonitored in this study) that remains in place at Two-Mile Beach at the request of the US Fish and Wildlife Service as they continue testing for the petroleum-like smell associated with the water to determine if there is a contamination issue.
- Ocean City – North and South
 - Ocean City is a municipal beach whose summer population swells with tourists enjoying the coastal environment. Over the course of the five months that the equipment was visible (although inside the same light fencing that protects the plover nests and nesting areas) there were never any incidents of tampering or vandalism.

- The 4" diameter pipe was jet in using high-pressure water. Installation was not as difficult as in the past, but still required two attempts at Ocean City - South. However, both wellpoints eventually went in and worked well.
- The 10'x25' plots were dug with help from the Ocean City High School Ecology Club. They were lined with plastic and filled with a thin layer of sand and wrack (to help retain moisture) and layered with fish fertilizer (to help attract invertebrates).
- A battery was added to the system last year and both sites were fitted with one this year. This allowed the pumps to run continuously 24 hr/day. The resulting consistent flow, coupled with the plots being lined, allowed water to puddle, creating the desired effect of artificial foraging areas that mimicked ephemeral pools. The addition of wrack and fish fertilizer allowed the plots to flourish and by the end of the season the desired wet, productive microhabitat had emerged in the dry dune environment.
- No birds were observed utilizing the plots, although that may have been mostly a function of the lack of adults and chicks in the area. Although the area around Ocean City–North has had a nesting pair of piping plovers for >10 years, a pair did not return this year. The Ocean City–South site did have a pair that nested near the system. Their one nest attempt hatched, but the chicks disappeared at 1-2 days old (presumably lost to predation). The pump at this site had some technical problems during the incubation period so the pair did not have the opportunity to use the plot. The technical difficulties were corrected but the pair did not re-nest and they left the area shortly after the chicks were lost.
- Formal invertebrate sampling was not conducted this year. Last year's testing confirmed that the plots attract piping plover food items, so it was deemed unnecessary to re-test. Testing of the wrack line was not conducted because there were no plovers at Ocean City–North, so we could not determine where sampling should take place since we had no geographic data from actual plover foraging. Ocean City–South had plovers using a wrack line, but the system was not functioning at the time when it would have been needed to sample invertebrates. However, informal observations revealed many of the same type of organisms (e.g., flies and beetles) noted last year were present.
- The municipality and school system of Ocean City were supportive and helpful with this project.

Conclusions:

- Lining the plots with plastic continued to play an integral role in water retention. The combination of the liner and a timer on the pump assured that plots stayed wet virtually all the time, even in the hottest weather.
- The solar power configuration continued to be a great success. The straightforward operation and the success of the panel throughout the season validated their continued use. They sustained no damage or obvious wear. Adding a battery to the system worked well, and it appeared from voltmeter readings that the battery was not discharging over the course of the season.
- As the field season progressed, the plots transitioned from a wet sandy area to a true microhabitat for foraging plovers. Wetland-associated plants grew and the invertebrate population appeared to be reacting to the positive change in available habitat for them.
- This was the third year utilizing a municipal site where the public had relatively easy access to the equipment, but no interference was detected. This is especially promising because plovers at many municipal sites would benefit from artificial foraging areas. Unfortunately, Ocean City's pair numbers have been on a downward trend and there is a chance that no pairs will return next year, making this site a poor location to continue the experiment.
- A strong working relationship with the landowner where the artificial foraging area is located is paramount to the success of the project.

Recommendations:

- Continue to use the Lorentz pump and the size 6-gauge wellpoint. Continue to line foraging plots with plastic, add wrack and fish fertilizer, and use the battery/timer to ensure continued success of the system.
- Eliminate Ocean City as a testing site. It is likely that no pairs will nest at that site in 2010 and therefore installing the system would not accomplish the goal of supplementing plover foraging habitat.
- Redirect efforts to a new site – Corson's Inlet State Park. Corson's Inlet State Park has fluctuated in the number of pairs it has housed in the over twenty years that it has been monitored, but it has been active (at

least one nesting pair) every year since 1987. It has a moderate amount of human disturbance and the foraging area could act as an attractant to piping plovers searching for nesting habitat.

- Locate a site within the park for the foraging area and obtain permission to install the unit from the superintendent of the site. Install components of wellpoint in the fall (late October) instead of the spring (late March). This will allow the rest of the system to be installed in late February and have the foraging area established by early March when piping plovers arrive. This may create an opportunity to draw prospecting plovers to the site.
- Reconfigure the systems so that instead of two smaller plots there will be one large plot that both wells will supply with water. This will create a larger foraging pond with the goal being to increase the visibility of the foraging area to prospecting piping plovers flying over the site.

Objective 3: Identify Mammalian Predators

Key Findings:

- Staff members were instructed on how to gather eggshell remains while reducing the chance of contamination by human DNA. Kits were created for each staff member to carry with them in the field. The contents of each kit included disposable latex gloves, Ziploc baggies and a marker to write the details of the collected eggs (species, date, evidence at scene) on the bags.
- Staff members gathered the remains of predated eggs on an opportunistic basis. Predated eggs were differentiated from hatched eggs by the way the eggs were cracked and by the way the membrane was connected to the egg.
- Two piping plover eggs were collected and two American oystercatcher eggs were collected. No other species' eggs were located.
- No DNA analysis was conducted this year because of problems purchasing the necessary supplies to process the samples. The continuation of this grant ensures that these eggs will be tested in the next project year.

Conclusions:

- Individual kits are an excellent way to ensure each staff member always has the necessary tools needed to securely collect any predated eggs that are found.
- The relatively small numbers of samples retrieved highlights the difficulty of detecting predated eggs despite the high numbers of eggs lost to predation.

Recommendations:

- Continue to collect predated eggs as they are encountered in the field.
- Resolve issues surrounding the procurement of supplies needed to conduct DNA tests.
- Since eggs are difficult to detect, consider making this a long-term collection process in order to amass a large enough sample to assess predator concerns at different sites around the state.

JOB 1C: Beach nesting Birds (Black Skimmer and Least Tern)

Project Co-leaders: Christina Kisiel, Senior Environmental Specialist, and Dave Jenkins, Chief

OBJECTIVE 1: To assess population and productivity trends of nesting black skimmers (*Rynchops niger*) and least terns (*Sterna antillarum*) through continued monitoring of nesting sites on the beach strand. Monitoring for black skimmers will also be extended into the Barnegat Bay marsh islands.

OBJECTIVE 2: To determine whether black skimmers are more sensitive to human disturbance when they first arrive at their potential breeding sites than during the incubation and chick-rearing period.

Key Findings:

- Black skimmer breeding surveys were conducted approximately every 2 weeks from mid-May until the end of August at barrier island beaches along the entire Atlantic coast and back bay islands in Barnegat Bay.

Active nesting occurred at five sites, including West Vol, Mordecai, and East Sedge islands within Barnegat Bay, and Seaview Harbor Marina and Stone Harbor Point on barrier islands in the southern portion of the state. A total of 2,219 adults were present at these sites (based on a cumulative total of peak counts that occurred in the July 1-15 survey period). Most (77%) of the state population was present at two sites during the peak count survey period, spread nearly evenly between Stone Harbor Point (865) and Seaview Harbor Marina (848). The colony at Seaview Harbor Marina grew to a peak of 1,678 birds in August after the Stone Harbor Point colony failed due to flooding and those birds moved to Seaview Harbor Marina. Most of the remaining black skimmers breeding in the state in 2009 were present at Mordecai Island.

- A peak count of 800 adult black skimmers were observed incubating/on nests, although several flooding events severely disrupted nesting and caused movement between colonies, so it is believed that the actual number of birds that had nests was somewhat higher than was detected during the surveys.
- Black skimmer productivity was low with only 308 fledglings produced statewide. Only one site (Seaview Harbor Marina) fledged young. Tidal flooding was by far the primary factor limiting reproductive success. The Stone Harbor and Mordecai colonies failed to hatch any young due to two severe overwash events that occurred about a month apart in late June and late July. Despite producing some young, the Seaview Harbor Marina colony was also affected by a late season flooding event that contributed to significant chick mortality at the site.
- 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. Active nesting occurred at 17 sites. A total of 1,166 adults were present at these sites (based on a cumulative total of peak counts that occurred in the June 1-15 survey period). Close to half (502) of the statewide total was present at one site (Belmar – Shark River Inlet). Other significant colonies in the state, based on the number of peak adults present at some point in the season, were Cape May Meadows (228), Cape May City–Poverty Beach (185), Sea Bright–North (166), Sandy Hook–North Gunnison (157) and Seaview Harbor Marina (149 peak adults).
- A peak total of 556 adult least terns were observed incubating/on nests. The number of incubating adults varied widely at individual sites during the different survey periods due to a combination of flooding and predation problems.
- Productivity was low to moderate for least terns with 284 fledglings being produced statewide (0.51 chicks per pair, based on the peak number of incubating adults). Nearly half (137) of the fledglings were produced from the Belmar–Shark River Inlet colony. Even so, that site experienced significant adult (and likely some chick) mortality due to the presence of a free-roaming cat. Only one other site (Cape May City–Poverty Beach) produced a notable number of fledglings (60), with most of the sites failing (or nearly completely failing) due to flooding or predators. Of note, crows had a severe impact on the large colony present at Cape May Meadows.
- A study which evaluated the sensitivity of black skimmers to human disturbance at various stages of breeding, including territory establishment, incubation and, brood rearing, was not completed as of the reporting date. Data was collected during the 2009 breeding season at sites within Barnegat Bay, but analysis of data was still pending.

Conclusions:

- The statewide black skimmer breeding population dropped 20% in 2009 from 2008 (2,219 vs. 2,787 total adults, respectively), although it was comparable to 2007 (2,103) and some other recent years. Furthermore, the 2009 population may have been higher than was detected on the surveys – as noted, several major flooding events resulted in considerable intra-colony disruption and movement between colonies, making survey efforts especially difficult.
- Although black skimmer productivity was low in 2009, it was relatively high the previous two years, so the dip this year is not expected to have any significant long-term impact on the statewide population.
- The number of known black skimmer colonies in the state had nearly doubled in 2008 (10 active colonies), somewhat alleviating our concerns over the small number of colonies remaining in the state. However, in 2009, the number of active colonies dropped sharply (down to five and of those only three were of any significant size), more consistent with the recent trend, renewing concerns about the vulnerability of the

state's black skimmer population. The fact that only one colony produced fledglings in 2009 illustrates the dilemma presented by such a small number of colonies.

- The statewide least tern breeding population was nearly the same in 2009 as in 2008 (1,166 vs. 1,179 total adults, respectively), and on par with levels since 2004. Despite the stability of the statewide population over the past five years, the population remains relatively low with respect to the long-term trend. Even with fairly strong productivity the previous two years, including especially robust results 2008, the statewide population has not grown.
- Productivity fell in 2009 compared to 2008, but last year was one of the most productive years on record for least terns in the state, and the number of fledglings produced in 2009 remained strong enough that it should not have a long-term impact on population.
- The number of active least tern colonies decreased notably in 2009 compared to 2008 (17 vs. 23, respectively). The number of colonies had remained nearly the same over the five years prior to 2009. It is not clear what may have caused the decrease this year, although most of colonies that became inactive in 2009 were very small and unsuccessful in recent years. Predator activity and changes in habitat suitability may have also been factors. That said, fairly wide fluctuations in the number of least tern colonies (and population) have been fairly typical in New Jersey on a long-term trend basis.

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 within Barnegat Bay) about once every two weeks during the breeding season in order to make a statewide assessment of population trends.
- Periodically monitor (no less than once every three years) other back bay island complexes within the coastal region of the state to insure that large numbers of skimmers are not nesting in these areas.
- Continue to incorporate management strategies for 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.
- Once completed, results from the study on the impacts of human disturbance on black skimmer colonies should be integrated into management recommendations to be implemented at Barnegat Bay island nesting sites (or other skimmer sites, as applicable).
- Continue to incorporate breeding data into the Landscape Project and NJ DEP's Biotics database.

JOB 1D: Osprey Monitoring and Management Planning

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 conducted aerial surveys in May and June to determine the size and growth of the statewide population since 2006, when the last aerial survey was conducted. The aerial survey covered the marshes and bays along the Atlantic Coast from Manasquan Inlet to Cape May. The second survey, which normally would have covered the same area as the first (to document failed nests), instead covered the Delaware Bay marshes from Goshen to Salem (an area not fully documented by ground). Air and ground surveys documented 485 nesting pairs in New Jersey, the most since the effects of DDT decimated the population. The population increased by 21% since 400 nests were counted in 2006 (Table 1).
- We documented 56 newly occupied nest platforms this year.
- In 2009, 71% of the overall population (345 of 485 pairs) was checked by ground surveys, providing productivity estimates for the major colonies and the state as a whole (Table 1). During ground surveys nestlings were banded with USGS aluminum bands by licensed bird banders.
- Biologists and volunteers conducted ground surveys in June and July to document nest success and productivity at 345 nests (Table 1). We grouped nests by watershed or water-body areas to which they were closest. Nest success averaged 1.59 young per active nest, double the rate needed to sustain a population.

Average nest success was higher in Delaware Bay than Atlantic coast colonies (1.78 vs. 1.53 young/active nest), and varied from 1.06 in Sea Isle City to 1.78 on the Maurice River near Delaware Bay.

- Most nests (386, 80%) were along the Atlantic coast, where many new platforms have been erected over the past three years to increase nesting opportunities. In recent years, more than 50 nest platforms have been installed with funding by private donations.
- Fifteen osprey eggs were collected during nest visits during the nestling-banding period. 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 left to dry for ≥ 2 months.
- Two new volunteers were trained to band osprey nestlings and were added as subpermittees to the ENSP's bird banding permit. The new volunteers were trained in the office on one day, and were accompanied and supervised for their first full day of banding.
- ENSP staff provided technical assistance and advice to the US Coast Guard, the US Army at Fort Monmouth, and others, to deal with osprey nests in hazardous or unsafe locations. In the case of Fort Monmouth, we advised the transfer of an active nest to a new structure, resulting in success for the ospreys and meeting the Army's needs.
- All nest locations were 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. The osprey habitat model for use in Landscape Project was also updated with new information. Although we have identified the need for a more streamlined data-handling system, we did not make any progress on that this segment.
- No information was gathered on fisheries' (menhaden and flounder species') trends to identify a potential correlation with osprey population parameters.

Conclusions:

- This year's triennial survey documented an increase in the state's osprey population to 485 nesting pairs, an increase of 21% since the last census in 2006. The population in 2009 is in the range of the historic (pre-DDT) population for New Jersey, estimated at approximately 500 pairs.
- ENSP's coordination of volunteers and licensed banders has made possible the accurate tracking of occupied nests and, in particular, 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 three years (next survey due in 2012) 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). Continue to recruit and train additional volunteers to conduct nest checks. Investigate a 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 2009 in all NJ nesting areas. Productivity determined by aerial and ground surveys in May-June-July. Productivity rates in 2006-2008 provided for comparison.

Nesting Area	# Nests	Known-Outcome Nests	# Young	# Banded	Production 2009	Previous Years		
						2008	2007	2006
Delaware River & North Jersey	6	0	unk	0	n/a	n/a	n/a	1.00
Raritan Bay area (w/Cheesequake)	34	26	40	16	1.54	1.67	1.38	1.35
Monmouth County	18	12	15	0	1.25	n/a	n/a	n/a
Barnegat Bay	48	32	57	36	1.78	2.25	2.06	n/a
Sedge Islands WMA	30	28	44	28	1.57	1.75	1.15	1.57
Great Bay to Atlantic City	56	36	55	35	1.53	2.09	1.95	1.56
Great Egg Harbor/Ocean City	55	49	84	46	1.71	1.72	1.52	1.65
Sea Isle City	22	17	18	15	1.06	1.55	1.75	2.10
Avalon/Stone Harbor Bays	77	49	71	58	1.45	1.76	1.93	1.64
Wildwood Bays & Cape May	40	18	25	16	1.39	1.88	1.89	1.89
Maurice River & Estuary Marshes	76	63	112	89	1.78	2.11	2.07	1.84
Salem Co./ Artificial Island / Delaware	23	16	29	9	1.81	1.80	1.70	2.00
TOTAL of Study Areas	485	346	550	348	1.59	1.88	1.78	1.66
Atlantic Coast only	386	266	407	250	1.53	1.82	1.72	1.74
Delaware Bay only	99	79	141	98	1.78	2.05	2.00	2.06
Total Statewide	485	346	550	348	1.59	---	---	400

JOB 1E: Colonial Waterbirds

Project Co-leaders: Christina Kisiel, Senior Environmental Specialist, and Dave Jenkins, Chief

OBJECTIVE 1: To determine statewide distribution, nesting populations and productivity of the great blue heron (*Ardea herodias*) through ground surveys. Increase the scope of this survey to include inland colonies of other long legged wading birds, especially black-crowned (*Nycticorax nycticorax*) and yellow-crowned (*Nyctanassa violacea*) night herons, in the northeastern portion of the state by developing and implementing a protocol to complete ground surveys for these species.

Key Findings:

- The birding community was extremely responsive to requests of locations of great blue heron and night-heron nesting areas. Requests for information were made on the “JerseyBirds” listserv (a listserv that focuses on New Jersey birding and is open to the public) and through New Jersey Audubon’s Cape May Bird Observatory website. Many locations submitted by the public were previously known to the state, but this method did uncover 19 new great blue heron sites and nine new night-heron sites. The new colonies represented 28% and 43%, respectively, of the great blue heron (n=66) and night-heron (n=21) sites surveyed. Information that was sent in from the public about known colonies was still useful as it filled in data gaps for the years where surveys had not taken place (the great blue heron survey is conducted once every five years and this was the first year of the night-heron survey).
- The nature of this survey makes it ideal for volunteers. The species involved are easy to identify and the survey protocol does not require a large commitment of time. Surveyors are asked to visit the colony three times over the course of eight months. Due to these factors, and the inherent charisma of the focal species, recruiting volunteers was not a difficult task. Requests for volunteers were posted on the Division of Fish and Wildlife’s website and Cape May Bird Observatory website and through the Division’s volunteer listserv as well as the JerseyBirds listserv.
- In addition to volunteers, staff of the NJ Division of Fish and Wildlife’s Endangered and Nongame Species Program (ENSP) also participated in this survey. In total, 27 volunteers and eight staff participated in the state-wide great blue heron survey and nine volunteers and two staff participated in the NJ-northeastern region night-heron survey. The volunteer hours only reflect 16 of these volunteers since the rest did not submit their timesheets by the deadline for this report.
- The online submittal form (which is part of a larger Endangered and Nongame Species Program-wide data submittal project) is still in development by the GIS staff and their contractor. It was not completed by the end of the SWG project year (August 2009) but may be by the end of the survey year (November 2009). However, data can be entered in the NJ DEP’s Biotics (Biotics) database, which will occur at the completion of the survey.
- The survey protocol was developed using techniques described in Steinkamp et al. (2003). These were visual surveys in which 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 and no disturbance to the birds.
- The protocol for the great blue heron and inland night-heron surveys were the same, except that the timing of the first and second survey periods. Great blue herons begin nesting in mid-late March while night-herons do not begin until May. The third survey period remained the same for both groups. The great blue heron survey was conducted state-wide while the inland night-heron survey focused on the northeastern region of the state.
- A staff biologist attended the NY-NJ Harbor Herons Working Group Meeting, which was held December 11-12, 2009 at the Meadowlands in Lyndhurst, NJ. She also attended the annual Waterbird Society Meeting in South Padre Island, TX from November 4-7, 2009. The Southern New England-Long Island Sound

Waterbird Working Group meeting was cancelled due to budget and travel restrictions. In its place, a bulletin was compiled (including NJ information supplied by ENSP) that summarized data that would have otherwise been presented at the meeting and distributed to all would-be participants.

- Restoration of habitat and investigations into limiting factors of wading bird populations were not included in the approach this year due to time constraints, but they still remain important venues that should be investigated in the future.
- No aerial survey was conducted this year since it was not a scheduled year (aerials are currently conducted every five years).

Conclusions:

- The birding community in New Jersey is an excellent resource for both information about where various species are distributed and also for recruiting volunteers. The Cape May Bird Observatory staff was helpful in posting the volunteer request, as was the NJ Division of Fish and Wildlife's staff. All colonies were covered thanks to the support of staff and volunteers. This was a huge success, considering there were 87 total sites to be surveyed for this project. This accomplished a Program goal of increasing efforts to locate and map species nesting in interior sections of the state.
- The survey protocol worked well, allowing biologists to compile enough data to monitor the population without requiring an overly intensive survey schedule that volunteers may struggle to maintain.
- The online submittal form will be a great asset to these surveys (either this survey year or in the future) since it will eliminate the need for a staff member to complete the data entry for each site. There were 87 total sites with three visits for each site, plus notes on directions and observations for each. This requires a time-consuming process of data entry by staff, whereas online submittal will allow each observer to enter their own data, a much more efficient method.
- Since the survey is not yet complete, there is no final data to report at this time. Preliminary, incomplete data suggests there will be an increase in the number of active sites this year (though this is largely a result of increased survey effort). Many sites appeared to do well, although some were abandoned mid-season for no discernable reason. Final data will be submitted to the Biotics staff for inclusion in state databases and presented in next year's SWG report.
- Regional and international meetings allow biologists to interact and share ideas on data collection and analysis as well as large-scale population trends. Interaction at this level accomplishes a Program goal of collaboration with regional biologists and understanding how they are working to recover species of conservation concern.

Recommendations:

- Continue to use the protocol that was developed for these surveys in future years.
- Consider decreasing the time between inland night-heron surveys from five years to three years to match the survey frequency of the aerial coastal marsh surveys (no aerial survey was conducted this year since one was not scheduled). There also appears to be an increase in the number of night-herons nesting at inland sites compared to areas within the Atlantic coast marsh islands and increasing the frequency of the surveys will help determine if this is an actual trend.
- 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.
- Despite travel and budgetary constraints, every effort should be made to continue to attend regional and international waterbird meetings.

Job 1F: Migratory Shorebirds - Conservation of Red Knot in Delaware Bay

Project leader: Amanda Dey, Principal Zoologist

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.

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.

OBJECTIVE 3: Assess recovery of the horseshoe crab egg resource: monitor horseshoe crab egg densities on Delaware Bay beaches.

Key Findings:

DELAWARE BAY STOPOVER

Key Findings:

- Thirteen years of trend information representing the body of work on the Delaware Bay stopover (shorebirds, horseshoe crabs/eggs) were published in the journal *Bioscience* in February 2009, vol. 59(2):153-164 (attached).
- In 2008-2009, preliminary shorebird and horseshoe crab models were developed by the Adaptive Resource Management modeling team. This team is a subgroup of the shorebird and horseshoe crab technical committees of the Atlantic States Marine Fisheries Commission (ASMFC), and the models will eventually inform fisheries regulators and managers on horseshoe crab harvest levels that will sustain the Delaware Bay Migratory Stopover. The *Bioscience* paper will serve as the quantitative baseline against which models will be evaluated.
- The moratorium on horseshoe crab harvest in New Jersey continued in 2009. The reinstatement of horseshoe crab harvest in New Jersey is tied to the biological recovery of the red knot population and horseshoe crab egg densities on Delaware Bay in accord with numeric targets identified in the USFWS Red Knot Status Assessment published in 2007 (Niles et al. 2007).
- In 2009, it was necessary to change observers in the weekly aerial shorebird surveys on Delaware Bay. While this change necessarily introduced a break in a continuous 23-year survey by the same observer (K. Clark, NJ ENSP), it offered an opportunity to add ground counts as a pilot method to calibrate aerial counts. We also added the interior of Mispillion Harbor, DE, to the aerial survey. This site had not previously been counted because the aerial survey historically counted only coastal beaches. With the addition of Mispillion inner harbor, shorebird counts were anticipated to be higher overall. Mispillion Harbor is a protected area with good horseshoe spawning activity especially on full and new moon tides. With the decline of horseshoe crabs and contraction of spawning to fewer sites in NJ and DE, Mispillion now has the highest egg densities in the bay and attracts large numbers of red knots and other shorebirds. Finally, to increase accuracy of aerial counts, we limited the two counters to one species each (red knot and ruddy turnstone); thus sanderlings and semipalmated sandpiper were not systematically counted in the 2009 aerial survey.
- As of this writing, a thorough review and reconciliation of aerial and ground survey methods and results has not yet been done by NJ and DE biologists, and results should be viewed as preliminary. Results of calibrated aerial surveys in 2009 showed a stable red knot population comparable to the previous six years of aerial survey. Aerial surveys calibrated by ground counts in 2009 showed good correspondence for red knots; there was greater variability for ruddy turnstones. For May 18, 21, 29 aerial survey dates, calibrated aerial counts for red knot and ruddy turnstone are shown in Table 1. The May 26 aerial survey was cancelled due to low ceiling, and attempts to reschedule the flight failed due to continued poor flying conditions and mechanical problems. Another aerial survey was not performed until May 29 after the majority of shorebirds had departed the Bay, thus peak numbers of shorebirds may not have been counted via aerial survey in 2009. However, ground counts were performed daily during the period May 22 to May 29 on various sites in NJ and DE representing variable survey effort (Table 2). It should also be noted that Mispillion Harbor was consistently ground-counted on all dates and accounted for the majority of red knots and other shorebirds counted during May 22-28 (Figure 1).

Table 1. Red knot and ruddy turnstone aerial counts calibrated by ground counts.

	May 18	May 21	May 26	May 29
Red Knot	8,083	16,229	No survey	3,380
Ruddy Turnstone	12,965	17,194		8,391

Table 2. Red knot and ruddy turnstone ground counts, May 22-28, during peak of shorebird numbers on Delaware Bay.

# Sites	N=9	N=5	N=8	N=9	N=9	N=24	N=13
Surveyed	6 DE 3 NJ	2 DE 3 NJ	6 DE 2 NJ	7 DE 2 NJ	3 DE 2 NJ	5 DE 19 NJ	6 DE 7 NJ
Date	22-May	23-May	24-May	25-May	26-May	27-May	28-May
Red Knot							
NJ all	2,620	1,600	2,700	4,300	900	3,685	1,742
Mispillion	17,000	11,085	17,500	14,290	26,055	435	518
DE other	172	150	12	179	232	440	1,803
Total	19,792	12,835	20,212	18,769	27,187	4,560	4,063
Ruddy Turnstone							
NJ All			300			5,654	2,285
Mispillion	7,286	1,615	7,200	2,590	3,300	1,100	1,316
DE Other	3,399	200	882	2,799	550	1,830	2,316
Total	10,685	1,815	8,382	5,389	3,850	8,584	5,917
Grand Total	30,477	14,650	28,594	24,158	31,037	13,144	9,980

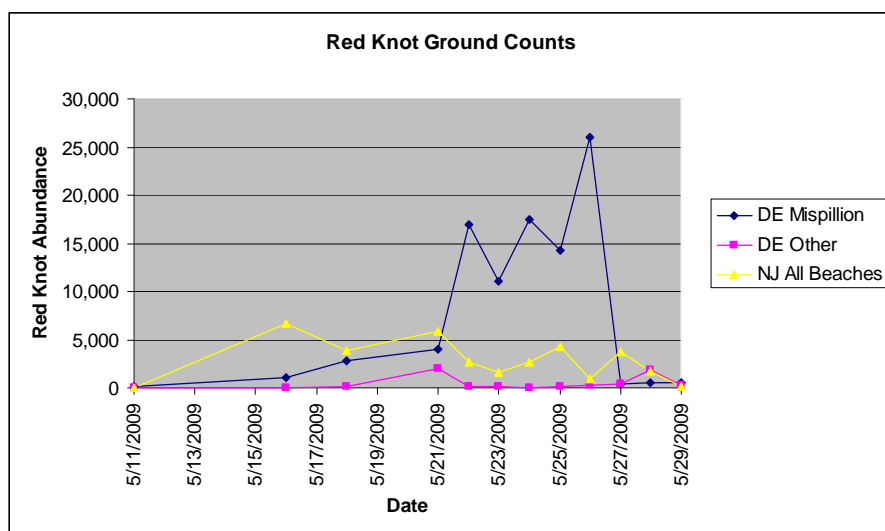


Figure 1. Red knots ground counted in New Jersey (all sites) and Delaware (Mispillion Harbor and other).

As shown in Figure 1 and Table 2, a peak number of red knots were ground counted in Mispillion Harbor on May 26. It is likely this peak represents the staging of most of the red knots present in Delaware Bay recorded on May 25 (18,769) and an arrival of red knots from Virginia (6,079 counted on May 25 in VA, B. Watts, pers. comm.), and was followed by the departure of red knots from Delaware Bay on the evening of May 26. By May 27 only 4,560 red knots remained in Delaware Bay.

The 2009 ground counts presented several difficulties. In absence of aerial surveys during peak shorebird abundance, it was difficult to reckon aerial counts with ground counts given the addition of Mispillion Harbor to the survey. It should be noted that this peak count was consistent with the number of red knots counted along the east coast in May (Table 3).

Table 3. Counts of Red Knots along the US east coast from Florida to Delaware Bay carried out over two consecutive days during 20-24 May in each year from 2006 to 2009.

	2006	2007	2008	2009
New Jersey	7,860	4,445	10,045	7,631
Delaware	820	2,950	5,350	5,730
Maryland			663	78
Virginia	5,783	5,939	7,802	3,261
North Carolina	235	304	1,137	1,466
South Carolina		125	180	10
Georgia	796	2,155	1,487	?
Florida			868	800
TOTAL	15,494	15,918	27,532	18,976

The number of ruddy turnstones counted in aerial (Table 1) and ground surveys (Figure 2) was much more variable because of a variety of sources of error including large variability in ground survey effort between NJ and DE, differences in foraging strategy and detectability between air and ground surveys, and observer error. In conclusion, biologists from NJ, DE and various researchers involved in the development of this new count method are still examining how to improve the method and reconcile aerial and ground surveys so that future surveys can be related to long-term trend derived from aerial surveys.

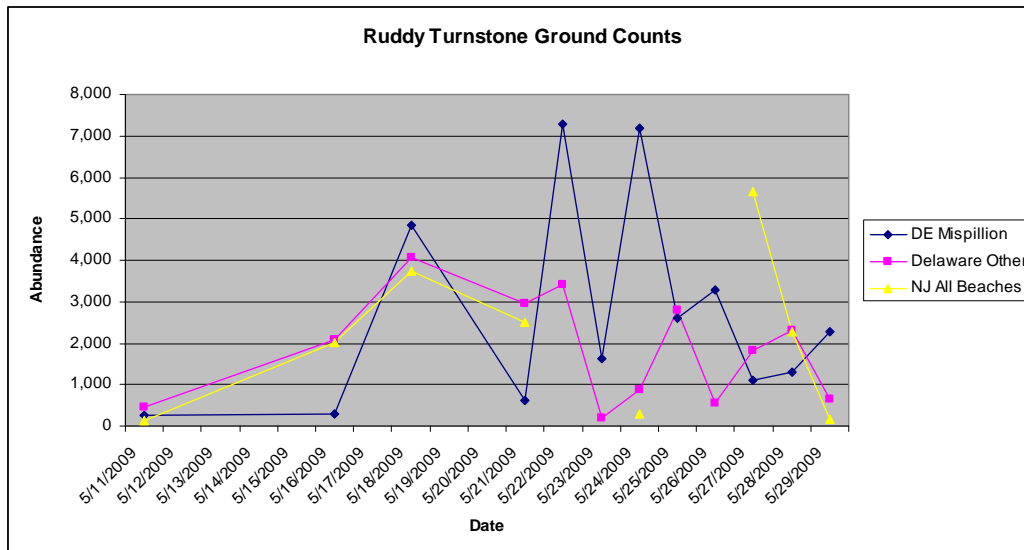


Figure 2. Ruddy turnstone ground counts, May 22-29, 2009.

- The most important measure of the success of the stopover on Delaware Bay is the proportion of red knots that reach threshold departure mass of 180 grams. Knots leaving the bay at ≥ 180 g have higher annual adult survival than birds departing at lower weight (Baker et al. 2004). This year ~35% of the red knots that came

to Delaware Bay reached the 180-g threshold weight. While this is an improvement from last year, the trend in mass gain is still significant and negative ($P < 0.001$; Fig. 3).

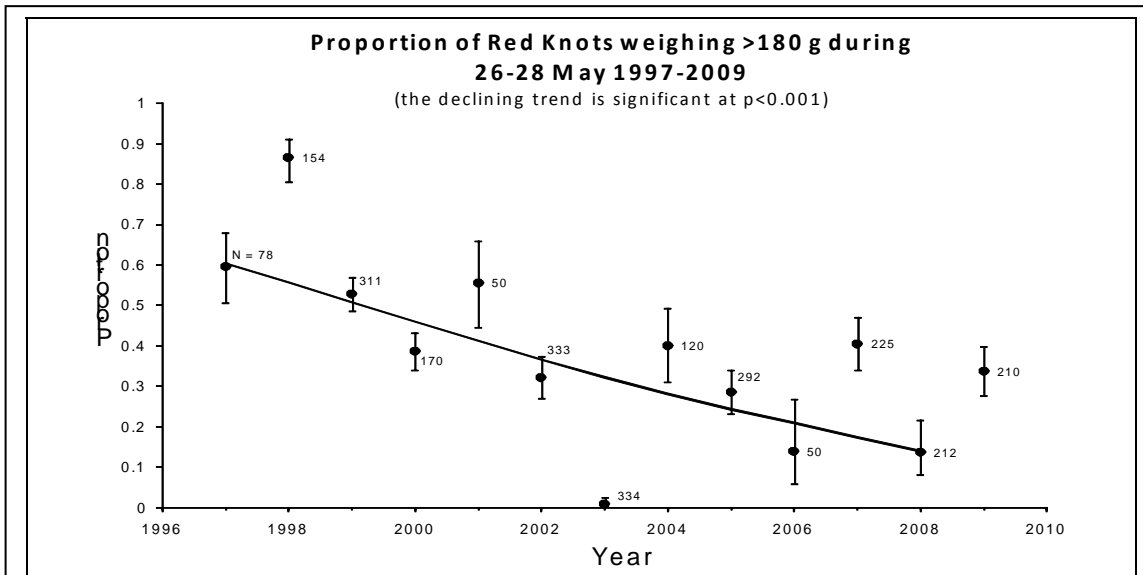


Figure 3. Proportion of Red knots reaching threshold departure weight on Delaware Bay, May 2009.

- A recent analysis of the proportion of ruddy turnstones and sanderlings during May 26-28, 1998-2008, has shown a similar decline in the ability to gain mass over time (Figures 4 and 5).

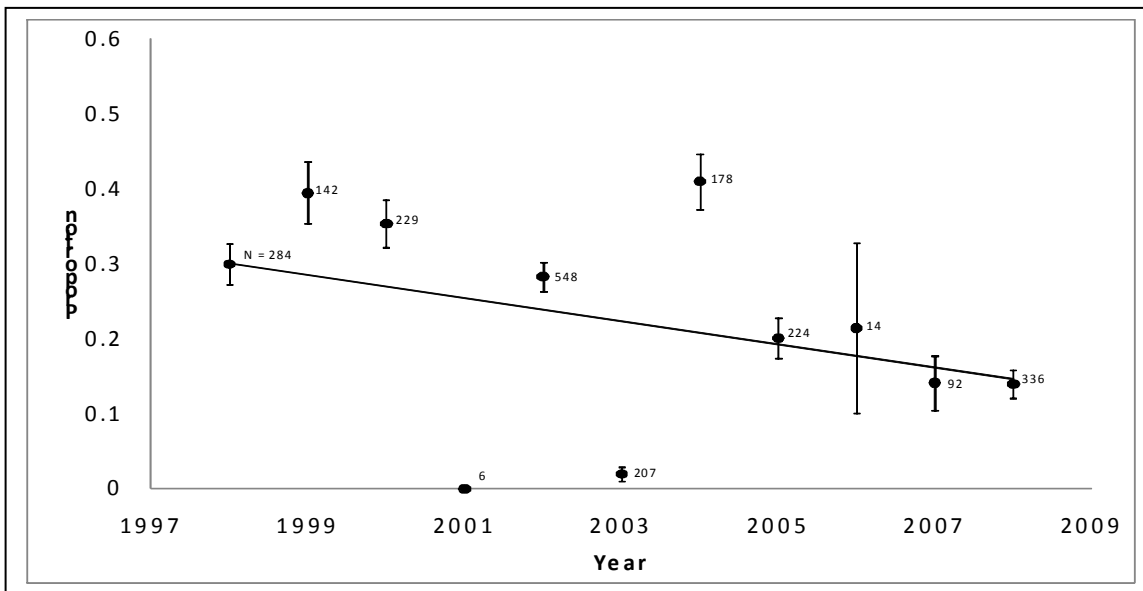


Figure 4. Proportion of Ruddy Turnstones weighing >155g during May 26-28, 1998-2008 (binary logistic regression: trend significant at $P < 0.01$).

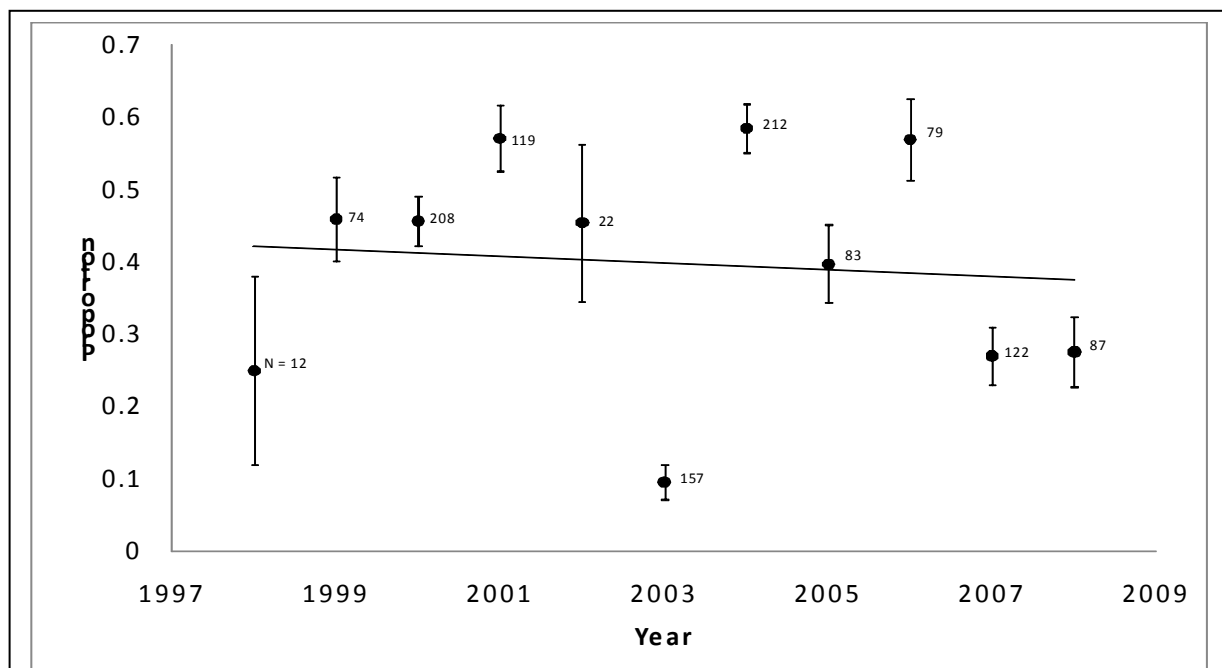


Figure 5. Proportion of Sanderlings weighing >80g during May 26-28, 1998-2008 (binary logistic regression: trend significant at $P < 0.01$).

- The viability of Delaware Bay remained impaired because of the continued low density of horseshoe crab eggs. While the mean egg density in 2009 did increase to 5,536 eggs per square meter, an improvement over the last three years, a sustained increase of eggs over 50% of spawning beaches will be necessary to begin and sustain the recovery of the red knot population and improve stopover conditions for other shorebird species (Figure 6).

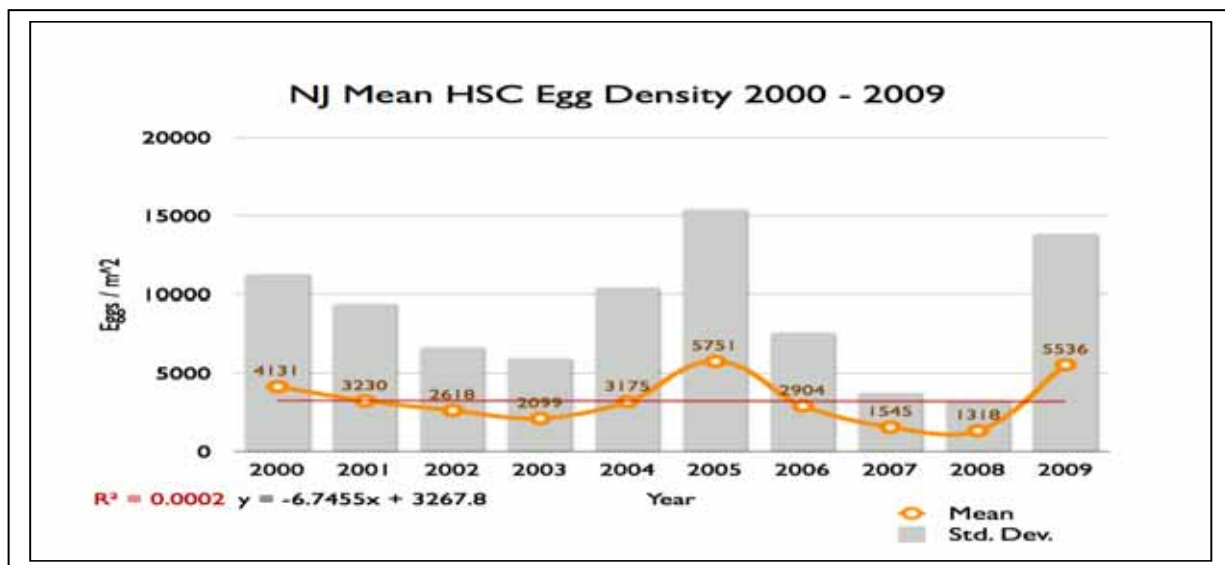


Figure 6. Horseshoe crab egg densities on the NJ shore of Delaware Bay 2000-2009 (from D. Hernandez, Richard Stockton College).

- New Jersey and Delaware Divisions of Fish and Wildlife continued to collect feather samples (small portion of 6th primary covert) for isotope analysis from all red knots captured. As primary coverts are replaced on wintering grounds, this analysis provides a means of identifying where individuals are wintering and the proportion of birds from those wintering populations passing through Delaware Bay.

- Intensive resightings efforts for red knot, ruddy turnstone and sanderling continued on both sides of Delaware Bay. A survival analysis using five years of resightings data for individually marked red knots will be undertaken by Dr. Allan Baker beginning in 2009.
- The NJ Division of Fish and Wildlife (DFW) and the Conserve Wildlife Foundation (CWF) biologists continued innovative management programs to improve conditions for knots and crabs.
 - Continuing since 2003, all important beaches on Delaware Bay were temporarily closed to human use to prevent the disturbance of feeding shorebirds. Beaches were closed for the period May 9-June 5, 2009.
 - Again in 2009, beach protection also covered three Atlantic coast areas: Stone Harbor Point, Champagne Island (Hereford Inlet) and Malibu Beach Wildlife Management Area.
 - NJ Endangered and Nongame Species Program (ENSP) did not conduct telemetry work on red knot movements in Delaware Bay. Recommendations cited in the NJ State Wildlife Grants Report (NJ T-1-4) have been integrated into the Western Hemisphere Shorebird Reserve Network (WHSRN) Red Knot Conservation Plan and the USFWS Red Knot Status Assessment. ENSP has taken on portions of these tasks and continued to work with WHSRN and other state and federal partners to encourage participation in necessary monitoring and protection.
- In 2009, a dredging project in Bidwell Creek provided material for replenishment of the northern half of Reeds Beach, an important horseshoe crab spawning and shorebird foraging beach on Delaware Bay. The restoration of Thompson's Beach, another important site, has been repeatedly delayed by permitting issues.
- The Red Knot Conservation Plan was released in August 2007 and is based on the USFWS Red Knot Status Assessment (Niles et al. 2007) and the US Shorebird Conservation Plan (Brown et al. 2000). The plan details research and monitoring needs for both the *rufa* and *roselaari* subspecies of the red knot. These documents are available at http://www.whsrn.org/sites/default/files/WHSRN-Red_Knot_Conservation_Plan_rv_08-10-30.pdf
- Meetings of the ASMFC joint shorebird and horseshoe crab technical committees were held on September 3-4, 2008, March 30, 2009, and September 2, 2009. The joint technical committees focused on the ongoing Adaptive Resource Modeling effort (see Key Findings, second bullet). The Atlantic Flyway Council (AFC) met in February and August of 2009; travel restrictions precluded NJ attendance in August. The nongame technical section of the AFC is currently limited to consideration of regulatory issues only. As such, the shorebird subcommittee has united with the Atlantic Coast Joint Venture to address migratory and wintering shorebird issues in the eastern US. This joint group is lead by Jon Staton, USFWS, and Brad Winn, Georgia Fish & Wildlife, and is currently working to identify key monitoring and conservation tasks in the Flyway.

Conclusions:

- The red knot population on Delaware Bay increased slightly in 2009 according to calibrated aerial surveys. The change in survey methods and addition of Mispillion Harbor led to more shorebirds being counted. The improved conditions in crab spawning this year (good weather and apparent increase in spawning activity) could have made the bay more attractive to red knots versus other years (see Table 3, East Coast Aerial Survey). However, the Delaware Bay and East Coast Survey have yet to be peer reviewed by all researchers involved in Delaware Bay, so results should be viewed as preliminary.
- Current egg densities (5,532 eggs/m²) are insufficient to support even a greatly-reduced migrant shorebird population and must be increased to a minimum of 50,000 eggs/m² on at least 50 percent of suitable spawning beaches to begin recovery of the stopover. Therefore, closure of crab harvest and/or significant coast-wide harvest reductions, particularly for crabs belonging to the Delaware Bay breeding population, are necessary to preserve breeding crabs and increase eggs on the beach.
- Other shorebirds, including the ruddy turnstone and sanderling have shown declining trends in mass gain similar to red knot.
- Analogous to red knot, semipalmated sandpipers have declined in the rate of mass gain while on Delaware Bay (D. Mizrahi, NJ Audubon Society, pers. comm.) recommendations include:
 - Recover and maintain Delaware Bay horseshoe crab egg densities at levels sufficient to sustain stopover populations of all shorebird species. Restoration targets from the Red Knot Status Assessment are: 50,000 horseshoe crab eggs/m² on 50% of suitable beaches and 100,000 red knots. In part this will be

supported by continuation of all current yearly studies on Delaware Bay of shorebird numbers, rate of mass gain, and horseshoe crab egg densities, as continuing inputs for models.

- Continue efforts to develop a system for annual determination of population status based on survey results, capture data and resightings of banded individuals in Delaware Bay and the Flyway.
- Develop annual estimates of productivity and juvenile survival as inputs for population models. Determine key southbound and northbound stopovers that account for at least 80% of stopover areas supporting at least 100 red knots and develop coast wide surveillance of birds as they migrate.
- Control disturbance at all major stopovers.

SOUTH AMERICAN AND US WINTERING/STOPOVER AREAS

Key Findings:

- The number of red knots in Tierra del Fuego declined from 17,211 in 2007 to 14,800 in 2008 and increased in 2009 to 17,800. This indicates the wintering population is apparently stable at a low number but has not yet shown signs of improvement.
- Work on a Hemisphere-wide system of protected areas is ongoing through the Western Hemisphere Shorebird Reserve Network at Manomet. This work requires collaboration with shorebird biologists throughout the hemisphere.
- Site assessments for Delaware Bay and Stone Harbor Point, New Jersey were not completed in 2009. The USFWS will conduct a site assessment of the Edwin B. Forsythe National Wildlife Refuge in late 2009/early 2010. As of this writing, it does not appear that site assessments have been completed for any of the sites listed in the Red Knot Conservation Plan.
- Florida Division of Fish and Wildlife has developed a monitoring program for red knots that will inform management plans to protect wintering sites. Federal environmental agencies in Punta Arenas, Chile, have expressed interest in developing a management plan for Bahia Lomas – a major wintering site for red knots and Hudsonian godwits. It continues to be difficult to locate and collaborate with shorebird biologists in Maranhao, Brazil.

ARCTIC BREEDING AREAS

Key Findings:

- Breeding density survey of Southampton Island, Nunavut, was not repeated in 2009 due to lack of funding. Moreover, the study should be redesigned to include nest and fledging success.
- It remains extremely difficult to quantify juvenile survival for red knots. As migration of adults and juveniles are staggered and some proportion of juveniles may not winter with adults, it is still unclear how to develop survival estimates. Resightings of marked juveniles may offer the only statistically robust method but requires significant effort over a large geographic area (i.e., the entire flyway).
- We did not identify the top ten breeding areas in Canada in 2009; other tasks took priority.

Conclusions:

- Bahia Lomas remains the most important wintering site for red knots in the Western Hemisphere.
- The greatest threat to the Tierra del Fuego population is declining horseshoe crab egg resources on Delaware Bay. The Chilean government is willing to increase protection on Bahia Lomas with the professional and monetary assistance from groups in the US.
- The west coast of Florida is the most important wintering area for the *rufa* red knot in the US but the least well-studied of the three wintering populations. The Florida wintering population has likely suffered declines because of habitat loss, disturbance and reduced food resources.
- The status of the northern Brazil wintering population is believed to be stable; however, systematic surveys are required.
- Application of the WHSRN Site Assessment Tool and development of management plans for important sites will require funding and survey effort by government agencies and non-government organizations. Moreover, greater federal agency participation and support would help states develop better regional monitoring and protection systems for shorebirds.

Recommendations:

SOUTH AMERICAN AND US WINTERING/STOPOVER AREAS

- In cooperation with regional and state biologists, determine the genetic and breeding status of the three main wintering populations (Tierra del Fuego, Maranhao and Florida).
- In cooperation with regional and state biologists, create a hemisphere-wide system of protected areas for each significant wintering, stopover and breeding area.
- By 2009, in cooperation with WHSRN, complete site assessments, using WHSRN site assessment tools, for Bahia Lomas, Rio Grande, San Antonio Oeste, Lagoa do Piexe, Maranhao, the west coast of Florida, the Altamaha Region of Georgia, the Virginia Barrier Islands, Delaware Bay, Stone Harbor Point, James Bay, Southampton Island and King William Island.
- In cooperation with regional and state biologists, delineate and propose protection measures for key habitats within the main wintering areas of Maranhao, Tierra del Fuego and Florida, and develop management plans to guide protection.

Recommendations:

ARCTIC BREEDING AREAS

- Collaborate with US and Canadian researchers to develop an estimate of red knot juvenile survival (hatching to fledging).
- In cooperation with regional and provincial biologists, identify all important breeding locations in Canada and recommend protection needs for the top ten sites.

JOB 1G: 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:

- In 2009 the New Jersey peregrine falcon population increased to 24 known pairs (Figure 1). The increase was driven by bridges that were newly occupied or newly discovered. The peregrines on the Walt Whitman Bridge moved back into NJ from PA, and peregrines at two north Jersey sites (Rt. 3/Hackensack and the Newark Bay Bridge) were found mid-season with young. One site on the coast (Margate) was not occupied this year, but one new building site was discovered in Woodbridge. Four occupied territories were documented in cliff habitats.
- All 24 occupied sites checked during the nesting season were known or suspected to be active (with eggs) (Table 1). Fourteen pairs on towers and buildings continued to be the core of the nesting population, producing 25 young, for a productivity rate of 1.79 young per active nest. Six pairs on bridges produced approximately 12 young, for a rate of 2.00 young/active nest. Some previously occupied bridges (e.g., Trenton) were not tracked. Four nest territories were occupied at the natural cliff habitat in northeastern NJ, which is a return to 2007 level, but none of the four nesting pairs were known to produce any young this year.
- Occupancy and nest success data were provided to the U.S. Fish and Wildlife Service in accordance with the Post-Delisting Monitoring Plan for the peregrine falcon.
- Statewide, 14 pairs nested on towers and buildings, six on NJ bridges, and four on cliffs. Of 14 pairs on coastal structures and buildings, 11 nested successfully, producing 27 young for a rate of 1.93 young per active nest on towers and buildings. This is close to the average of 1.80 recorded since 1986 when the population stabilized. New Jersey monitored four pairs on bridges spanning the NJ-PA border. Pairs on the Betsy Ross and Walt Whitman bridges raised three and two young, respectively; pairs at Burlington-Bristol and Tacony-Palmyra bridges produced three and one young, respectively. Nests were newly discovered on two bridges in northern NJ: at the Route 3 Bridge over the Hackensack, two young were observed when they were about three weeks old. A railroad bridge over Newark Bay hosted peregrines that successfully fledged

at least one young, observed in June. Other bridges may have been occupied in 2009, but the program lacked monitors in northern NJ to document all possible sites.

- The peregrines on the natural cliff habitat increased back to four documented pairs, similar to recent years. Only one territory, furthest south on the cliffs, remained unoccupied; we suspect this pair now nests on the George Washington Bridge. Despite regular monitoring, no successful nesting was observed at the four nest sites. Unlike previous years, there were no major easterly or northeasterly storms that would account for this complete failure at the cliffs. As noted in previous reports, the north-south orientation of the cliffs makes the cliff population vulnerable to easterly storms, which are damaging to peregrine eggs or young nestlings.
- For a fourth year, NJ donated peregrine nestlings to the New River Gorge hack site in West Virginia. A total of five young (two from a building and three from bridges) were delivered to and hacked at the New River Gorge hack site near Beckley. Moving young from the coastal population, where production is well above the minimum needed for population stability, supports the recovery of the peregrine in the southern Appalachian mountains where nesting is still lacking.
- We banded all but four of the 39 young produced at 17 nests, using both a federal band and a bicolor band with an alpha-numeric code. One young fledged before banding, and three young on two bridges could not be accessed for banding.
- Staff collected five addled eggs from three sites for future analysis. The study of contaminants in mid-Atlantic eggs was published in the journal *Environmental Contamination and Toxicology* (Clark et al. 2009). Coastal-NJ eggs were of special concern with regard to elevated levels of PCBs and DDT compounds, and warrant continued study. One adult carcass recovered in Atlantic City was necropsied, and brain and liver tissues were archived for future contaminant analysis.
- In 2009 we continued to use remote, motion-activated cameras to photograph peregrines at nests. Using this method we read the legbands on 20 breeding adults at ten nest sites. An additional five birds were identified using optics. 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.
- All nest sites were maintained during the non-nesting season. New predator guards were installed on three towers, and repairs were made to guards on the others. One new nest box was installed at the Jersey City site.
- All new sites were added to the Biotics database, along with an updated record of existing sites.

Conclusions:

- While the peregrine population increased slightly in 2009, nest success and productivity were lower than normal (Figure 1). Nest success was slightly low at 61% and 1.50 young/active site of non-bridge sites (towers, buildings and cliffs); nest success was closer to normal at 79% and 1.9 young/active site when the cliffs were excluded. Across all sites (including bridges), 24 sites (17 successful) fledged 39 young, for a rate of 1.6 young/active site. The decline in nest success and productivity was due in part to losses of young hatchlings to parasitic flies (family *Carnidae*) at some coastal sites. In addition, the lack of nest success at the four cliff territories was disheartening, and we could not attribute those failures to specific weather events that caused past losses.
- 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.

Recommendations:

- Continue to monitor the peregrine falcon nesting population to maintain the database of nest site occupancy and nest success. The variability in nest site occupancy at natural cliff sites raises questions about the ultimate full recovery of the peregrine population in the state.
- 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. New research suggests the high levels of brominated fire-retardant chemicals (polybrominated diphenyl ethers) found in peregrines may affect adult peregrine nesting behavior and nest success, which certainly bears watching in NJ.
- Take measures 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.

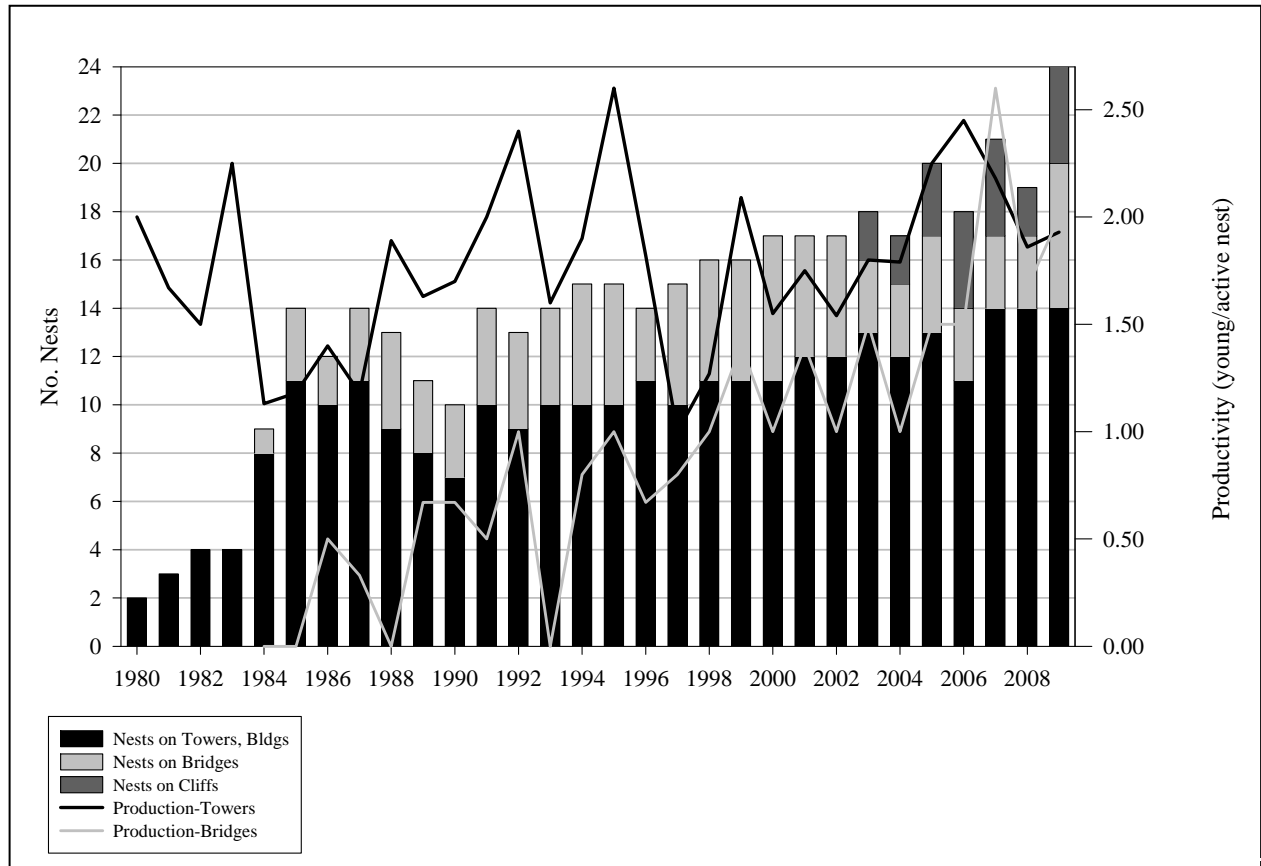


Figure 1. Nesting and productivity of peregrine falcons in New Jersey, with comparisons between towers/buildings, cliffs, and bridges.

Table 1. Site-specific results of peregrine falcon nesting in New Jersey, 2009.

Name	Occupied	Active	Eggs	Yng Hatched	Yng@ BandAge	Yng Fledged	Comments
Sedge Island WMA Tower	Y	Y	4	≥3	1	1	Parasitic fly problem
Forsythe NWR/Brigantine Tower	Y	Y	4	≥2	1	1	Parasitic fly problem ¹
Forsythe NWR/Barnegat Tower	Y	Y	3	≥1	1	1	
Marmora WMA / Sea Isle Tower	Y	Y	4	≥3	0	0	Parasitic fly problem ¹
Great Bay WMA/ water tower	single	N					
Heislerville WMA Tower	Y	Y	4	0	0	0	Lost eggs sequentially, intruder?
Egg Island WMA Tower	Y	Y	4	4	4	4	Late nest
Swan Bay WMA Tower	Y	Y	4	4	4	4	
Tuckahoe WMA Tower	Y	Y	3	≥1	1	1	
Ocean Gate (AT&T) Tower	Y	Y	4	1	1	1	Coll 3 eggs
Stone Harbor marsh	Y	Y	4	≥3	2	2	
Margate marsh	N	N					
Hilton/The Grand Casino	Y	Y	4	3	3	3	2 to WV; coll 1 egg
101 Hudson, Jersey City	Y	Y	4	3	3	2	1 died at fledging
Newark -Broad St bldg.	U	U					
Elizabeth-Union Co. Court House	Y	Y	4	4	4	4	
Sewaren building	Y	Y	≥3	0	0	0	Laid 2 clutches, 1 egg coll.
<i>SUBTOTAL TOWERS & BUILDINGS</i>	14	14			25	24	
Natural Site C-1 (Alpine)	Y	Y	?	?	0	0	
Natural Site C-2 (South)	Y	Y	?	?	0	0	
Natural Site C-3 (South)	N	N	0				
Natural Site C-4 (North)	Y	Y	?	?	0	0	
Natural Site C-5 (Tenafly)	Y	Y	?	?	0	0	
SUBTOTAL NATURAL SITES	4	4			0	0	
G. Washington Br. (Hudson River)	Y	Y	?	?	2	2	NY side
Betsy Ross Br. (Delaware River)	Y	Y	4	3	3	3	1 to WV
Walt Whitman Br. (Delaware River)	Y	Y	4	2	2	2	2 to WV (>fledging)
Ben Franklin Br. (Delaware River)	Y	Y	?	≥3	3	3	PA
NJ-PA Turnpike (Delaware River)	Y	Y	4	4	4	4	PA
Tacony-Palmyra (Delaware River)	Y	Y	3	1	1	1	
Burlington-Bristol (Delaware River)	Y	Y	3	3	3	2	1 died at fledging
Brigantine Bridge (A.C.)	N	N					
Vince Lombardi - NJTP Bridge	U	U					
Secaucus-Kearny NJTP Bridge	U	U					
Newark Bay Br. (NJTP or Conrail)	Y	Y	?	≥1	≥1	1	Conrail bridge
Trenton RR Bridge	U	U					
Route 3 Bridge/Hackensack (NJDOT)	Y	Y	?	≥2	2	2	Discovered '09
<i>SUBTOTAL BRIDGES</i>	6 (NJ)	6			≥12	11	
TOTALS (NJ only)	24	24			≥37	35	(5 yng to WV)

¹ Identified as Carnidae (*Carnus hemapterus*)

JOB 1H: Grassland Birds

Project leader: Kim Korth, Senior Zoologist

OBJECTIVE 1: To develop long-term population monitoring and distribution approaches, particularly on grasslands enrolled in incentive programs, for endangered, threatened, and special concern grassland-nesting birds: grasshopper sparrow (*Ammodramus savannarum*), vesper sparrow (*Pooecetes gramineus*), bobolink (*Dolichonyx oryzivorus*), Henslow's sparrow (*Ammodramus henslowii*), savannah sparrow (*Passerculus sandwichensis*), upland sandpiper (*Bartramia longicauda*), horned lark (*Eremophila alpestris*), eastern meadowlark (*Sturnella magna*) and northern harrier (*Circus cyaneus*).

OBJECTIVE 2: To continue to expand properties managed for grassland birds via incentive programs and create, evaluate and modify management techniques for grassland bird species (see above for list of species).

OBJECTIVE 3: Create predictive models using landscape variables related to grassland bird species presence to identify areas to target management for specific grassland bird species (see above list of species).

Key Findings:

- NJ Audubon Society (NJAS) has been contracted since 2005 to use trained Citizen Scientists to conduct bird surveys on managed grassland habitats across New Jersey as part of ENSP's effort to evaluate management techniques on grassland bird populations.
- ENSP biologists, NJAS staff and volunteers performed two fixed-radius point count bird surveys per survey location to record the numbers of breeding target grassland species. All observations were recorded and mapped.
 - Bird Survey I (May 15 to May 31, 2009)
 - Bird Survey II (June 1 to June 15, 2009)
- During each of the two grassland bird surveys, staff and volunteers also conducted a general habitat assessment at each point location which included overall habitat category (upland or wetland), habitat class (e.g. fallow field, row crop, meadow, sod) and average vegetation height.
- A total of 475 grassland bird survey points were assigned in the 2009 breeding season, including unmanaged roadside control points and managed Landowner Incentive Program (LIP), Wildlife Habitat Incentive Program (WHIP), Wildlife Management Areas (WMA), landfill and additional managed grasslands within the Raritan-Piedmont Wildlife Habitat Partnership (RPWHP). One LIP site (2 survey points) was not assigned in 2009.
 - Assigned sites and points included:
 - Roadside control – 28 routes/199 points
 - LIP managed – 63 sites/160 points
 - WHIP managed – 9 sites/19 points
 - WMA managed – 4 sites/15 points
 - Landfill managed – 5 sites/11 points
 - RPWHP managed – 13 sites/71 points
- Grassland bird survey data from the 2005 – 2008 field seasons were standardized and all but the 2008 data have been entered into the NJ DEP's Biotics (Biotics) database in completion. Staff continue to enter the 2008 data into the Biotics database.
- Approximately 90% of the 2009 grassland bird data have been submitted to ENSP; we expect all the data by year's end and will subsequently be entered in the Biotics database.
- Habitat and management data on all Landowner Incentive Program (LIP) sites were standardized using ARC GIS; management treatments were digitized and standardized for each grassland site.
 - The standardization will allow us to use these data in our predictive modeling and evaluation analysis as well as to assess the threat of habitat loss/conversion, agricultural practices, prescribed burns, and fragmentation (area sensitivity) using habitat information gathered and changes in Land Use/Land Cover over time.

- The evaluation of the effectiveness of management techniques was not completed because problems (standardization between years) with the dataset needed to be addressed.
- ENSP staff and volunteers collected microhabitat data on a sample of five LIP sites (ten survey locations) that were completing their contract period. Surveyors used M² quadrats to estimate percent cover: grass type (warm season grass, cool season grass), forbs, woody, litter, open space, standing dead, bare ground, or moss. The dominant grass species was identified. Weins Pole technique was used to estimate stand height and density at each M² quadrat; used Robel Pole technique to estimate total biomass at each M² quadrat.
 - Collected data will help inform a predictive model by describing stand age and structure at a microhabitat level.
- The predictive habitat model was not completed because problems with the database needed to be addressed. Landscape variables were calculated and a list of other covariates for the model was created, so the model can be completed once the database is reformatted. Because the model was not completed, we were unable to use the model to identify areas of suitable habitat, create species-specific management plans or evaluate the model.
- The best management practices (BMPs) for target grassland species were not completed; however, a statistician is currently analyzing the microhabitat data. The results of the analyses will be the basis of the BMPs.
- Threat assessment was not addressed because the 2007 Land use–land cover data have not been released for the state of New Jersey.
- Two biologists attended the Northeast Coordinated Bird Monitoring (NE CBM) meeting September 22-25, 2008, in Cape May, NJ. No grassland working group meetings were held since then.

Conclusions:

- The use of Citizen Scientists for grassland bird surveys continues to be an efficient method to collect data.
- Due to the need for people skilled in plant identification it will likely be necessary to hire trained surveyors to conduct the microhabitat data. It also quickly became apparent in the field that our current protocol is too time consuming and must be scaled back; working with the preliminary data, a statistician should be able to consolidate some of the variables we are currently using. The statistician will also be able to help us identify minimum sample size required to collect the proper microhabitat data on a landscape scale to ensure minimal cost and labor required to perform the research since there is not enough time to conduct microhabitat surveys at all bird survey points.
- The microhabitat pilot study was used to devise proper microhabitat data collection techniques and will help inform necessary methods for a larger study at a future date.

Recommendations:

- Continue to conduct two replicates of point count surveys for target grassland bird species at each site where management techniques are to be evaluated and its paired control using Citizen Scientists.
- Work with a statistician to develop microhabitat variables that we can effectively and efficiently collect at target sites. Determine the minimum sample size required to collect the proper microhabitat data and ensure all management practices are adequately represented.
- Continue working on BMPs based on survey and habitat data (see above) for each endangered, threatened and special concern grassland bird species
- Evaluate the effectiveness of management techniques (delayed mowing, burning, WSG, CSG, etc.) on LIP and other sites actively managed for grassland birds using control and pre- and post- treatment surveys.
- Continue to create and validate a predictive habitat model using landscape variables (# total acres, core area, proximity to other open habitat, etc.) for one endangered or threatened grassland bird species and establish a protocol for developing habitat models for the remaining endangered, threatened and special concern grassland bird species.

- Use the predictive GIS model to identify areas of suitable and potentially suitable habitat where preserved farmlands and incentive programs for private landowners could improve quality and quantity of habitat for grassland bird species.
- Create species-specific management plans for each property actively managed for endangered, threatened and special concern grassland birds (LIP, WHIP, state lands, etc.) based upon the results of a predictive model.
- Evaluate and modify the predictive model as new data become available.
- Continue participating in NE CBM Grassland Working Group meetings.

JOB 1J: Raptors

Project co-leaders: Kathleen Clark, Supervising Zoologist and Kris Schantz, Principal Zoologist

OBJECTIVE 1: To inventory and monitor state-listed woodland raptor populations and their habitat, and determine population trends in relation to available habitat. To develop forest management practice guidelines and informational vehicles that help reverse the declines of the state-endangered northern goshawk (*Accipiter gentiles*) and red-shouldered hawk (*Buteo lineatus*), and the state-threatened Cooper's hawk (*Accipiter cooperii*) and barred owl (*Strix varia*).

OBJECTIVE 2: To determine the distribution of owls throughout NJ including the listed short-eared owl (*Asio flammeus*), long-eared owl (*Asio otus*), and barred owl (*Strix varia*), special concern status common barn owl (*Tyto alba*), and other inhabitants including the great horned owl (*Bubo virginianus*), eastern screech owl (*Megascops asio*), and the northern saw-whet owl (*Aegolius acadicus*); and develop baseline data for long-term monitoring of owl populations, distribution, and habitat selection.

OBJECTIVE 3: To determine home range and broader habitat usage by barred owls within NJ, specifically targeting the differences between northern and southern residents.

Objective 1: Woodland Raptors

Key Findings:

- Staff worked to compile survey data from 1986 – 2006 into a single, standardized database.
 - Southern region data compilation was completed. Survey routes and stations were compiled, collated and renumbered (where appropriate) for clarification for future potential surveys.
 - Route 6 (Belleplain): 1987 survey data has only had two survey station identification numbers that overlapped between the hard copy survey data and the digital database. Additionally, there were no identification numbers on the 1987 maps that would enable us to determine if the findings at those stations were actually the same survey stations or if the ID numbers had been moved.
 - Route 8 (Tuckahoe): According to the hard copy survey data, survey station identification numbers ranged from 166-1 through 166-10 (i.e., 166-1, 166-2...) including new points added in 1988-89, 2002 and 2006. The survey stations labeled 166-1 and 166-10 have been identified as “newer” 1988-89 points but there is no indication of where the original points had been located. At this time, since one barred owl was located in 1987 at the 1987 station numbered 166-10, we’ve included it in the database that references the “166-10 1988/89” location with the assumption that the original station was close by.
 - Route 7 (Cedar Swamp): The digital GIS file shows the same route that was used in 1988-89 and later but this route does not match the hardcopy map used from 1987. Since there were no identification numbers on the 1987 map, we could not determine point identity prior to the rearrangement in 1988, nor the reasons for the changes. There were a total of seven barred owls observed at five of the ten survey locations in 1987, but this information will be excluded from analysis due to lack of information.
 - Northern region data compilation was not yet completed. Survey routes and stations continued to be compiled, collated and will be renumbered (where necessary for clarification for future potential surveys).

- Of the 25 routes surveyed in 2006, all of the routes had been altered to some extent or added in their entirety between the 1986, 1988, 2001-2002 and 2006 surveys, generally due to development or other major habitat changes.
- Trend analysis has not been conducted as data compilation is not complete and consequently, survey techniques were not evaluated.
- ENSP continued to solicit observations from the public and conservation partners to populate the Biotics database.
 - Conservation partners, such as the NJ Audubon Society, encouraged their volunteers and constituents to report observations through one-on-one contact (e.g., e-mail, telephone, group programs).
- No volunteers were recruited to conduct site visits at historic locations to confirm continued owl presence.

Conclusions:

- Data compilation has proven complicated, as surveyors and survey leaders have changed from the late 1980's to the present. While general survey methods (call-playback surveys at stations along routes) were consistent, the means of addressing eliminated or altered survey stations varied. This variation has included the addition, alteration and/or reuse of identification numbers and survey stations (in some cases, entire routes) as well as inconsistency when describing why an alteration was made. This has created confusion as we have moved to compile the data into a single database.
 - Future surveys, if continued, should include clear and consistent instructions to address survey stations in unsuitable habitats and numbering formats for added or altered survey stations.
 - Hard copy data (maps and survey sheets) must be consistent with digital files, including all pertinent information such as current survey points and any new/altered locations (supplied by surveyors).

Recommendations:

- ENSP must complete data compilation of all the available data.
 - Once data compilation is complete, ENSP must develop digital files identifying Land Use/Land Cover over time in relation to the survey periods and stations.
 - Completed files containing survey periods, routes, observations and Land Use/Land Cover over time must be analyzed to identify potential population trends of woodland raptor populations and the relationship to the land use/ land cover.
- Once analysis is completed, ENSP staff must review the findings and evaluate the goals for future surveys and/or the need to revise survey methods.
- ENSP will continue to solicit observations from the public and partners in conservation to populate the Biotics database.

Objective 2: Owl Distribution

Key Findings:

- Although identifying owl distribution was identified as an objective of this job, the 2008-2009 SWG proposal eliminated the necessary work to achieve this objective due to limited resources.

Conclusions:

- This was not considered a priority given our limited resources.

Recommendations:

- Should additional resources become available, ENSP should re-examine this objective to evaluate its necessity and ultimately, how the information will assist in the conservation of species of greatest conservation need.

Objective 3: Barred Owl, Home Range Study

Key Findings:

- This part of the job was not initiated or completed. Staff evaluated our approach, specifically whether it would be more feasible to employ a graduate student at Rutgers or another state university, versus assigning it to staff biologists. We discussed the project with Rutgers University professors but we have not yet made a decision. The funding needed to support a graduate student is more than the grant allowed in this segment, so we needed more time to find additional funding or obtain more university support for a student.

Conclusions:

- This project remains one that is needed for ENSP to develop informed conservation plans for the state's barred owl populations in northern and southern NJ.

Recommendations:

- Develop the necessary support for a graduate assistantship or an advanced internship to carry out this project.

JOB 1L: American Kestrel

Project co-leaders: Peter Winkler, GIS Specialist and Kim Korth, Senior Zoologist

OBJECTIVE: To halt and reverse the decline of the proposed to be listed American kestrel through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection, management, research, education and environmental review.

Key findings:

- Suitable sites for American kestrels were identified by using a GIS predictive model based on the NJ Department of Environmental Protection's 2002 Level III Land Use/Land Cover data layer (LU/LC) and kestrel occupancy data from Dr. Smallwood of Montclair State University. Areas of contiguous kestrel habitat were divided into three patch sizes: 0-250 hectares, 250-1000 hectares, and >1000 hectares.
- Since 2006, over 275 nest boxes were placed in suitable habitat as identified by the GIS predictive model. ENSP did not reach its goal of 400 boxes due to lack of landowner cooperation to hang boxes in suitable locations and lack of suitable locations where we did have landowner cooperation. Boxes were concentrated in three major study areas identified as Clinton, Amwell Valley and Assunpink (244 nest boxes); some boxes were placed outside of the three study areas (31 nest boxes).
- For the 2009 season, ENSP decided to monitor a subset (176) of the existing 275 boxes. This decision was made due to the fact that kestrel use of boxes in the smallest patch size was limited in the previous three seasons. In addition, some boxes while located in a suitable patch, the actual box location was not optimal and several boxes were not monitored due to a loss of volunteers, lack of landowner cooperation or nest box failure (box broke or the structure the box was attached to fell down). A total of 176 nest boxes were monitored once every 12-15 days from April through August 2009. Of those 176 nest boxes, 54 (31%) were occupied by American kestrels. Thirty three (61%) kestrel-occupied boxes resulted in failed nesting by kestrels, while 21 (39%) were successful.
- Nest boxes placed in the top two patch categories accounted for the majority of active nest boxes throughout the four-year study.

Study Year	Percentage of Active Nest Boxes in patches >250 ha
2006	84%
2007	82%
2008	78%
2009	86%

- A total of 67 kestrels were newly banded: 58 young (32 females, 26 males) and nine adults (six females, three males) at 30 nest boxes.
 - Six additional adults were recaptures; two were females that were banded by ENSP as adults in 2008. One returned to nest in the same nest box and the other returned to the same area to nest in a different nest box.
- Fifteen failed/addled eggs were collected at ten different nest boxes.
- A total of eight volunteers checked 50 nest boxes while staff monitored 126 boxes.
- All data collected were entered online through a Google documents online interface.
- All banding data are being supplied to USFWS. USFWS will supply ENSP with recovery information that we can use to develop a better understanding of population dynamics.
- ENSP created a pilot call play-back survey protocol for American kestrels. This survey protocol will be tested in the field next breeding season (2010).
- No funding was established for investigating failed nesting attempts or loss of migration habitat, due to staff focus on higher priorities.
- Investigations were made into a radio telemetry study however the cost was prohibitive at this time.

Conclusions:

- Nest box placement has been successful; we have determined the patch size to prioritize 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 next box program.
- Banding chicks and adults provides good baseline data. These data may fill in data gaps of dispersal.
- ENSP monitored fewer nest boxes but maintained the total number of breeding pairs by concentrating on the most productive areas identified in previous years. This focus allowed us to maximize staff and volunteer time and the number of pairs monitored.

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.
- Remove unproductive nest boxes in unsuitable habitat and relocate to locations in the largest patch size and on properties that are permanently protected from development to maximize use by kestrels;
- Continue to evaluate effectiveness of nest box program (to kestrel reproductive success).
- Recruit and train a group of dedicated Citizen Scientist volunteers to monitor nest box activity throughout the breeding season.
- Develop survey protocols to determine habitat use by kestrels to be used in environmental review process.
- Develop kestrel patch model using updated NJDEP Land Use Land Cover (2007) and compare kestrel patch statistics to previous years (1995 and 2002).

JOB 1M: Secretive Marsh Birds

Project co-leaders: Christina Kisiel, Senior Environmental Specialist and Robert Somes, Assistant Zoologist

OBJECTIVE: Develop and implement a monitoring program for secretive marsh birds.

Key Findings:

- The Landscape Project (Landscape) was used as a starting point to determine where survey routes should be located within the Highlands Region. The paucity of secretive marsh bird models in

Landscape meant that there was not enough information to inform an approach based solely on prior sightings. A habitat model was created and updated with 2008 data from Landscape and used in conjunction with extensive advice from local birders highly experienced with secretive marsh bird species. The methods utilized so far in this survey have worked well, and outside of minor changes in how we target survey locations (trying to target more remote areas) there has been no need for any revisions.

- Although the NJ Highlands are defined by political boundaries, covering the entire range of this area was not a realistic goal with ENSP's limited staffing resources. Due to this limitation, this survey focused on areas that were deemed to represent suitable habitat for secretive marsh birds based on an examination of NJ Department of Environmental Protection 2002 Level III Land Use/ Land Cover data (LU/LC) overlaid on aerial photographs and soliciting information from local birders.
- Twelve routes were created throughout the Highlands Region. Each route had 9-12 survey points, located a minimum of 0.25 miles apart. Most of these routes and survey points were determined through a combination of GIS mapping and consults with local birders who had knowledge of where secretive marsh birds were likely to occur.
- These routes were a combination of seven repeated survey routes from 2008 and five new routes. The new routes were chosen to cover areas that had been left out during previous surveys, had poor access, or lacked secretive marsh bird data.
 - Volunteers surveyed five of the twelve routes.
 - Volunteers were recruited through a number of sources, including list serves and e-mail solicitations to the Division of Fish and Wildlife's Wildlife Conservation Corps.
 - The same small, core group of four volunteers was utilized from the previous year's survey to improve replication of sites that were to be repeated during the 2009 season.
 - Two ENSP biologists surveyed seven of the twelve routes.
- A one-day training session was conducted to review the protocol with volunteers, carry out distance estimation exercises, and to distribute datasheets and equipment to the volunteers.
- Surveyors followed the Conway protocol (Conway 2005), the standard recommended in the Coordinated Bird Monitoring protocols, which requires passive listening as well as call-back portions of the survey. Conway supplied digital files of the focal species' calls. The equipment that was available for this survey included compact disc players and MP3 players. The files were downloaded to the appropriate media with no problems, although the MP3 players performed slightly better than the compact disc players. Calls were amplified using speaker boxes at a decibel level of 90 decibels at one meter in front of the speaker.
- This year's survey yielded extensive results. For all 12 routes, 32 points out of 118 had positive responses from secretive marsh bird species. These 32 points had 78 responses from the following species: Virginia Rails (54 individuals), Sora Rails (8), American Bitterns (1), and Common Moorhens (10). There were no responses from Least Bitterns, King Rails, Clapper Rails, or Black Rails.
- This year's surveys targeted several areas of wetlands not owned by the public. The survey results will serve to protect vulnerable wetland habitat through our Landscape Project by valuing areas that previously had no secretive marsh bird occurrences.
- Expansion of the project in central and southern New Jersey (the Atlantic Coastal Landscape and the Delaware Bay Landscape) was accomplished on only a limited basis by two routes that were run in southern New Jersey. Surveys in most of these areas will require a greater time and equipment (watercraft) commitment due to the presence of large inaccessible marshes when compared to the Highlands Region. Equipment shortages and lack of personnel limited the effort and will present a future problem.
- A trial effort to conduct the survey in conjunction with the statewide Breeding Waterfowl Survey was unsuccessful. Two problems prevented this from working. First, there were seasonal timing differences that rendered the two surveys incompatible. Second, the Breeding Waterfowl Survey had also been charged with incorporating a resident Canada Goose survey into their research, which increased the work load and limited the amount of time that could be committed to the Secretive Marsh Bird Survey. The two survey efforts have been meshed through a Coordinated Bird Monitoring

protocol during which non-waterfowl species are recorded during the Breeding Waterfowl Survey. This does not follow our specific survey guidelines for secretive marsh birds, but does provide additional data on the distribution of these species.

- Coordination of data sharing with the New Jersey Audubon Society has been unsuccessful due to difficulties in developing a data sharing agreement.
- Due to limited staff time and resources we were unable to adjust the survey to better target Black Rails.

Conclusions:

- A large area of previously unsurveyed habitat was surveyed during this season and led to some of the highest numbers of responses from target species.
- The cool, slow start to spring caused many birds to arrive later in the season and may have led to an apparent decrease in observations in previously surveyed locations. Poor weather also limited the number of days that could be committed to the survey effort. However, a full analysis that links results to survey effort must be completed to evaluate all factors.

Recommendations:

- Continue creating new routes in suitable and unsurveyed habitats; they may be harder to access, but could be more likely to garner responses from the focal species. Continue to use an integrated approach based on knowledge from local birders and GIS tools to create future routes.
- Continue recruitment and ensure retention of highly skilled volunteers.
- Utilize this year's results to refine the habitat model used to select survey locations and reduce the number of sites surveyed that lack suitable habitat.
- Work to expand the survey in central and southern New Jersey.

JOB 2: Species of Special Concern

OBJECTIVE: To conserve populations of birds having Special Concern status in New Jersey, and prevent declines that would necessitate listing through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review.

JOB 2B: Scrub-shrub/Open Field Passerines

Project leader: Sharon Petzinger, Senior Zoologist

OBJECTIVE: To stabilize and reverse the decline in scrub-shrub/open-field nesting birds of special concern and regional priority, both those that migrate through New Jersey and, in particular, those that breed in NJ. Goals include: inventorying and monitoring species populations, (specifically those not covered by the Breeding Bird Survey), the identification and preservation of critical habitat, the identification of specific threats at these sites, and the provision of guidance/recommendations to land managers and landowners. In 2008-09: To determine the characteristics of source habitat for golden-winged warblers occupying utility ROWs in New Jersey as well as golden-winged warbler (GWWA) response to certain management techniques used by the utility companies and create, implement, and evaluate habitat management guidelines for the creation of source golden-winged warbler habitat in NJ.

Key Findings:

- The GWWA management guidelines are not yet completed but are being analyzed by a statistician.
 - Results of the 2003-2007 research were written to be submitted to a peer-reviewed journal.
 - Data were reorganized for further analyses using Bayesian modeling.
- Foresters were not contacted because the management guidelines are still in progress.

- One utility company was contacted to discuss the management of spans but the meeting took place after the grant period ended.
- Meetings with a state land manager and a utility company took place to determine interest in managing for GWWAs on state lands and ROWs. No management began because the management guidelines are not completed.
- Pre- and post-management surveys were not conducted because habitat management had not been implemented.
- The predictive GIS model was not completed because the statistical analyses are still in progress. However, more data were collected in 2009 for the model. Biologists surveyed 179 points for golden-winged warblers in potential habitats (utility ROW, shrub swamp, old field) in northwestern NJ to aid in the identification of priority areas for golden-winged warbler management. Habitat data were collected at 174 of the 182 survey points.
 - Approximately 46% of the points were in predominately wetland habitat, and 54% of the points were in predominately upland habitat.
 - The majority of the survey points were in upland shrubby fields (17%) and fens (15%), wetland successional forest (14%), upland successional forest (12%), and abandoned farmland (12%). The remainder of the points were in upland utility ROWs (9%), bogs (6%), beaver wetlands (6%), wetland utility ROWs (4%), upland pasture (2%), residential areas (2%), lake (0.6%), and riverine marsh (0.6%) (Figure 2B-1).
 - Most (84%) of the survey points contained <50% tree cover, with the majority of those (50%) containing 25-50% tree cover (Figure 2B-2).
 - Most (75%) of the survey points contained 25-75% herbaceous cover with the majority of those (42%) containing 25-50% herbaceous cover (Figure 2B-2).
 - Most (84%) of the survey points contained <50% shrub cover with the majority of those (51%) containing 25-50% shrub cover (Figure 2B-2).
 - Dead vegetation cover was only measured at 51 points. Over 90% of those survey points contained <25% dead vegetative cover with the majority of those (70%) containing no dead vegetative cover (Figure 2B-2).
 - The height of the vegetation at survey points was <2 m tall at most (62%) points, but 20% of the points had vegetation >3m tall.
 - The majority of points (61%) had swamp or wet ground present; 29% had no water visible.
 - Twenty-two golden-winged warblers, three hybrids, and 74 blue-winged warblers were observed during the 2009 survey.
 - Almost all (21/22) golden-winged warblers were observed on protected lands (state parks, state wildlife management areas, county parks, city watersheds, NGO properties).
 - Of the 22 golden-winged warblers observed, 18 locations had habitat measurements: six (33%) were in upland utility ROWs, four (22%) in shrubby fields, three (17%) in wetland utility ROWs, three (17%) in successional forest wetlands, one (5%) in a beaver wetland and one (5%) in a fen (Figure 2B-1).
 - Most (87%) of the golden-winged warblers were observed in areas with <25% herbaceous cover. All golden-winged warblers were observed in areas with <50% tree cover and shrub cover and <24% dead vegetation cover (Figure 2B-2).
 - Almost half of the GWWAs occurred in areas where the average vegetation height was 1-2 m (Figure 2B-3).
 - Most (73.3%) of the GWWAs occurred in areas where a swamp or wet ground was observed (Figure 2B-4).
- The Golden-winged Warbler Working Group met October 2008 in Colombia, April 2009 in Rector, PA, and August 2009 in Philadelphia, PA. Staff attended the meeting in Rector and Philadelphia but was unable to attend the October meeting in Colombia due to travel restrictions.
- The status assessment (employing the Delphi technique) began for the golden-winged warbler. Round 1 has been completed and Round 2 is in process. A third round may be necessary to reach full consensus on both breeding and non-breeding statuses.
- The data will be submitted for entry into the NJ DEP's Biotics (Biotics) database by mid-November.

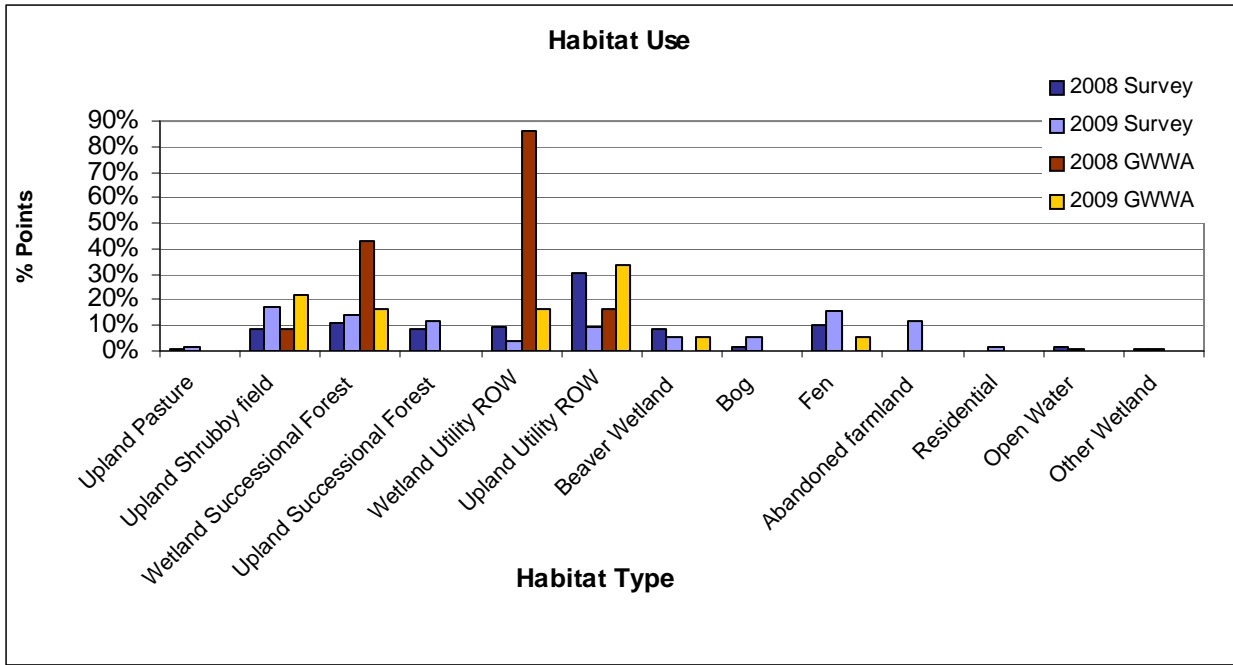


Figure 2B-1. Habitats used by golden-winged warblers (GWWA) vs. available habitat surveyed (Survey) during the 2008 and 2009 survey.

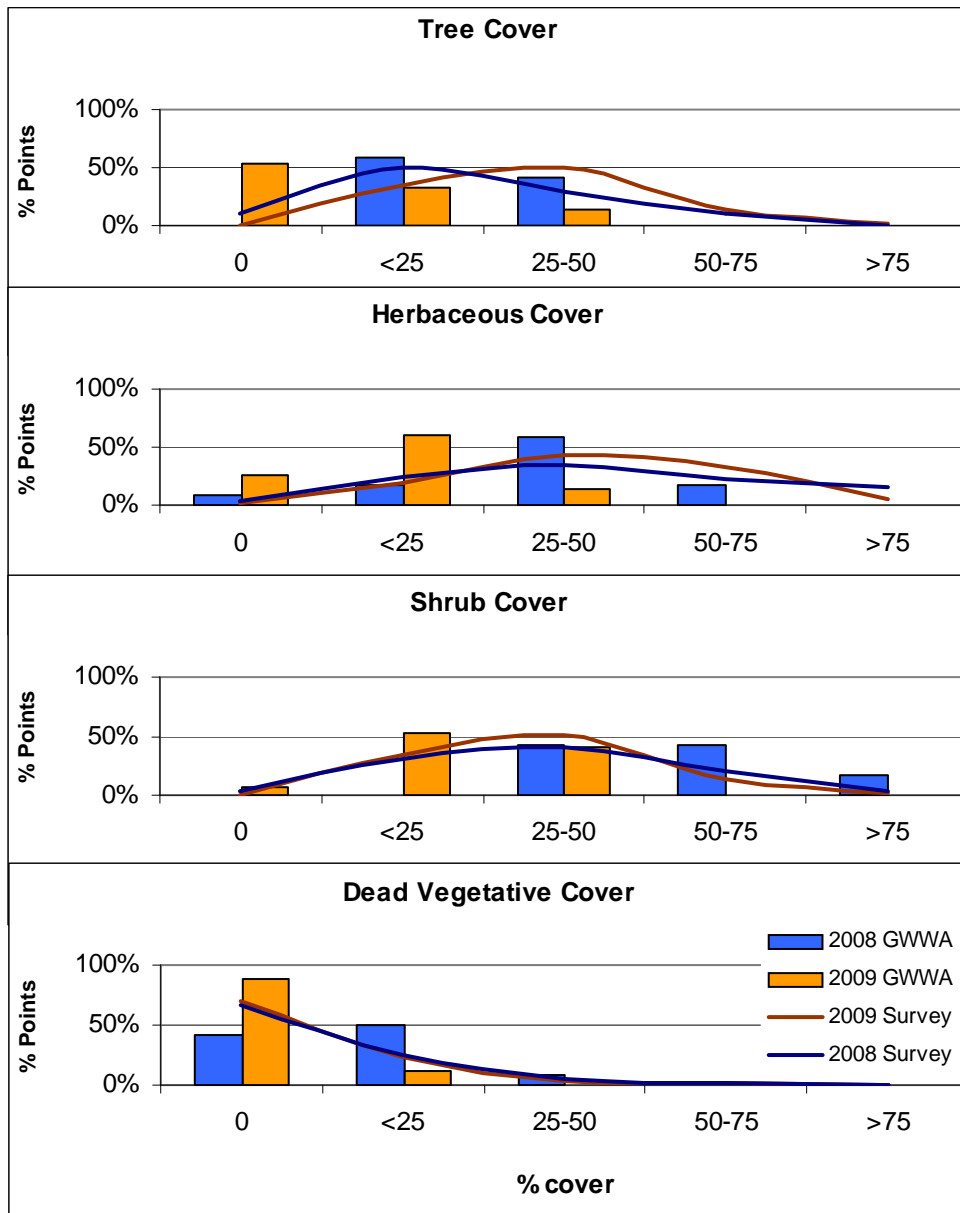


Figure 2B-2. Percent cover type used by golden-winged warblers (GWWA) vs what was available (Survey) during the 2008 and 2009 survey.

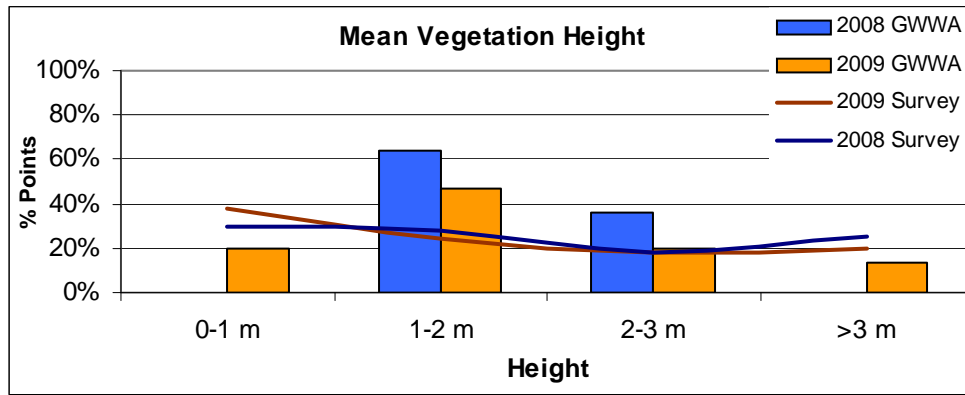


Figure 2B-3. Mean vegetation height in the area used by golden-winged warblers (GWWA) vs what was available (Survey) during the 2008 and 2009 survey.

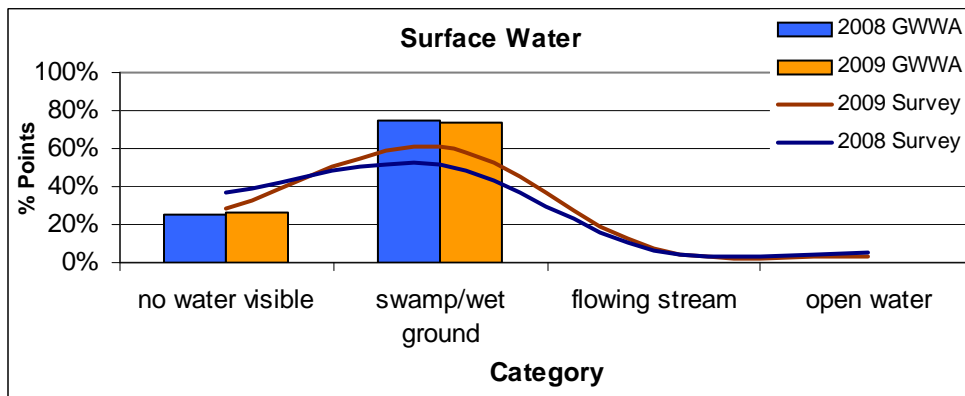


Figure 2B-4. Surface water observed in the area used by golden-winged warblers (GWWA) vs what was available (Survey) during the 2008 and 2009 survey.

Conclusions:

- Although habitat exists in NJ for golden-winged warblers, the population appears to not have changed from 2008.
- The results of the 2009 survey demonstrate an affinity by golden-winged warblers for both upland and wetland utility ROWs with <25% tree cover, <25% herbaceous cover, <25% shrub cover, and no dead vegetation, and areas with overall vegetation height of 1-2 meters with a swamp or wet ground present.
 - This differs from areas where GWWAs were observed in 2008. In 2009 it seems as though GWWAs preferred drier sites overall, targeting ROWs in general with fewer wetland forests and more upland shrubby fields, although the preference for swamp or wet ground on site did not change.
 - The GWWA preferences for overall composition of the sites seemed to change from 2008 to 2009. In 2009, sites where GWWA occurred had less tree cover, herbaceous cover, shrub cover, and dead vegetation than sites in 2008, and the overall vegetation height in those sites had a more expansive distribution than 2008 (Fig. 2B-3), although the GWWAs still chose areas with a vegetation height of 1-2 meters.

Recommendations:

- Complete the species status review to evaluate possible listing of the golden-winged warbler as state endangered.

- Create management recommendations for source golden-winged warbler habitat based on the analyses of 2003-2007 data and in coordination with the Golden-winged Warbler Working Group.
- 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.
- Work with land managers to use the best methods for maintaining optimal golden-winged warbler habitat in areas where individuals have already nested without displacing those individuals by severely altering the habitat.

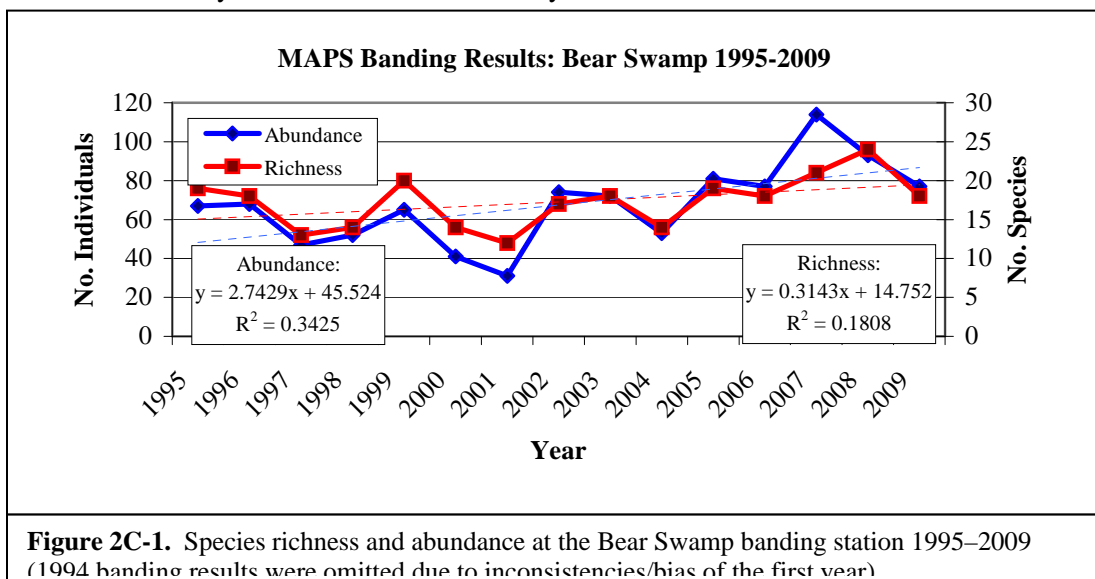
JOB 2C: Monitoring Avian Productivity and Survivorship (MAPS)

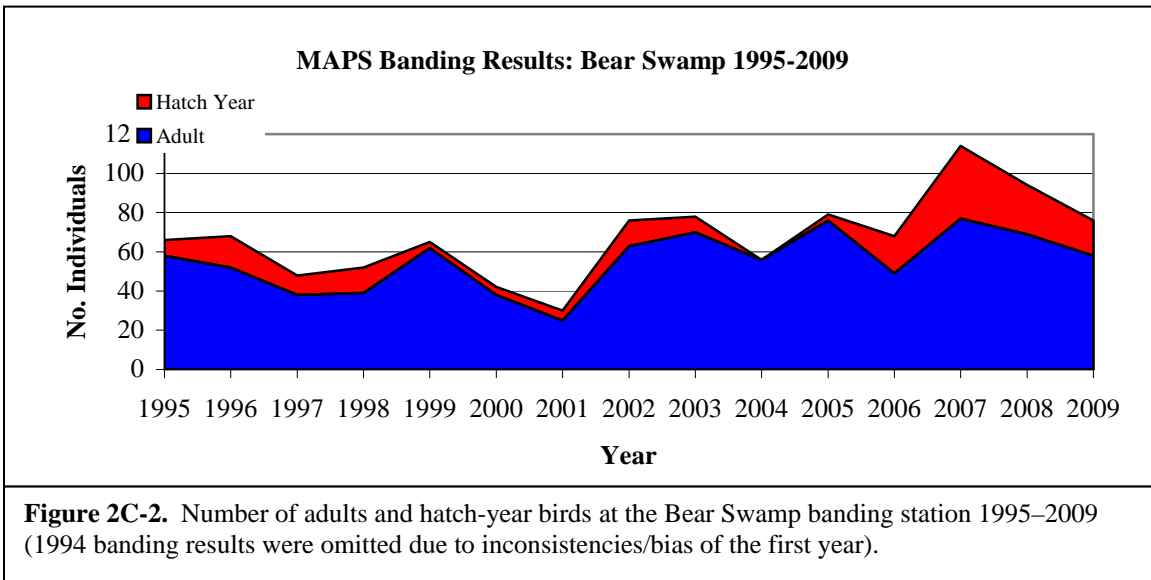
Project leader: Sharon Petzinger, Senior Zoologist

OBJECTIVE: To provide data to the Institute for Bird Populations that will help describe temporal and spatial patterns in the vital rates of target species. Identify causes of population declines, formulate strategies to reverse declines and maintain healthy populations, and evaluate effectiveness of strategies.

Key Findings:

- In 2009, two trained volunteers, with assistance from six untrained volunteers, mist-netted in Bear Swamp, Cumberland County for approximately 457 net hours on eight different days from May through August. This is the 16th consecutive year of operation at this station.
 - Seventy-seven individual birds of 18 different species were mist-netted, 59 of these were new captures (52 banded) and 18 were recaptures from previous years.
 - The majority of the birds netted were ovenbirds (23), followed by worm-eating warblers (8), wood thrush (8), tufted titmice (6), black-and-white warblers (5), red-eyed vireos (4), and northern cardinals (4).
 - The mean species abundance in Bear Swamp from 1995–2009 was 72.62 (± 7.23); mean species richness was 18.00 (± 1.08)
 - While the species abundance and richness still have an overall increasing trend from 1995-2009, both figures are lower than 2008 (Figure 2C-1).
 - Productivity was tied as the fifth highest with 18 (24%) of the 76 aged individuals being young fledged from this year (Figure 2C-2).
- Data have been submitted to the Institute of Bird Populations and the Bird Banding Lab and will be submitted for entry into the Biotics database by mid-November.





Conclusions:

- Bear Swamp continues to be a stable community for forest birds. Both species abundance and richness show a positive trend and productivity is still above the mean of the last 16 years.

Recommendations:

- Continue the long-term monitoring project and supplement the Institute for Bird Populations with data. Investigate comparing this data with trends from other forest songbird surveys.

JOB 3: Species of Regional Priority

OBJECTIVE: To monitor and conserve populations of birds having a Regional Priority status in the northeast, and prevent declines that would necessitate listing.

JOB 3A: American Oystercatcher

Project leader: Christina Kiesel, Senior Environmental Specialist

OBJECTIVE 1: Determine statewide distribution of wintering populations of American oystercatcher (*Haematopus palliatus*).

OBJECTIVE 2: Determine breeding population and reproductive success of American oystercatchers that utilize beach strand habitat (i.e. Atlantic coastal beaches, inlet beaches, inlet sand islands).

OBJECTIVE 3: Continue collaborative range-wide research and survey efforts, especially band resighting, coordinated and facilitated through the American Oystercatcher Working Group.

Key Findings:

- American oystercatcher breeding surveys were conducted in 2009 at all Atlantic coast barrier island beach strand sites, with the exception of Little Beach Island, an isolated barrier island that is part of the Edwin B. Forsythe NWR. Intensive surveys were completed in conjunction with piping plover and other beach nesting bird surveys and through research projects conducted by Rutgers University.
 - 67 nesting pairs were identified at 23 beach nesting sites.
 - About a third (34%) of the beach nesting pairs hatched young.
 - Productivity was 0.36 chicks fledged per beach nesting pair.
 - Flooding and predation were the primary causes of nest failure, although flooding was particularly acute at several sites where there was a concentration of breeding oystercatchers (i.e. Holgate, Stone Harbor Point, and Champagne Island).
 - Half of the chicks fledged in 2009 from beach strand habitat came from one site (Sandy Hook), where all of the beach nesting pairs successfully hatched young.
 - About half (52%) of the beach nesting pairs were located in the southernmost portion of the state, from Stone Harbor Point to Cape May Meadows. The only other significant concentrations on beach strand is Holgate (part of the Edwin B. Forsythe NWR) and, to a lesser degree, Sandy Hook (Gateway National Recreation Area).
- A survey of wintering American oystercatchers, focusing on inlet areas from Barnegat Inlet to Cape May (Canal) Inlet, was conducted December 4-17, 2008. Additional ground surveys were also conducted later in the season (January 4-17, 2009 and February 4-17, 2009); the fourth consecutive year late winter surveys were completed. The surveys were conducted by ground (or watercraft) within an hour of high tide to determine the total number of birds present, the ratio of adults and juveniles, and the presence of banded individuals.
 - A total of 755 birds were counted during the 2008 December winter survey. This total is higher than the past three years (617, 636, and 546, respectively in 2007, 2006, and 2005) and comparable to 2004 (807), covering the period when similar ground surveys were completed, but still less than the highest number (973) tallied in 2002 when a baseline aerial survey was completed.
 - A total of six high tide roost flocks were identified during the 2008 December survey, the largest, by far, being within Hereford and Absecon Inlets.
 - Hereford Inlet (Stone Harbor Point) and Absecon Inlet (Brigantine Cove/Rum Point) had nearly the same number of birds present (343 and 310, respectively). These two inlets combined hosted the majority (86%) of the state's wintering population in 2008, similar to the previous year (82%) and consistent with the trend during the past five years that winter ground surveys have been conducted in December.
 - The only other significant roost flock during the December survey was within Great Egg Harbor Inlet (North Ocean City), with 75 birds present.

- About half as many birds (368) were present during the January survey and even fewer (220) during the February survey, in comparison to the December survey.
 - Nearly all the birds present in the late winter surveys were found in Absecon Inlet (85% and 89% of the coast wide total in January and February, respectively).
 - With the exception of one individual bird at Cape May Inlet, the only other flock present in January and February was within Great Egg Harbor Inlet. Of note, no birds were observed in Hereford Inlet during the late winter surveys, despite this being the largest flock location during the December survey.
- Forty-two American oystercatchers, including 36 juveniles and 6 adults, were marked with orange color bands during the breeding season, following the protocol established by the American Oystercatcher Working Group and consistent with other states along the Atlantic coast. Adults were captured using decoys and noose-carpets (McGowan et al. 2005) placed near nest scrapes on breeding territories. Juveniles were captured with a dip net or by hand prior to fledging. This season an emphasis was placed on increasing the number of chicks that were banded, as well as banding birds at sites not necessarily targeted in the previous five years. The total number of oystercatchers banded in New Jersey since 2004 (when the banding program began) is now 205 individuals.
- The resighting of banded American oystercatchers is ongoing and is being conducted by ENSP, the Conserve Wildlife Foundation of N.J., Rutgers University, various federal agencies in the state, the American Oystercatcher Working Group and the public. The number of resighted New Jersey-banded oystercatchers is now close to 1,000, although an exact tabulation was not completed in time for this report. Information from the resightings is being used for a variety of purposes within the state and range-wide, in particular trying to determine patterns of movement during both the breeding and migration periods. Banding data from the various states are also being used to calculate a survival rate for the species.
- Comprehensive monitoring, banding and research protocols for American oystercatchers were completed in collaboration with Rutgers University prior to the 2009 breeding season. A new, more detailed breeding (nest/pair) data sheet was developed prior to this season, again in partnership with Rutgers University, using a long established piping plover data sheet as a template.
- All breeding and wintering populations are documented using GIS for incorporation into NJ DEP's Biotics database and ENSP's Landscape Project.
- ENSP, in conjunction with the U.S. Fish and Wildlife Service–New Jersey Field Office, continued developing comprehensive beach management plans to address threats to beach nesting birds and implement management strategies. Twelve plans were completed with coastal municipalities or other agencies by the end of the grant period, and another six plans were in some stage of development. The plans initially focused only on state or federally listed (T&E) species, but as of last year, American oystercatchers were integrated into the plans, where applicable.
- A statewide breeding survey was not conducted during this grant period. The funds or resources to complete a survey of the entire coastal zone are not presently available. However, it is still recommended that such a survey be initiated some time in the near future, and that once a baseline survey is completed, that it be repeated at least every five years.
- Using breeding data from 2005-2008 and wintering use data from 2003-2008, GIS map layers were created that indicate the known distribution of American oystercatcher within the coastal zone. The mapping will be included as part of proposed revisions to the portion of the state's coastal zone management rules that deal with critical wildlife designations. However, final preparation, review and adoption of those rule changes will not be completed until next year at the earliest. Data do not currently exist to also identify critical foraging areas for oystercatchers in the mapping or regulatory process.

Conclusions:

- The number of breeding pairs of American oystercatcher (67) on barrier/beach strand (the beach nesting portion of the population) in 2009 was the highest for the period since 2003 when comprehensive monitoring began and above the average for the period (59 pairs). It is not clear what

accounted for the increase as reproductive success has been low in recent years and the beach nesting population remained nearly stationary around 59 pairs each year from 2005-2008.

- Productivity for beach nesting American oystercatchers in 2009 was more than double the level in 2008 (0.36 vs. 0.17 fledglings per pair, respectively). Furthermore, it was the highest level since comprehensive monitoring began in 2003, and was above average for the period (0.26 fledglings per pair). Although the increase in productivity was encouraging, it is tempered somewhat by the fact that it was largely driven by the success at one site; Sandy Hook, which recorded 1.50 fledglings per pair (8 pairs).
- The National Park Service (in coordination with the U.S. Department of Agriculture) implemented an intensive predator control program focusing on red fox over the past two years at Sandy Hook. The exceptionally high nest hatch success and productivity for American oystercatchers at Sandy Hook in 2009, and increased nest success by piping plovers and least terns there, demonstrate the benefits of targeted predator control programs.
- The state's wintering population of American oystercatcher (as determined from the December survey period) was higher this year than the past several years, but still within the range found since ground surveys using consistent protocols began in 2004 (range = 546-807 birds). As has been the case every year that late winter surveys in January and February have been completed (2005-2008), there are significantly fewer birds present in the late winter. Birds have been consistently present in high numbers at Absecon Inlet throughout all survey periods and year to year, clearly making this the most important winter roost location in the state. Hereford Inlet is also a significant wintering site, although for reasons not apparent, this site is not consistently used (or used at all) in the late winter.
- Use and distribution of American oystercatchers within the state is now fairly well documented during the breeding and wintering seasons. However, data gaps exist for use during the period following breeding and through winter (August-November). Occasional surveys and casual observations during the "fall" suggest large flocks (even larger than those seen during winter surveys) are present in the state at that time. As the northernmost state in the range where any significant birds are present in the winter, it would be expected that a sizable number of birds (i.e., all birds breeding north of the state) pass through New Jersey during fall migration.

Recommendations:

- Continue to monitor breeding population and productivity of beach nesting American oystercatchers on an annual basis. Monitor population and productivity of oystercatchers breeding in other habitat types (i.e., back bay marsh island, dredge sites), as resources allow.
- Continue to track American oystercatcher wintering population and distribution annually, although monitoring during the late winter period appears to be less important.
- Conduct a statewide American oystercatcher breeding survey across all habitat types along the Atlantic coast and Delaware and Raritan Bays at a minimum of 5-year intervals.
- Continue to mark (band) American oystercatchers as part of an Atlantic coast initiative to track and study movements of birds and gather other key demographic data.
- Continue including American oystercatchers as part of management strategies (i.e. fencing and signage) implemented at sites where other beach nesting birds (i.e., piping plover, least tern, black skimmers) are present. Assess whether areas where concentrations of oystercatchers occur by themselves or in areas not protected because of other beach nesting birds also require protection through management actions.
- Continue including protections for American oystercatchers in beach nesting bird management plans being developed in partnership with the U.S. Fish and Wildlife Service for municipalities and other breeding sites in the state's coastal zone.
- Continue working to designate American oystercatcher breeding sites and wintering roost locations as critical wildlife habitat in the state's coastal zone.
- Continue collaborating with the American Oystercatcher Working Group, and using the American Oystercatcher Conservation Plan for the Atlantic and Gulf Coasts of the U.S., the Business Plan for the Conservation of the American Oystercatcher--A 10-year Plan to Secure a Coastal Keystone

Species, and New Jersey's Wildlife Action Plan to help establish conservation priorities for the monitoring, management, and research efforts within the state.

- Continue to incorporate breeding and wintering data into Biotics and Landscape Project databases

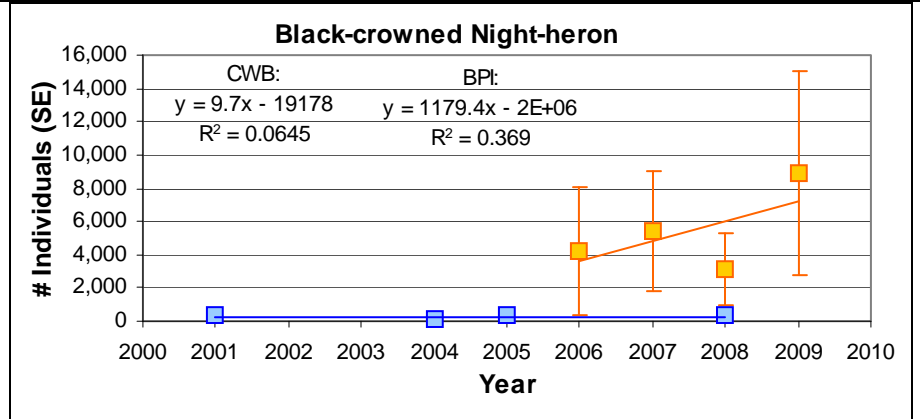
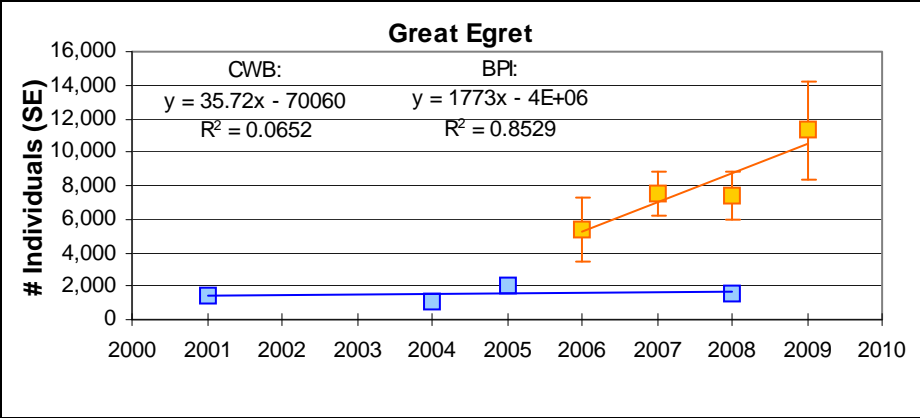
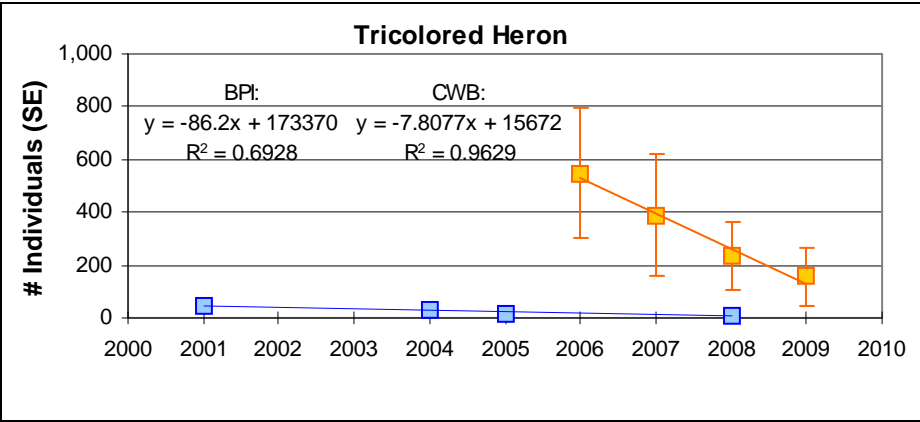
JOB 3B: Regional & National Bird Coordination

Project leader: Sharon Petzinger, Senior Zoologist

OBJECTIVE: To continue active participation in regional/national meetings, planning, and surveys including the Breeding Bird Survey, Coordinated Bird Monitoring, Partners in Flight, Atlantic Flyway Council, Nongame Technical Section and other working groups pertinent to bird research.

Key Findings:

- Three biologists from NJ Division of Fish and Wildlife (NJ DFW) attended the Northeast Coordinated Bird Monitoring Workshop September 22-25, 2008 in Cape May, NJ and participated in the grassland, scrub-shrub, marsh and forest bird working groups to create survey protocols and identify target species for the surveys. Many of the working groups were held simultaneously, so the shorebird, waterbird, and nightjar working groups were not attended. Biologists also attended the NE PIF meeting that followed the NE CBM meeting. A biologist from NJ DFW attended the Atlantic Flyway Council Meeting March 23-25 in Easton, MD and the NABCI meeting July 7-8, 2009. Biologists did not attend the Cerulean Warbler Working Group or the ACJV meeting due to travel restrictions. The AMJV meeting was postponed until October 2009.
- Regional nightjar surveys, a collaborative survey effort for the northeastern states, were contracted out to NJ Audubon in 2008.
- Despite numerous recruiting efforts in 2009, 24 out of 28 of the USGS Breeding Bird Survey (BBS) routes in New Jersey were assigned and 23 were surveyed.
- Three staff biologists conducted one BBS route each in 2008.
- As part of the NJ Coordinated Bird Monitoring Plan, biologists from NJ DFW collaborated for the fifth year to conduct a joint waterfowl breeding population index (BPI) and endangered and threatened waterbird survey.
 - A total 184 state endangered or threatened and 131 state special concern individuals were observed in 2009.
 - Trends can be detected in the saltmarsh strata for great egrets, snowy egrets, tricolored herons, little blue herons and black-crowned night-herons (Figure 3B-1).
 - Trends from the waterfowl BPI are different from trends from the waterbird colony count.
 - Data will be submitted for entry into the NJ DEP's Biotics (Biotics) database by mid-October.



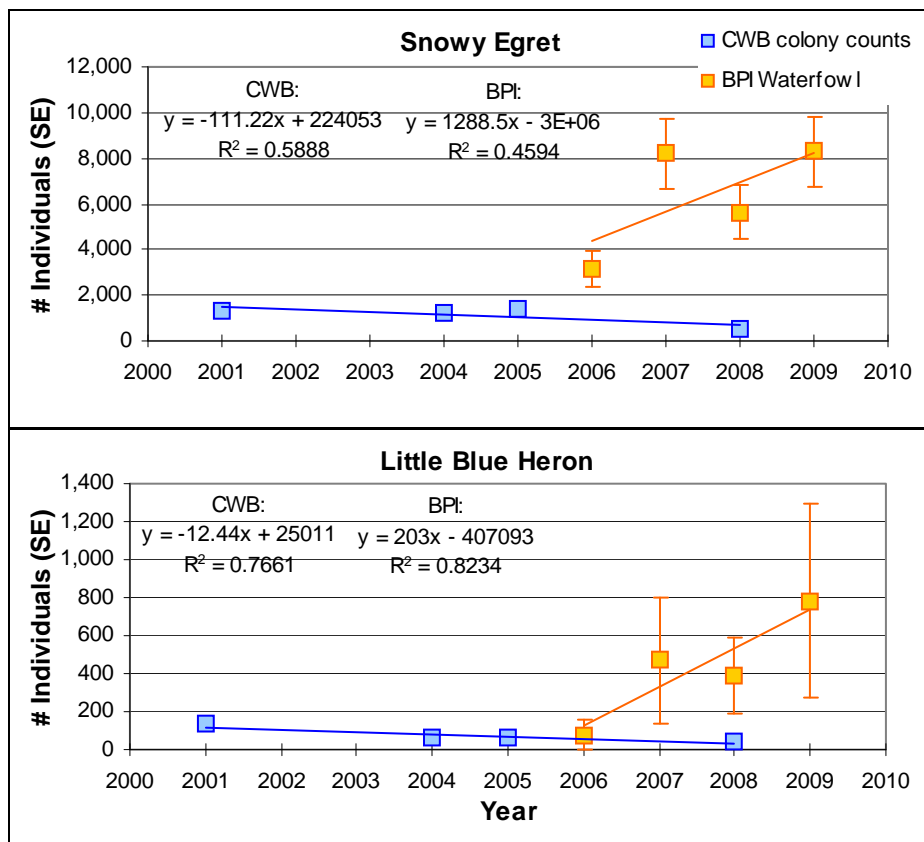


Figure 3B-1. Trends of the BPI waterfowl surveys, 2006–2009 (yellow), and the colonial waterbird aerial colony count, 2001–2008 (blue). The year 2005 was dropped from the BPI waterfowl survey due to first-year bias.

Conclusions:

- Collaboration with other states and regions is critical for large-scale bird monitoring and should be a high priority for the state of New Jersey.
- Trends from the BPI cannot be accurately compared with results of the colonial waterbird surveys due to discrepancies in protocol and analyses (area ground search for population index versus systematic aerial colony count).
- Collaborating waterfowl and waterbird surveys within state provides results and should be continued at least a few more years to determine whether the waterfowl survey can adequately replace the more expensive waterbird surveys.

Recommendations:

- Continue to collaborate on waterfowl and waterbird surveys in NJ and analyze the efficiency of the survey protocol at estimating trends and population indices of waterbirds in NJ when the data become available.
- Continue to participate in the Northeast Coordinated Bird Monitoring Working Groups and other regional coordination efforts.

JOB 4: New Jersey Important Bird and Birding Areas (IBBA)

Project leader: Amanda Dey, Principal Zoologist

OBJECTIVE: The primary objective for 2008 is to continue ENSP staff participation in the final phases of the current IBBA project. Completed objectives include development of digital IBBA maps and compilation of endangered/threatened species data from the nomination process. As important bird and birding sites have now been identified and mapped, the NJ IBBA Project will seek to ensure continued viability of these sites through development of management plans, increased public awareness, and by providing public access to digital mapping of important bird areas both on the Audubon website and the NJ Department of Environmental Protection's interactive mapping website.

Key Findings:

- ENSP contracted with NJ Audubon (NJAS), whose staff updated and refined IBA inventory and IBA data. Data were collected from volunteers and IBA monitoring efforts for >10 IBAs. NJAS IBBA staff updated the program's two comprehensive data warehouses with new data (i.e., National Audubon's searchable IBA database, NJ Audubon Society's IBBA Program Site Guide). There were no new sites nominated during the period of 2008-2009; we continued to collect monitoring data at provisional IBAs, macrosite IBAs and priority IBAs.
- NJAS IBBA staff submitted the final Important Bird Areas (IBA) boundaries (GIS file and metadata, Figures 1 and 2) to the ENSP. These files are under review by ENSP for spatial accuracy as well as metadata compliance to the national standard. Once all identified issues have been corrected, IBA boundaries will appear as a "stand-alone" layer in ENSP's Landscape Project mapping. As part of ENSP's Landscape Project mapping (V. 3), the IBA boundaries will be available to the public on the Department's interactive mapping application, download on the Department's GIS download page or on CD by request.
- No new endangered/threatened species data were submitted to be incorporated into Landscape Project critical habitat mapping and the NJ DEP's Biotics (Biotics) database.
- There are 111 IBAs grouped into two categories, 11 Macrosites (1,450,844 acres) and 100 Individual (2,162,511 acres). There is considerable overlap between the Individual and Macro sites (Figures 1 and 2).
- NJAS worked to eliminate all overlap between IBAs within each of the IBA types.
- NJAS IBBA Program repeated avian and vegetation surveys at several IBAs including: Southern Pine Barrens Macrosite IBA, Greenwood Forest/ Pasadena WMA IBA, Northern Pine Barrens Macrosite IBA, Cohansey River Corridor IBA and the Mad Horse Creek & Abbots Meadow WMA/ Stowe Creek IBA. Data will be prepared for entry into online databases.
- The IBBA Program identified additional opportunities to expand conservation efforts, implement habitat restoration plans and conduct outreach in priority IBAs. Current and proposed projects directly implement priority goals for habitat management and species recovery in the State Wildlife Action Plan

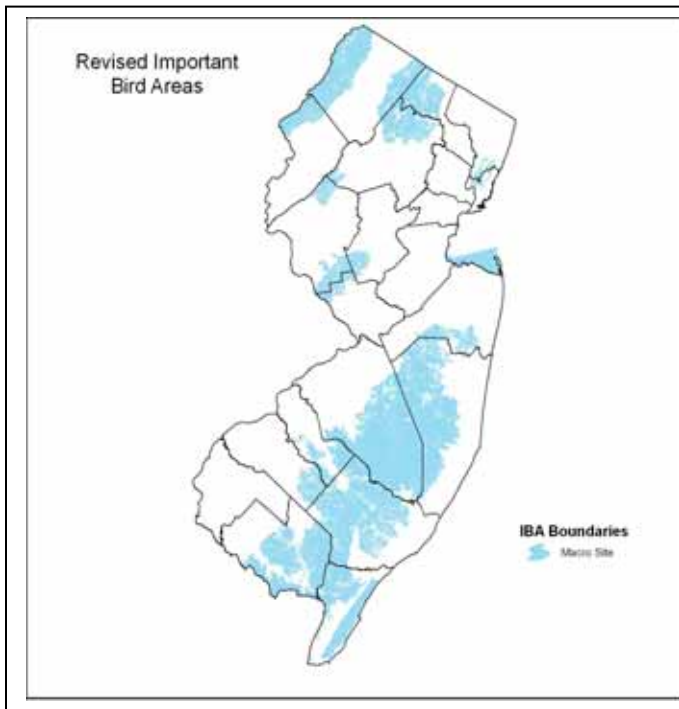


Figure 1. IBA boundaries for IBA Macrosites.

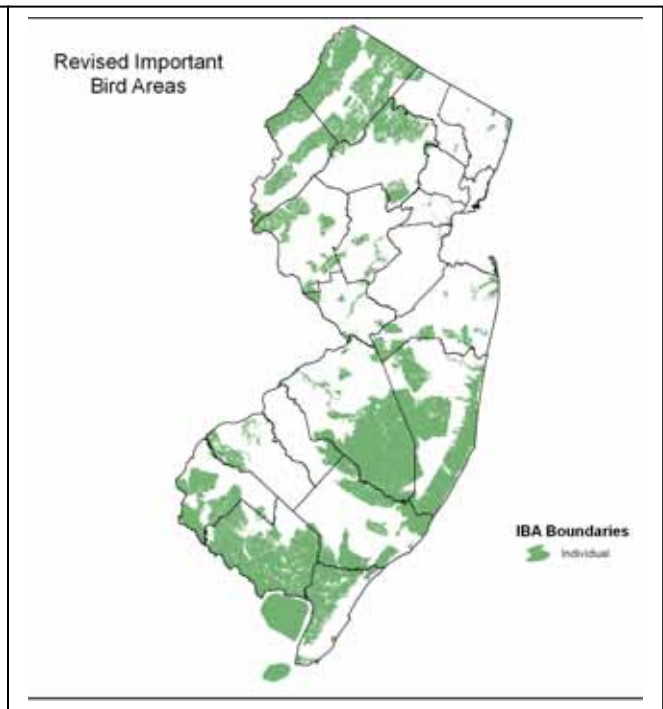


Figure 2. IBA boundaries for Individual sites.

Conclusions:

- The boundaries of the IBA GIS file need to be simplified to make the file more realistic in the depiction of the intended IBA.

Recommendations:

- Simplify the boundaries of the IBA GIS file.
- Continue annual submission of avian data from IBAs to the Biotics database to inform the Landscape Project and avoid discrepancies between the two databases.
- Update IBA boundaries when Landscape Project Version 3.1 data or new Land Use/ Land Cover data becomes available. Continue progress toward the inclusion of IBA boundaries in NJ DEP's I-Map and Landscape Project, Version 3.1.
- Analyze data collected during avian and vegetation monitoring at IBAs to allow for the assessment of pre- and post-management impacts.
- The IBBA Program should identify new opportunities within priority IBAs to implement habitat restoration plans as well as expand upon ongoing conservation efforts. Additional priority IBAs should also be identified and targeted for conservation.
- Continue community involvement in the protection and restoration of IBAs through participation in the Adopt-an-IBA Program.
- Continue outreach and education for citizens and landowners about the goals of IBBA, the importance of habitat conservation, and the various state and federal incentive programs available to landowners.
- Continue to initiate and foster partnerships with local governments, citizens groups and professional planning organizations to facilitate the identification and protection of important bird habitat within communities.
- The Endangered and Nongame Species Program and New Jersey Audubon should continue to collaborate on the IBBA program including development of new funding.

EXECUTIVE SUMMARY

Project:	Mammal Conservation
Federal Aid Project:	T-1-5 (State Wildlife Grants)
Segment dates:	September 1, 2008 to August 31, 2009
Total Project Expenditures:	\$99,000 (\$49,500 Federal, \$49,500 State)

JOB 1: Federal and State Listed Mammals

OBJECTIVE: To conserve populations of federal and state-listed species through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review.

JOB 1A: Bobcat Conservation

Project leader: Mick Valent, Principal Zoologist

OBJECTIVE: Determine the distribution, minimum size, population and genetic structure, and habitat needs of New Jersey's bobcat population and use the information to preserve the habitat necessary to maintain a viable population.

Key Findings:

- In November 2008 we received the DNA results from the bobcat scat survey by the scent dog-handler team conducted last year (January–May, 2008). The results indicated we had adequate data to estimate a population size in the core of bobcat range in northern New Jersey for the first time. Therefore, additional survey work was not conducted during this reporting period and instead we focused on analyzing results and entering data into the Biotics database.
- The DNA results indicated that there were 44 unique individuals consisting of 19 females and 25 males. There were 25 additional scats that had poor quality DNA such that the species could not be identified and an additional 38 bobcat scats with poor quality DNA such that the individual identification could not be determined. When we extrapolated the number of bobcat scats and then added unique individuals that were missed because of poor quality DNA, the population estimate was 79 bobcats in northern New Jersey (Figure 1).
- No confirmed bobcat scats were collected south of Route 80 despite the fact that habitat predicted to be suitable for bobcats exists and the handler team ran 23 of 127 transects south of Route 80. The detection dog responded to approximately 75 scats (28%) that were identified by DNA as canid scat. We decided not to survey for bobcats in central and southern NJ as planned, because the detection dog must undergo additional training to better differentiate bobcat and canid scats.
- Tissue samples were obtained from NJ road-killed bobcats, incidentally-trapped bobcats (by licensed fur trappers), and from bobcats in New York, Pennsylvania and Maine (provided by those states) for the regional genetic variability study. This study is aimed at understanding the genetic structure of the New Jersey population. These samples totaled 79 samples that were sent to the U.S. Forest Service Rocky Mountain Research Station lab (Montana). To date, bobcat tissue samples from New Jersey (n=34), New York (n=57), Pennsylvania (n=40) and Maine (n=25) have been sent to the lab. The lab has not yet determined if the sample size and distribution are now adequate to perform mitochondrial DNA sequencing and analysis. Samples are still lacking for the counties in Pennsylvania and New York that border New Jersey (Figure 2), which will be important for evaluating the NJ population.
- Bobcat observation data from the public as well as our survey efforts over the past two years (n=196) have been entered into the Biotics database.

- Fourteen bobcats were observed on roads during the reporting period and ten of these were dead on a road.
- We did not conduct a track identification training seminar for volunteers during the current project reporting year. Instead we sent out materials on the proper identification and documentation of bobcat tracks to the 18 volunteers that had previously attended the training seminars. The materials were sent out both as a refresher and reminder to volunteers that we wanted them to continue bobcat surveys during 2008-2009. Only two volunteers conducted track searches during the project year and therefore we did not reach the anticipated goal of surveying 80 km of track surveys. Lack of suitable tracking snow contributed to the low volunteer track searching effort during the current project year. No volunteers reported sightings of tracks during the project year.

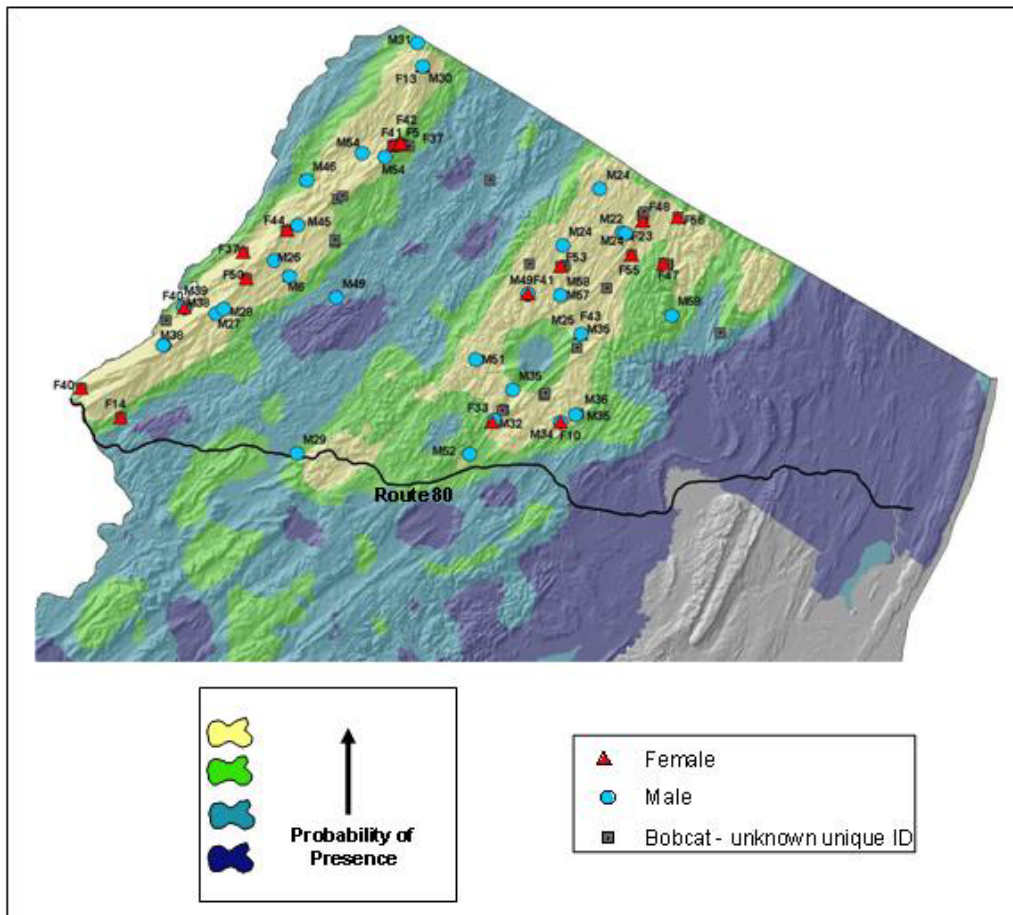


Figure 1. Results of the scat survey conducted by a dog-handler team in northern New Jersey between January and May 2008. DNA-based results are overlaid on a habitat suitability probability map.

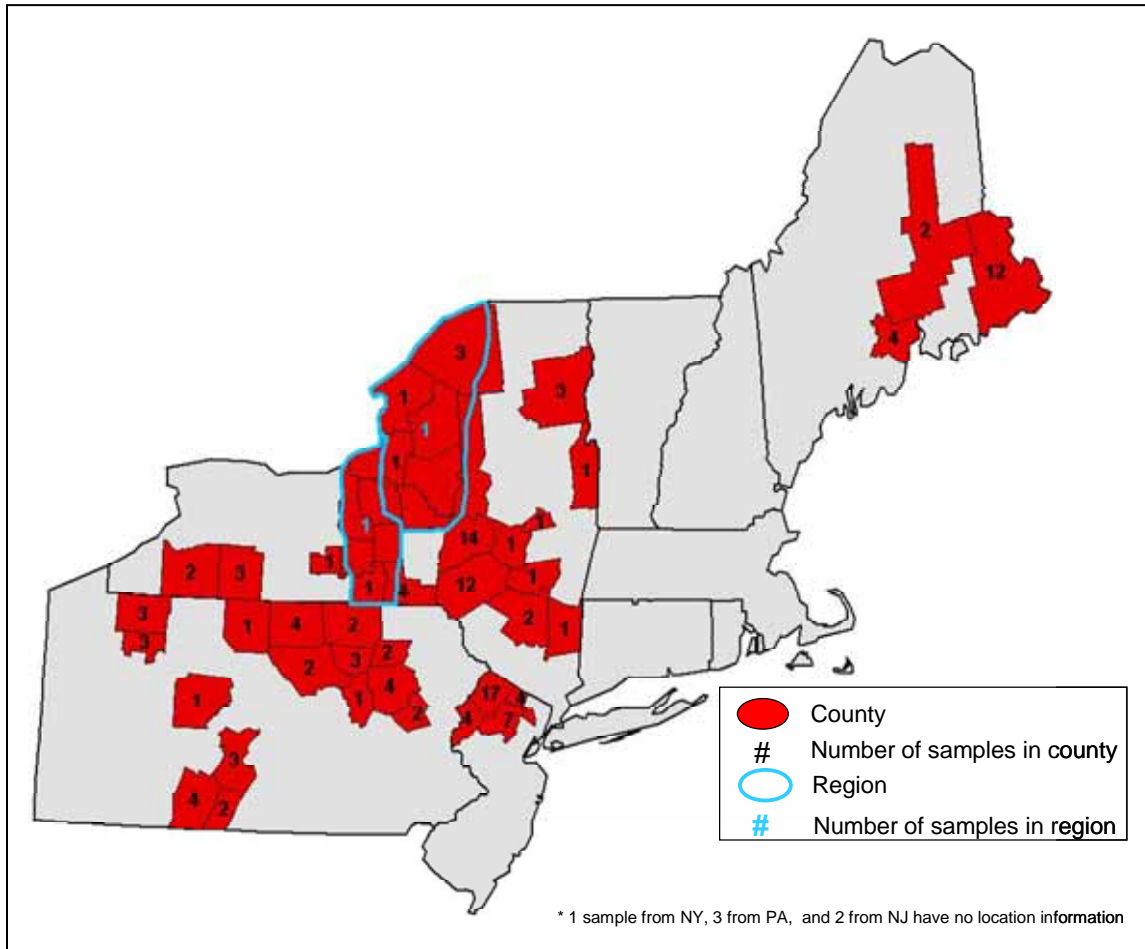


Figure 2. Distribution of bobcat tissue samples collected from Pennsylvania, New York, New Jersey, and Maine for a regional genetic analysis.

- Six new GPS/VHF collars were purchased from Advanced Telemetry Systems for monitoring bobcat movements and habitat use during the project year.
- Live-trapping was conducted between January 27 and March 16, 2009. Trapping occurred on 392 nights during the period. Trained volunteers, cooperating trappers and staff conducted the trapping. Three bobcats were successfully trapped during the period. The trapped bobcats included an adult female, a juvenile male and juvenile female. Only the adult female was fitted with a GPS/VHF collar for tracking. The juvenile bobcats were not fitted with collars due to low body weights compared to collar weight and released immediately at the site of capture. The adult cat is being tracked via the VHF signal a minimum of twice monthly. The collar is scheduled to drop off on January 27, 2010.
- Biologists again met with members of the NJ Trappers Association and the NJ Fur Harvesters to present the state's research efforts and attempt to get the cooperation of the organizations' memberships to report incidental captures of bobcats during the trapping season. The ENSP has set up a response team to assist trappers in the safe release of incidentally snared bobcats. Response team contact information was disseminated to trappers prior to the start of the trapping season. Three trappers called to report incidental bobcat captures during the 2008-2009 trapping season. One bobcat was discovered dead in a snare when the trapper checked his traps. Another was reported by a trapper who found an adult male bobcat alive in a snare. Biologists responded to the call but upon arrival found the bobcat dead in the snare. Another trapper reported an adult male bobcat alive in his snare. Biologists again responded and found the animal alive in the snare. The bobcat was

chemically immobilized but died once the snare was cut. The snare had closed tightly around the animal's mid-section just in front of the pelvis. The hind legs were completely frozen. It is believed that the bobcat died from cardiac arrest when the cold blood was released upon cutting the snare or from internal injuries resulting from the snare.

- Biologists identified four locations along Interstate Route 80 in Warren County, NJ that had the potential to provide wildlife passage across the roadway that was also suitable for bobcats. They included three culverts and one stream crossing. Volunteers set up motion-sensitive cameras to monitor animals entering or exiting the culverts. Deer and raccoon were the only species documented as using the culverts to cross from one side of the road to the other. Other species were photographed but it was inconclusive from the photos whether or not they crossed the roadway. No bobcats were documented at any of the sites. This work was done instead of conducting scent-station surveys of suitable bobcat habitat in north Jersey because the surveys required to develop a population estimate were complete.

Conclusions:

- The bobcat scat survey conducted by the dog-handler team was an effective survey method and ENSP now has a baseline estimate of the sex ratio and population size of bobcats in northern New Jersey (the core of their range in New Jersey) for the first time. Results from the survey effort indicate that Route 80 may be a barrier to bobcat movement.
- It is yet to be determined if the 79 additional bobcat tissues samples sent in from New Jersey, New York, Pennsylvania and Maine will be sufficient to properly analyze the regional genetic structure of the bobcat population.
- Bobcat data is now up-to-date in the Biotics database.
- There was a very high incidence of bobcats killed on roads during this reporting period: 10 to 12.5% of the estimated population.
- The use of experienced volunteers to establish and monitor scent stations and motion-sensitive cameras appears to be one of several effective techniques to survey for bobcats. We will continue to use this as one of the techniques we employ to survey areas for bobcat occurrence.

Recommendations:

- Work with the genetics lab to analyze the confirmed canid scats collected during the 2008 survey to determine if the detection dog is alerting to coyote scats only in addition to bobcat, and evaluate whether to work to retrain the dog on just bobcat, or if data from the coyote scat would be useful. Once a course of action is pursued, use the dog-handler team to begin surveying areas in central and southern New Jersey where bobcats have been reported in an effort to confirm their presence.
- Work with the U.S. Forest Service Rocky Mountain Research Station lab as they perform the mitochondrial DNA sequencing and analysis for the regional genetic variability study to determine if the sample size and distribution of the samples are adequate for the analysis.
- Use the updated bobcat occurrence data to refine the existing predictive bobcat habitat model.
- Build a corridor map for bobcats informed by the refined predictive model and combine with known occurrences of bobcats on roads to identify segments of roads where a crossing structure or other mitigation efforts would be effective in making roads more permeable for bobcats and reduce mortality. Monitor the targeted road segments with motion-sensitive cameras as well as possibly the dog-handler team to further document bobcat presence by the road segment and work with the newly formed NJ Roads & Wildlife Working Group to propose a mitigation plan, obtain funding and implement the plan.
- Use results from the scat survey effort as well as the regional genetic study to start draft a recovery plan for bobcats in New Jersey.
- Continue to use scent stations and motion-sensitive cameras to survey suitable bobcat habitat. Experiment with the use of hair snares and scent lures as an additional technique to identify bobcat locations.

- Live trap and fit GPS/VHF collars on up to five adult bobcats to obtain additional data on movements, home range size and habitat use in areas of northern NJ where this information is lacking. The focus in the coming year will be to trap and collar bobcats in areas of suitable habitat adjacent to major roadways that may act as a barrier to bobcat movement. Bobcat movements may provide an insight to how roads affect habitat use and act as barriers to their movements.
- A follow-up training session on bobcat track identification should be conducted annually to serve as a refresher course for those previously trained and to train new volunteers.

JOB 1C: Allegheny Woodrat Conservation

Project leader: Mick Valent, Principal Zoologist

OBJECTIVE: Annually monitor NJ's Allegheny woodrat (*Neotoma magister*) population and assess the potential exposure risk to raccoon roundworm (*Baylisascaris procyonis*). Actively manage raccoon roundworm levels in the raccoon population at New Jersey's last remaining woodrat population through the use of medicated raccoon baits.

Key Findings:

- Standard trapping protocol was conducted at six separate talus slope sites at the base of the Palisades Interstate Park on September 30 and October 1, 2008. Tomahawk TM Model 201 (5"x5"x16") Collapsible Single-door Live Traps were used for sampling. The traps were baited with apple slices and peanut butter.
- Forty traps were set for two consecutive days for a total of 80 trap-nights (2 nights x 40 traps) of sampling effort.
- A total of nine woodrats were captured resulting in a capture index of 1.13 individuals trapped/10 trap-nights.
 - Captured animals consisted of three adult females, one sub-adult female, two adult males and three sub-adult males.
 - Two (one female and one male) of the nine individuals captured in 2008 were recaptures from previous years. Both animals were initially captured in fall 2007 at the same sites where they were captured during the current reporting year.
- All captured animals were held for several minutes prior to their release to determine if they exhibited any symptoms of infection by *B. procyonis*. None of the captured animals exhibited such signs. All animals were sexed, weighed, and ear-tagged with a unique identification number and released at their capture site.
- Due to the decline in the capture index for the third consecutive year, we continued to distribute piperazine-treated fishmeal/polymer baits at a rate of 10 – 15 baits per acre surrounding the active woodrat sites in an effort to interrupt egg shedding by *B. procyonis* infected raccoons. Additional treated baits were distributed along the shoreline of the Hudson River below the active woodrat sites as this serves as a travel corridor for raccoons. Treated baits were distributed at the site on October 17 and again on November 24, 2008. Studies have shown that *B. procyonis* egg-shedding peaks in the fall. We had intended to distribute treated baits in the fall and spring months but due to a lack of resources failed to distribute baits during the spring. Several of the baited locations were monitored with motion-sensitive cameras in an effort to determine what species were taking the baits. Raccoons were documented at several of the bait locations. However, limitations on camera function failed to document raccoon consumption of the baits.
- We collaborated with Kathleen LoGiudice, PhD, of Union College, Schenectady, NY to test the efficacy of distributing piperazine-treated fishmeal/polymer baits in reducing *B. procyonis* egg shedding in raccoons. A biology honors student conducted the project to test the effectiveness of our baiting technique in reducing prevalence of *B. procyonis* in the Palisades Interstate Park, NJ (Figure

1). Raccoon scat was collected at the test and reference sites throughout the peak egg-shedding season to assess the levels of *B. procyonis* contamination. Scat was collected between September 20 and December 16. Raccoon roundworm contamination was measured throughout the period and compared against historical data collected in NJ during the same months. Consistent with patterns previously observed, contamination increased in both the test site and the reference sites as the egg shedding period progressed. However, by late November the contamination had risen to 65% in the reference sites and only 33% in the test site (Figure 2). This study suggests that anti-parasitic baits can reduce contamination levels.

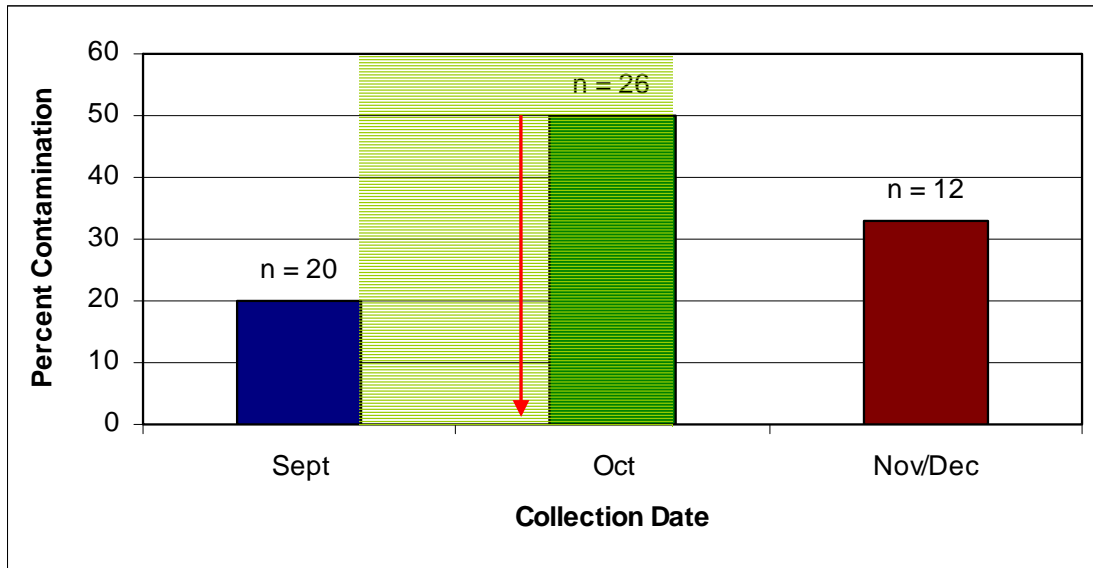


Figure 1. The percent of contaminated scats per month. The arrow (red) represents the baiting date (October 17), while the shaded area (green) represents the intermediate time period containing both pre- and post-baiting samples. The bar on the left (blue) represents pre-baiting samples in September, the bar on the right (maroon, Nov/Dec) is post-baiting samples and the middle bar (green, October) represents intermediate samples. The sample sizes are indicated. (Bowden 2009)

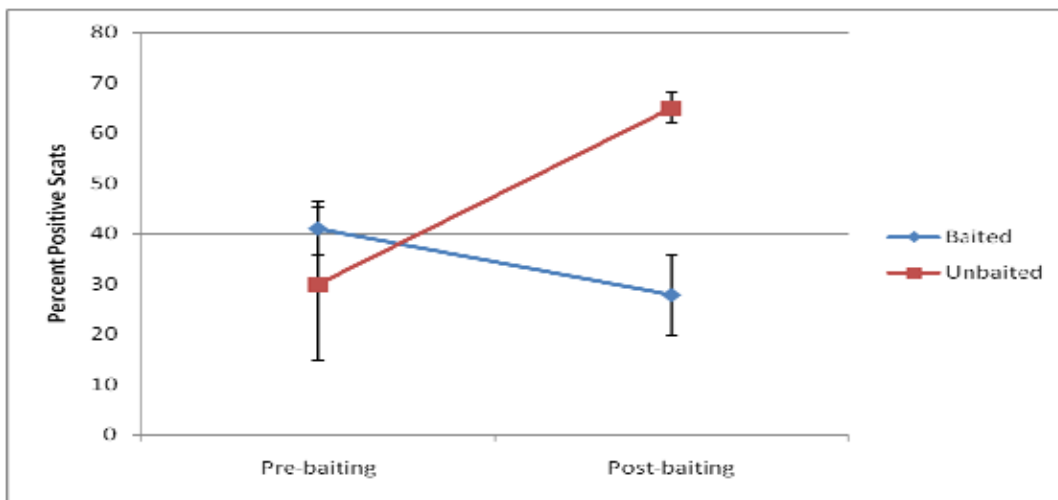


Figure 2. The percent positive scats before and after baiting in 3 baited sites, Palisades 2009 and 2 sites in Middlesex Co., NJ in 1995, and 2 unbaited reference sites in Middlesex Co., NJ in 1995. Error bars indicate standard error. Data courtesy of LoGiudice 2009.

Conclusions:

- For the third consecutive year the Allegheny woodrat capture index has declined, suggesting a decline in the woodrat population within the Palisades Interstate Park, the only known extant site. In addition, results from searches for raccoon scats/latrines suggest a possible increase in the raccoon population based on the number of scats/latrines located, compared to previous years. This year only two individuals were recaptures from previous years (2007) suggesting that at least some adult animals within the population are surviving and not succumbing to *B. procyonis* infection. Additionally, none of the captured animals exhibited any symptoms of infection by *B. procyonis*.
- A documented decline in the percentage of raccoon scats positive for *B. procyonis* eggs indicates that treatment of the population with medicated baits is successfully reducing egg loads in the woodrat environment.

Recommendations:

- Research (LoGuidice 2000, McGowan 1993) suggests that *B. procyonis* infection in Allegheny woodrat populations is a serious mortality factor and can result in rapid population declines for the intermediate host. Therefore, woodrat/raccoon population monitoring at the Palisades Interstate Park site should continue. Periodic searches for raccoon evidence should continue and should include scat analysis for *B. procyonis* egg prevalence.
- Given that raccoon sign (scat and latrine sites) has increased in the area occupied by woodrats, it is recommended that fishmeal/polymer baits, treated with the anthelmintic drug piperazine, be distributed at regularly scheduled time intervals throughout the year (Spring and Fall) in an effort to interrupt the egg-shedding cycle. Piperazine was chosen due to its high efficacy in clearing roundworms and its low toxicity (LoGuidice 2000). We plan to evaluate a bait-dispensing device, which was developed for dispensing oral rabies vaccines to raccoons, for dispensing the piperazine treated fishmeal/polymer baits at the Palisades.
- Due to the continued decline in trapping success, suggesting a declining population, we will conduct non-invasive genetic sampling to determine if inbreeding depression is a potential threat facing the Palisades woodrat population.

Job 2: Bat Conservation and Management

Project leader: Mick Valent, Principal Zoologist

This job is jointly supported by State Wildlife Grants and Multi-State Competitive SWG Program funding.

OBJECTIVE 1: To identify, characterize and monitor summer bat colonies roosting within man-made structures and to provide guidance for proper management of those sites, especially where the federal endangered Indiana bats roost or maternity colonies exist.

OBJECTIVE 2: To identify, characterize, and monitor important winter habitats of New Jersey's bat species, including the federal endangered Indiana bat; and to gather Indiana bat winter population counts to contribute to USFWS database.

Key findings:

- NJ participated in two regional research projects focused on: 1) the immune response of White-nose syndrome (WNS) affected bats and 2) an analysis of body fat deposition in bats from WNS affected and unaffected sites (Kunz and Moore 2008, Kunz et al. 2008). Biologists hand captured seven *Myotis lucifugus* of each sex and age (total n=28 per sampling date) during mid-November, mid-January and mid-March from Hibernia Mine in Morris County, NJ. Sample collection was

coordinated for the two studies so collections were made simultaneously and collected bats were used for both projects.

- Volunteers monitored 3 mine portals during December 2008 and January 2009 for unusual bat behaviors associated with WNS. During late December volunteers observed WNS-associated behavior and dead bats outside of the Hibernia and two Mt. Hope mines. Samples were collected and submitted to the National Wildlife Health Center (NWHC) in Madison, WI for testing. Testing confirmed the presence of *Geomyces destructans*, the recently described fungus responsible for WNS in bats, on the submitted bats. Further observations confirmed the presence of *G. destructans* from samples collected at the upper and lower Copper mines in Warren County, NJ. To date, 5 sites have been confirmed as being affected by WNS.
- A full survey was conducted at Hibernia Mine on January 13, 2009. Biologists followed the newly developed protocol that requires photographic documentation of all bats. Final count and totals for each species are not yet available. The count was conducted simultaneously with the second sample collection for the two research projects in which we participated. Data loggers have been installed in Hibernia Mine since 2004 and were removed in August 2009. Data from the data loggers have not yet been downloaded and analyzed.
- Following several successful and unsuccessful gate breaches at the Hibernia Mine in recent years, the Division of Fish and Wildlife installed a security system on the gate. The system has the ability to notify law enforcement officials when a breach attempt is in progress. This allows a prompt response to the vandalism with the potential to catch the perpetrators in the act of attempting to breach the gate. As of August 31, 2009, the end of this reporting period, no attempts were made to breach the gate since the installation of the security system.
- Additional bat surveys were conducted in Hunterdon County at the Jugtown Mountain Tunnel and Asbury Mine on January 15, 2009, and Leigh Cave on November 29, 2008. A total of 227 *Myotis* spp and 32 *Eptesicus fuscus* were tallied from the Jugtown Mountain tunnel. This represents an increase of 102 *Myotis* spp from the last survey conducted in 2005. No *E. fuscus* were counted during the 2005 survey. A total of 73 bats were counted at Leigh Cave, including 32 *Perimyotis subflavus* and 41 *Myotis lucifugus*. A total of 197 bats were tallied at the Asbury Mine (172 *M. lucifugus*. and 25 *P. subflavus*). This represents an increase of 27 *M. lucifugus* and 17 *P. subflavus* over the last survey conducted in 2004. No signs of WNS were detected at either of these sites during the surveys.
- Data on summer roost sites and habitat use by Indiana bats was submitted by researchers at the Great Swamp and Walkill River National Wildlife Refuges. The data was entered into the Biotics database for inclusion into the next update of the Landscape Project.
- ENSP biologists continued to provide technical assistance to state and municipal agencies and private individuals and land managers regarding the proper eviction and bat proofing of bat-occupied dwellings. In addition, technical assistance was provided for persons wishing to provide alternative roost sites where large colonies were evicted.
- ENSP biologists continued to conduct field surveys of abandoned mines and caves in northern New Jersey to assess their suitability as wintering bat habitat. Most surveys have documented flooded shafts, open fissures, shallow workings with too much airflow or, in some cases, no remaining evidence of previous mine activity. Three mines were located and assessed for suitability as bat hibernacula during the current project year. Two were located in Milton, Morris County, NJ and one in Sparta, Sussex County, NJ. Neither of the Milton mines have suitable habitat for hibernating bats. The Sparta mine was discovered during the previous project year and was monitored for bat activity during September 2008. No bat activity was observed during three nights of observation when the weather was conducive to fall swarming. No bat guano was found outside of the mine suggesting bat use. To date, a total of 127 mines have been field checked for bat suitability.
- Due to the discovery and confirmation of WNS at the Hibernia, Mt. Hope and Copper mines during 2009, it was decided that all internal mine/cave surveys be suspended in an effort to reduce the threat of spreading *Geomyces destructans* to unaffected sites. The NJ Department of Environmental

Protection (NJ DEP) distributed a news release requesting that all people stay out of caves and mines in NJ until further notice.

- NJ biologists contacted a private landowner in July 2009 to request permission to construct a bat-friendly gate over the portal of an abandoned mine that shows substantial evidence of human use and vandalism. Preliminary surveys have tallied 100–200 *Myotis* spp using the mine during the winter months. The landowner has tentatively agreed to allow the construction of the gate, which will take place in the fall of 2009.
- At the request of the NWHC several fresh dead bat carcasses were collected from summer roost sites and sent to the lab for WNS testing. The bats were found dead on the ground below the roost and were from sites that exhibited what was considered unusually large summer mortality. Laboratory results for these specimens are pending.
- Biologists participated in monitoring the large summer bat roost at Supawna Meadows National Wildlife Refuge on July 30, 2009. In cooperation with USFWS biologists and other volunteers, we captured bats emerging from the barn at sunset using harp traps. A total of 164 bats were banded, weighed, sexed, aged, measured (forearm), assessed for wing damage associated with WNS and released. Only four bats exhibited significant wing damage that was potentially caused by the WNS fungus. The bat exhibiting the most severe wing scarring and de-pigmentation was sent to the NWHC for testing.
- One *Eptesicus fuscus* summer roost site was sampled using hand capture during the project year. Eleven *E. fuscus* were captured in the attic of an occupied residence on July 20, 2009. The captured animals consisted of 10 juveniles and one adult female. No evidence (wing scarring and de-pigmentation) of WNS was detected on any of the specimens.
- Five additional summer roost sites were sampled during July and early August 2009. All bats were captured either by hand capture or harp traps. All bats were banded, weighed, sexed, aged and assessed for wing damage and then released at the site of capture. A total of 172 *M. lucifugus* were processed at the six sites.
- The Summer Bat Count was reorganized this year in cooperation with the Conserve Wildlife Foundation of New Jersey. To date, 46 out of 80 volunteers have submitted data for the 2009 summer roost exit counts. Some were returning volunteers from previous years and others were new to the exit counts.
 - Volunteer surveyors were asked to conduct exit counts at known roost sites at least one time (two or more if possible) during the summer roosting season (May 15 – August 1). Volunteers tallied all bats exiting the roost and recorded the numbers on data forms for submittal. Standardized protocols created by the PA Game Commission were distributed to the states late in the season. We attempted to contact our volunteers to request that they follow the new protocols but not all were able to comply.
 - 46 volunteers from nine NJ counties submitted data.
 - Of the volunteers that counted bats during both the pre-volant and post-volant period (n=17), the post-volant count showed an average 51% increase in colony size;
 - For those summer colonies where we had enough information to compare current bat counts with historical observations (2008 or prior; i.e. pre-WNS in NJ (n=40)), the bat colonies showed an average 30% decrease in size in 2009;
 - GIS shape files (points) have been created for each summer roost site that was counted since the project began.
 - All Summer Bat Count data has been entered into the Access database created by the PA Game Commission in an effort to standardize the protocols and data collection throughout the NE.
- Biologists participated in regular agency conference calls to keep apprised of WNS news and changing requirements for surveying, etc.
- Staff attended the WNS meeting in Pittsburgh, PA from August 11-13, 2009 and M. Valent served as task group co-chair on rehabilitation and captive propagation.

- M. Valent was unable to attend the NE Bat Working Group meeting during the project period.

Conclusions:

- The Summer Bat Count was successfully reorganized in 2009 with the assistance of the Conserve Wildlife Foundation of New Jersey. We will use the PA Game Commission's standardized protocols for the Summer Bat Count in 2010.
- Very few (less than 3) bats that were observed during summer roost monitoring exhibited significant wing scarring or de-pigmentation that has been associated with infection by *Geomyces destructans*, the fungus that causes WNS. There are two possible hypotheses for this observation. First, bats that were observed were not from WNS-affected hibernacula. Second, bats that were from WNS-affected hibernacula, were infected with *G. destructans* and would have exhibited wing scarring, were not surviving into late summer.
- Based on observations of mortality at the Hibernia Mine during early, middle and late stages of hibernation it is believed that a significant portion (>80%) of the population succumbed to WNS in the first year that it was observed in the mine. Based on these observations it is expected that the winter populations in the two Mt. Hope mines suffered similar mortality losses as observations at both mines indicate that they too were affected by WNS during the winter of 2008-2009.

Recommendations:

- Continue to support the NJ DEP's recommendation that the general public stay out of caves and mines until further notice.
- Continue field surveys of abandoned mines and caves in northern New Jersey to assess their suitability for wintering bat populations. Mine suitability assessments will be done externally.
- Replace the bat conservation gate at Hibernia Mine. The replacement gate would employ an improved design with new materials that would make breaching the gate more difficult. The current gate security system would be retrofitted to the new gate increasing the security of the mine.
- Identify additional hibernacula that would benefit from the installation of bat friendly gates to prevent human disturbance and contamination with *Geomyces destructans*.
- Continue to monitor known bat hibernacula (externally) in an attempt to identify WNS symptoms. We are looking into the use of video equipment that could continuously monitor mine portals for evidence of abnormal bat behavior suggestive of WNS contamination.
- Continue the volunteer Summer Bat Count project and expand participation. Protocols developed by the PA Game Commission will be utilized in the future in order to standardize the project throughout the region. Continue the partnership with the Conserve Wildlife Foundation of New Jersey to increase volunteer recruitment efforts.

JOB 3: Pinniped Research and Conservation

Project leader: Jeanette Bowers Altman, Principal Zoologist

OBJECTIVE: Develop a pinniped conservation plan to identify and protect overwintering colonies or haul-out areas and other transient occurrences of harbor seals and other pinnipeds.

Key Findings:

- ENSP contracted the Conserve Wildlife Foundation of NJ (CWF) to perform site visits at the three major pinniped haul out areas in the state (within Monmouth and Ocean counties) to conduct population surveys and identify potential threats.
 - Up to 47 harbor seals and 2 gray seals were observed at the Sandy Hook site in February 2009. No seals were observed at the Barnegat Light site during repeated site visits.

- Seals at the Sandy Hook site were observed hauled-out on bayside beach areas as well as on floating patches of ice when available. Hauled-out seals on ice were in closer proximity to deeper and more open water. Low-flying military aircraft (twin-rotor helicopters) were observed flying immediately over the primary Sandy Hook haul-out; although an alarm response was not observed (the incident occurred en-route to the survey site), no seals were present at the haul-out for at least several hours afterward.
- For the second year in a row, an advertisement was included within the NJ Division of Fish and Wildlife's annual Marine Digest, requesting that mariners and/or fishermen report their incidental observations of marine mammals and sea turtles to ENSP biologists using the recently created Marine Rare Species Sighting Form. This form is also posted on the ENSP's website for ease of submittal, although no pinniped sightings data have been submitted to the ENSP from mariners or fishermen as of this report's preparation.
- Submittal of the ENSP's general Rare Species Sighting Report Forms by individuals apart from CWF or the Marine Mammal Stranding Center (MMSC) staff yielded only one new pinniped record for inclusion in the Biotics database.
- ENSP and CWF staff met with NJ Division of Fish and Wildlife's Bureau of Marine Fisheries staff as well as GIS and Marine Science staff from Richard Stockton College (RSC) to discuss alternatives for incorporating marine species data into future versions of the Landscape Project.
- ENSP contracted with RSC to acquire baseline data on New Jersey's largest seal colony (Great Bay) from 1994 to 2008 and to perform a threats assessment and habitat characterization of the colony. Baseline data were submitted in a format compatible with the ENSP's Biotics database and have been entered into the database. Data submitted included specific locations of haul-out sites as well as detailed data associated with individual haul-out sites. The threats assessment evaluated the magnitude of adverse impacts of threats to pinnipeds at haul-out sites based on multi-year observation data, including but not limited to disturbance by motorized watercraft; disturbance by non-motorized watercraft; and disturbance by aircraft. Using RSC data on locations where pinnipeds have been observed, RSC and CWF staff characterized these habitats using several environmental variables, including land-use/land-cover types, wave exposure, distance and access to open water and/or deep channels, etc. Based upon this characterization, GIS tools were utilized in order to determine whether any other coastal areas within NJ also meet the criteria for pinniped habitat in order to direct future survey efforts.
- A threats assessment of the Great Bay seal colony conducted under contract by RSC staff, based on data acquired 1994-2008, revealed the following:
 - Disturbance did not appear to increase over the study period (Figure 1).
 - Boat disturbances were slightly more frequent than aircraft disturbances.
 - No paddled boats (considered the most disruptive boats) were observed in the area during this study, probably due to weather.
 - More extreme seal reactions resulted from boat disturbances than from aircraft; 46% of disturbance events were followed by seals hauling-in/re-entering the water. In contrast, only 9% of aircraft disturbances were followed by that reaction.
 - Aircraft were less disruptive, especially commercial aircraft flying high.
 - The most disruptive aircraft were military aircraft (planes and helicopters) flying low (lower than the 600 ft. allowed by Marine Mammal Protection Act).

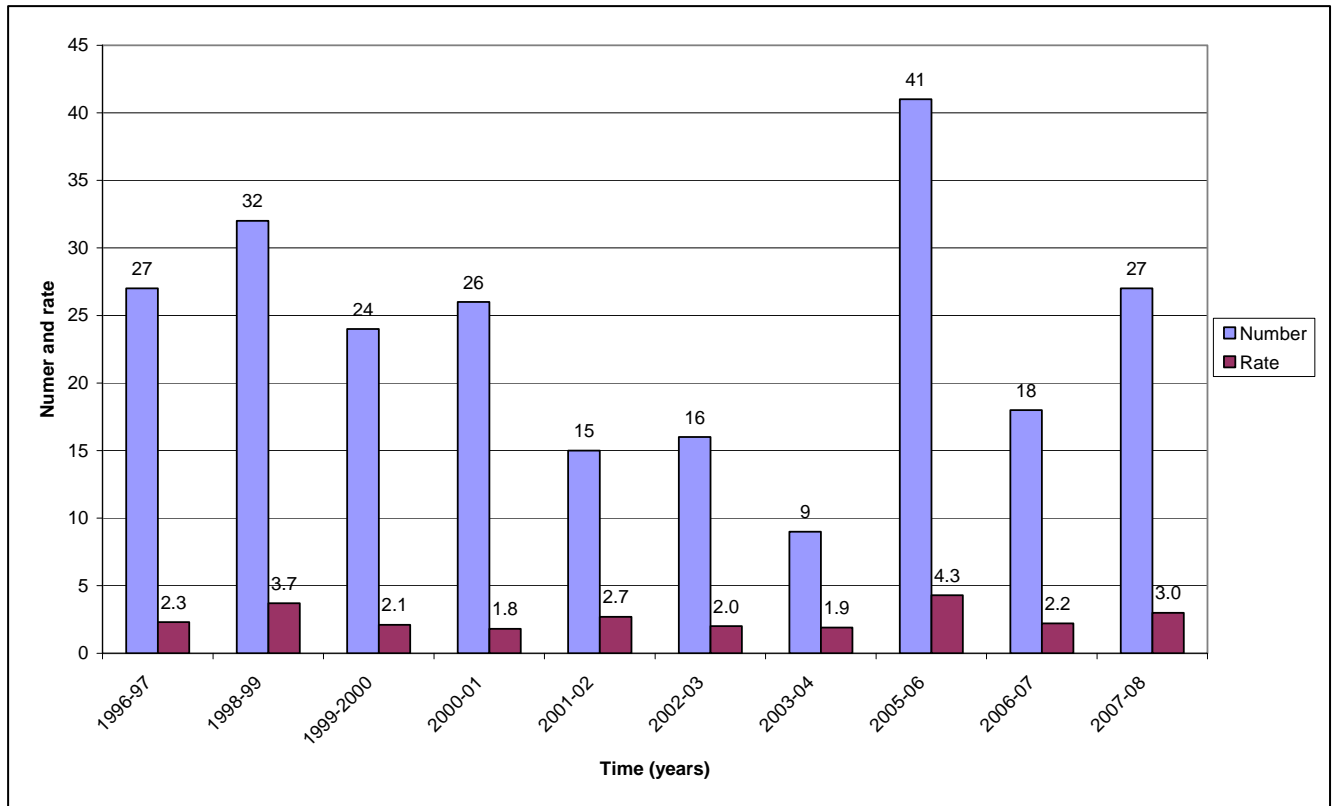


Figure 1: Total disturbances at the Great Bay seal colony; number and rate.

- A habitat characterization of New Jersey’s three major haul-out sites, conducted under contract by CWF and RSC staff, revealed the following:
 - Although the Great Bay site is subject to frequent disturbance, in many measures using GIS, this site comes out as potentially less disturbed than the two other major haul-out sites within the state.
 - Overall, the Great Bay site is most protected because it is farthest from large urban areas, airport or military installations, and the mainland.
 - Inlet size and distance to inlets appeared to be the most significant measures within the habitat characterization.
 - Proximity to deep channels most likely plays a major role in seal preference for haul-out locations.
 - GIS data in NJ are largely terrestrial and those marine data sets that do exist are not consistent across the entire state. If statewide marine GIS data sets were available, the final results may have differed and may have been more accurate.
- Shipboard and aerial marine mammal surveys related to the NJ Wind Power Initiative that had begun in early 2008 are still being conducted. On July 2, 2009, Geo-Marine, Inc. (GMI, the Texas-based consulting firm which is conducting the survey) issued its sixth Quarterly Report, detailing activities and findings between April and June 2009. Both shipboard and aerial surveys have documented harbor seals. However, no GIS data have yet been submitted to ENSP for either 2008 or 2009 project years. Upon the conclusion of survey work, all pinniped sightings gleaned from the survey will be incorporated into the ENSP’s Biotics database.

Conclusions:

- Repeated site visits by CWF staff resulted in survey count data for only one out of three sites visited (Sandy Hook).

- The Great Bay site continues to be the largest NJ haul-out site, in fact, the largest seal haul-out on the US Atlantic coast south of eastern Long Island, NY. Harbor seals continue to be, by far, the most numerous of the seal species present.
- Boat surveys focusing on known haul out locations may be more effective in terms of counting individuals and determining species.
- Predictive mapping, completed by CWF, showed a substantial area of suitable haul-out locations along the inland bay coastlines of Atlantic and Cape May counties, as well as a larger area of suitable haul-out locations around the documented Barnegat Inlet haul-out location.
- Predictive mapping, completed by CWF, revealed no suitable haul-out locations between Sandy Hook and Barnegat Inlet, a substantial geographical gap, despite the existence of several inlets such as Shark River and Manasquan River.
- Although no pinniped sightings data have been submitted to ENSP due to the advertisement placed in the Marine Digest, soliciting help from fishermen and mariners has been effective method for gathering information on marine mammals in other states. Given time, it is possible that valuable sightings data will be collected using this approach..

Recommendations:

- Partner with the Marine Mammal Stranding Center (MMSC) and Richard Stockton College (RSC) to establish a secure web based video camera directed at the Great Bay, NJ seal colony. The camera should be positioned on Division owned property and used to supplement ongoing observations by RSC and MMSC seal researchers.
- Incorporate pinniped sightings information from 2008-2009 GMI, Inc. surveys into Biotics; identify threats to colonies/haul-out sites at new locations.
- Obtain Great Bay colony data from RSC research for the 2008-2009 season and incorporate into Biotics.
- Apply SOAs and Land Use/ Land Cover types to seal occurrences (gray, harbor and harp) for use in future versions of the Landscape Project as well as additional ENSP GIS products.
- Continue to solicit pinniped sightings information from whale watch groups, fishermen and environmental organizations.
- Include information from RSC threats assessment and mitigation strategies into the coastal section (Atlantic Coastal Landscape) of the Wildlife Action Plan.
- Revisit Barnegat Light haul out sites by boat to determine numbers, species present and areas utilized. Boat surveys may be more effective at this location due to the range of habitats and familiarity of individuals with boat traffic.
- Conduct outreach programs that focus on protecting pinnipeds from human disturbance and develop a NJ pinniped conservation plan.
- Identify, acquire and standardize marine data sets for future GIS analysis to better understand seal habitat in New Jersey.

EXECUTIVE SUMMARY

Project:	Reptile and Amphibian Conservation
Federal Aid Project:	T-1-5 (State Wildlife Grants)
Segment dates:	September 1, 2008 to August 31, 2009
Total Project Expenditures:	\$196,000 (\$98,000 Federal, \$98,000 State)

JOB 1: Federal and State Listed Reptiles and Amphibians

OBJECTIVE: To develop comprehensive, landscape-level conservation and management plans for all federal and state-listed reptiles to ensure long-term viability of populations.

JOB 1A: Bog Turtle

Project leader: Brian Zarate, Assistant Zoologist

This job is jointly supported by State Wildlife Grants and Section Six funding.

OBJECTIVE: To monitor and conserve populations of the federally threatened and state endangered bog turtle (*Glyptemys muhlenbergi*) on public and private lands.

Key Findings

- ENSP enlisted the assistance of 15 qualified New Jersey bog turtle surveyors to opportunistically locate bog turtles at known sites as part of an experimental mark-recapture population estimate study. Surveyors were asked to spend one hour at a site once per week during the Phase II survey window beginning in May following Phase II survey guidelines. Over 35 sites were visited. Not all data associated with this project has been turned in by surveyors as of this writing, but over 100 turtles were located during this effort. ENSP expects to analyze the complete dataset this winter.
- ENSP conducted bog turtle surveys using a dog-handler team on 20 days beginning in early May. Some of this work was completed using supplemental funding sources. This was the team's first year of fieldwork surveying in real conditions rather than as training scenarios as in the previous year. Twenty-five different sites were visited and characterized as being known populations (n=13) and low density or unknown populations (n=12). Habitat restoration occurred within the past three years at eight of the sites and, in part, the dog-handler team worked in areas designated as post-treatment habitat.
 - For initial and refreshing training purposes, the dog-handler team detected turtles (n>35) in established plots or other controlled scenarios where a separate surveyor had already identified turtle presence. This technique is used to establish an appropriate detection response by the dog and to reinforce the target's scent to the dog.
 - After initial training, two survey methods were used throughout all visits:
 - *Trial Plots* – ENSP biologists would set up plots roughly five square meters in size. The dog-handler team entered the plot and attempted to detect turtles. After being thoroughly checked by the dog-handler team, a qualified surveyor entered the plot and attempted to find any turtles missed by the dog-handler team as a quality control exercise. In approximately 40 trials there was a single instance where a surveyor found a turtle that the dog-handler team did not detect. The turtle found by the surveyor was probed and had no surface exposure. The dog-handler team found nine turtles over the course of the season using the trial plot method.
 - *Free Searching* – This technique is similar to that used by qualified surveyors during a Phase II study. It is a combination of the dog being allowed to self-target areas to investigate and

- the handler presenting areas for the dog to search. The dog-handler team found five live turtles and one hatchling shell using the free search method.
- In total, the dog-handler team independently detected 14 live turtles plus one hatchling shell at five different sites, which were all known population sites.
 - In only one case the dog detected a turtle that was completely subsurface. The remainder of the detections were of turtles that were all or partially exposed above the surface, but covered by varying amounts of vegetation.
 - Live turtles detected ranged in ages from three years old and up.
 - Two of the 15 turtles were detected in a patch of formerly grazed habitat.
 - Only five of the 25 sites surveyed were visited more than once.
 - The dog-handler team detected at least one bog turtle in May, June, July, and September. During the month of August, only low and unknown population sites were visited and no turtles were detected by either the dog-handler team or independent, qualified surveyors.
 - ENSP conducted visual surveys at a total of 31 bog turtle sites.
 - Three of the sites had been identified as suitable habitat only, without any previous documented turtle observations. Two of these sites appeared highly suitable and supplemental surveys are scheduled for next season.
 - Eighteen of the 31 sites were characterized as unknown or low-density sites, those valued by two or less documented occurrences. No bog turtles were found at any of these sites, although full Phase II protocols were not followed and some sites were only visited once. Thirteen of the sites had not been visited in over five years.
 - Eight of the sites (known populations) had previously been managed, either with restoration grazing or woody veg. management, and surveys were completed here to assess the effectiveness of the management and turtle response. At all but one site turtles were found in or immediately adjacent to managed areas.
 - The Great Swamp National Wildlife Refuge embarked on an effort to increase recruitment at one of their extant sites by encouraging nesting in a semi-wild setting and employing predator exclusion fencing. Contact the Refuge staff for complete details: Mike_Horne@fws.gov. ENSP served only an advisory role on this initiative.
 - At this time, NJDEP lands management staff is not engaged in managing state-owned bog turtle wetlands. ENSP will continue work with lands management staff in the future to assist with woody vegetation and invasive plant restoration.
 - Two new volunteers were enlisted to survey bog turtle sites beginning next season.
 - Bog turtle wetlands priority mapping has been postponed. ENSP looks to continue this effort as part of a larger corridor mapping project that will address all rare species' habitats.
 - Limitations in staff time did not allow ENSP to work with wildlife conservation community partners to become site stewards of low priority bog turtle sites.
 - ENSP assisted USFWS Law Enforcement with two investigations (ongoing) and provided numerous leads and information.
 - Habitat restoration work was completed under supplemental funding sources. Restoration efforts were focused on existing habitat and no potential habitat adjacent to known populations was managed due to limitations in staff and funding.

Conclusions

- Working with NJ bog turtle surveyors to visit known population sites to survey for bog turtles resulted in a fair amount (turtle captures >100; all data not yet received) of mark-recapture data that ENSP will use to estimate population size at individual sites. Surveyors gained from the experience by having access to some of the most productive NJ sites to help add turtle captures to their resumes in order to remain on the USFWS qualified surveyors list.
- On the use of a dog-handler team to detect bog turtles:

- Detection rates are highest when turtles are at least partially above the surface, regardless of season.
- Detection rates are highest when human detection rates are typically the highest following Phase II guidance, i.e., no vegetative monocultures, any habitat where trapping would not be deemed necessary to determine presence.
- Overall search effort is considered detailed and therefore habitat is covered at a slow rate relative to a human moving through a site on an initial pass and then coming back to perform detailed searches in high-likelihood areas. This may affect rate of capture at sites with known populations, but is unlikely to be a factor at low-density sites where turtles are more difficult to detect.
- Detection rates between the dog-handler and qualified surveyor at low-density sites is currently equal.
- An advantage of using a dog-handler team is that the dog may target areas to investigate based on scent alone that a qualified surveyor may overlook based on visual inspection, past experience, etc. and thus a dog may be more apt to find turtles in unexpected areas. Also, the dog will investigate areas where he picks up any scent very thoroughly, regardless of vegetative structure, whereas a qualified surveyor has less of an indication to the possible presence of a turtle.

Recommendations

- After population estimate data is analyzed determine whether or not surveys should continue at sites from this year, or if new sites should be targeted. More importantly, determine if this estimation method is a reliable tool. If so, perhaps look into creating a regional protocol/methodology for estimating population size by site for the northern population.
- Continue to work with the dog-handler team on bog turtle detection by expanding field scenarios. It is without doubt that the team can be used to detect turtles, but we need to better assess what situations, if any, a dog-handler team may be better at detecting bog turtles than a qualified human surveyor. Using the team when turtles are most likely to be up basking appears to be the most effective use of this tool. It is unclear if the dog's capacity to detect turtles when submerged will increase with exposure. Currently, the dog is strong at detecting turtles even when deep in brush and vegetation as long as a portion is above the surface. ENSP looks to use this new tool as an effective way to determine presence at suitable habitat sites and those with low or unknown densities.
- Continue to build a network of trusted volunteers to work with bog turtles, specifically to survey low or unknown density sites and to assist with habitat restoration.
- Continue to coordinate with state and federal law enforcement.

JOB 1B: Wood Turtles

Project leader: Brian Zarate, Assistant Zoologist

OBJECTIVE: To determine wood turtle (*Glyptemys insculpta*) productivity, recruitment and mortality factors for adults, juveniles and nests, as well as home range sizes and habitat selection. Use this information to develop conservation strategies for viable populations.

Key Findings:

- Volunteers monitored artificial wood turtle nest pit use using motion-sensitive cameras and by regular field inspections. The pits were installed between 2005 and 2007 in areas identified as wood turtle habitat by ENSP's Landscape Project and on specific areas on a property suitable for nesting success (e.g. proximal to stream, exposure to sunlight). No pits were installed immediately adjacent to or within 100m of any known wood turtle nesting areas. To date, no wood turtles have been documented to nest using the artificial pits. Successful nesting by snapping turtles and musk turtles has occurred at three different pits in 2009. One dead adult musk turtle with evidence of predation

was found at a pit. Photographs obtained by the motion-sensitive cameras and field inspections have identified turkey, deer, and raccoon evidence on the pits.

- The production of wood turtle nest pit excluders was not completed because none of the artificial pits supported wood turtle nesting. A volunteer working under a state permit covered five wood turtle nests at three nesting sites in the beginning of August, 2009. Identified nests were left uncovered initially to evaluate the degree of predation. None of the identified nests were predated. Covered nests had successful hatching in two cases. The remaining three nests did not have viable eggs.
- Six wood turtle sites were surveyed in the fall of 2008 and six in the spring of 2009. Out of the 12 sites surveyed, four were considered reference sites while the remainder were considered historic falling into two categories: low density (n<5 turtles known) or unknown density. New turtles (all adult individuals) and recaptures (all adult individuals) were found at two of the low-density sites, but nowhere else (except for reference sites). Each site was visited at least twice during optimal survey windows.
- ENSP coordinated with USFWS law enforcement on one project involving wood turtle. This investigation is ongoing.
- No new volunteers were enlisted to survey sites, but existing volunteers assisted in surveying seven different sites. Volunteers are underutilized for this project. The coordination aspect of organizing volunteer efforts takes a significant amount of time.

Conclusions:

- The artificial nest pits do support nesting by turtles, but to date, no wood turtles have used them to our knowledge. Artificial nest areas created at the Great Swamp National Wildlife Refuge in a known wood turtle nesting area attracted wood turtles the following nesting season. This experiment investigates how much time after creation it will take for the local wood turtle population to find these pits built outside of known nesting areas.
- Predator exclusion fencing/screening is an effective tool for protecting turtle nests from predators. Even with this advantage, though, some nests will not produce viable offspring due to any variety of environmental factors. Regular monitoring of egg development may be critical to encourage successful recruitment in low-density sites. The volunteer study showed that in a viable population, only two of five protected nests successfully hatched in 2009. This past June significant rain fell perhaps spoiling some of the clutches, while in previous years low rainfall left some clutches desiccated.

Recommendations:

- ENSP will work with at least one landowner/land steward who has artificial nest pits on their properties to locate gravid female wood turtles. An experimental study is to create pens surrounding the nest pits and place gravid females within the pens to encourage nesting in the artificial pits. Nests can then be monitored closely and the experience may imprint the pits on the female for subsequent annual use.
- ENSP is considering using our scent detection dog to locate wood turtles. Efforts on this front may begin in March 2010 if staff agrees this would be a useful tool.
- The use of volunteers to survey for wood turtles should be expanded.

JOB 1C: Timber Rattlesnake

Project leader: Kris Schantz, Principal Zoologist

OBJECTIVE: To conserve NJ's timber rattlesnake (*Crotalus horridus*) populations through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review, and to identify timber rattlesnake dens and critical habitat use in the Highlands, Pinelands, and along the Kittatinny Ridge where data gaps exist.

Key Findings:

STATEWIDE

- A species identification guide was developed for the State Dept. of Transportation (DOT) maintenance crews to aid the crew in collecting roadkill data. Timber rattlesnakes were one of the ten species described in this guide and over the next year DOT crews will begin to collect data on “dead on road” rattlesnakes in both the Pinelands and Highlands/Kittatinny Ridge Regions
- During this reporting period 76 rattlesnake sightings were entered into NJ DEP’s Biotics database (Biotics). An additional 86 rattlesnake 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.
- ENSP biologists did not attend any conferences focused on timber rattlesnake management as no conferences focused on rattlesnake management were conducted in the northeastern region (Region 5 for the USFWS). The Northeast Partners for Amphibian and Reptile Conservation held a meeting in August 2009, whereby a working group met to discuss rattlesnake management and potential diseases and pathogens, however, only one ENSP biologist (co-coordinator for the meeting) attended and participated in this working group.
- The Biotics database continues to be updated with sighting records for timber rattlesnakes and this information will ultimately make its way into the Landscape Project mapping.

PINELANDS REGION

- In the Pinelands Regions, ENSP staff received 13 calls from NJ residents claiming that they had timber rattlesnakes “uncomfortably close” to their property or residences. Six of these calls were handled over the phone and were determined to be species other than rattlesnakes. The Venomous Snake Response Team physically responded to seven of these calls by traveling to the site where the snakes were being temporarily detained. In two of these cases the snakes in question turned out to be Eastern Garter Snakes. In the other five cases the snakes were rattlesnakes were released according to protocol.
- One nongravid timber rattlesnake was captured and implanted with a transmitter. She was/is being tracked by volunteers and staff of a conservation partner, the NJ Conservation Foundation, two-three times per week during the active season in hope of locating mature males and this fall, her den. She has eluded trackers on occasion throughout the season, and currently has not been relocated since August 15, 2009.
- One male was captured and implanted with a transmitter in late July 2009. Trackers have consistently relocated him through August.

HIGHLANDS REGION & KITTATINNY RIDGE

- K. Schantz completed the analysis of the micro- and macro-habitat data collected within the Highlands Region and along the Kittatinny Ridge for use in developing a model of timber rattlesnakes’ critical habitats in mountainous temperate regions and to refine the current den model [see attachment, *Characterization of Landscape-scale habitat use by timber rattlesnakes (Crotalus horridus) within the Ridge and Valley and Highlands Regions of New Jersey*]. A summary of these findings are as follows:
 - Den model, summary of findings:
 - The inclusion of dens within the interior forest and the exclusion of questionable historic dens led to a revised list of habitat and topographic features that influenced the predictability of the model.
 - Slope at 0-20% rise and deciduous wetlands were negatively associated with dens as areas with shallow slopes and/or the presence of deciduous wetlands decreased the likelihood of den presence.

- Sun index was directly related to the likelihood of den presence. As the sun index value increased, the likelihood of den presence increased, and the sun index indicated that dens are most likely to be found in areas with steep slopes and southerly aspects (as expected per the extensive literature available on rattlesnake dens of the northeast).
- Elevation, although used in developing the 2004-2005 den model, was excluded from the 2009 den model as it decreased the statistical significance ($P=0.078$).
- Using logistic regression and an optimal probability cut-off value=0.11, the 2009 model correctly predicted 92% (296 of 320) of absence locations and 91% (29 of 32) of presence locations. Relative operating characteristic (ROC) plots yielded an area under the curve (AUC) of 0.996 ± 0.015 , indicating that the model could correctly distinguish between rattlesnake presence and absence 99% of the time.
- GIS was used to apply the resultant final model and produce a map of the predicted relative probability of occurrence of dens throughout the study area (the Kittatinny Ridge and the Highlands Region). An evaluation of these predictive maps revealed the 2004 den model valued approximately 16,553 acres (3% of study area) as suitable den habitat and the 2009 model valued approximately 36,939 acres (7% of study area) as suitable den habitat, of which 16,278 acres were also captured in the 2004 model. Of those areas deemed suitable by the 2004 and 2009 models, 12,509 acres (76%, using NJDEP's pre-2008 open space data layer) and 26,797 acres (73%, using NJDEP's 2008 open space data layer), respectively, were/are located on conserved lands.
- The 2009 model has identified potential interior forest hibernacula areas (and likely, the associated open-canopy transient areas) in addition to the more typical den habitats where targeted reconnaissance may result in the discovery of additional populations.
- Critical summer habitat at a large-scale level, summary of findings:
 - Microhabitat analysis confirmed that timber rattlesnakes select particular microhabitats and microclimates, as had been found by Reinert (1984a and 1984b) and Martin (1992a).
 - Analyses revealed that the snakes are selecting for landscape-scale features including the avoidance of paved roads and human-occupied areas, and suggests they may also tend to avoid forest edge and waterways $\geq 10\text{m}$ wide.
 - Snakes were more commonly located within 50 m of rock outcrops compared to random sample points (representing available habitat) regardless of whether or not the analyses included or excluded repeated observations at basking areas.
 - Canopy closure showed statistical differences between used and available habitats among all analyses, clearly indicating the snakes are selecting for a particular canopy condition. Snake-used habitat appeared to have a slightly more open canopy than what was available to them.
 - The majority of snake observations (551 of 756; 73%) for which GIS data was available were found within deciduous forests with $>50\%$ canopy closure. The figures decline precipitously with only 91 observations located within deciduous forests with 10-50% canopy closure [although this exceeded the expected number of observations (28)], 35 observations within deciduous wooded wetlands and 17 observations within mixed forests ($>50\%$ coniferous species and $>50\%$ canopy closure). The remaining 62 observations are in a few additional habitat types with ≤ 10 observations in each.
 - A review of the habitat valued by the species-based patch system in *The Landscape Project* map (Version 3.0, Highlands; Winkler et al. 2008) confirmed that approximately 93% of the study snakes' locations during our work in the Highlands Region (2003-2006) were captured within this newer species-based patch system.
- ENSP volunteers and staff continued to attempt to validate the den model and collect data to help refine the model by surveying for rattlesnake presence at potential dens during the gestation period (September, 2008) and emergence period (April-May, 2009).

- Using the den model and probability maps ENSP developed in the fall of 2004 and spring of 2005, respectively, and 15 historic locations that were identified as dens and fall within the den model boundaries, but were lacking documentation of the actual findings:
 - Approximately 6.7 kilometers of ridgeline (with belts widely ranging in width dependent on geomorphic structures) were surveyed. Four surveys were conducted along the same ~1.5 km stretch with four different teams, a fifth team repeatedly surveyed another ~1.5 km stretch and the remaining surveys were conducted on one day each. Coordination of volunteers' and staff's work schedules continues to be difficult although has improved slightly, with seven volunteers assisting during den emergence (as opposed to last year's four); four surveying on two days, one surveying on one and a half days, and two surveying one day each. For the most part, one ENSP biologist surveyed alone during optimal weather conditions, but did accompany volunteers on two days.
 - One den and transient area were confirmed during spring emergence; the site whereby four surveys had been conducted.
- Three snakes (ID# 0801, 0802, and 0803) captured in 2008, implanted with radio-transmitters and tracked throughout the active season resulted in the discovery of three new den sites during fall ingress. The snakes were captured during emergence, after leaving their den and transient areas, for transmitter removal. All appeared healthy; two had gained weight since their 2008 capture (including the female who had obtained minor injuries from being "rocked" by a resident in 2008), one snake had lost weight.
- No rattlesnakes were captured during the 2009 active season that warranted implantation of a radio-transmitter. All observations could be linked to a known den.
- Training for the Endangered and Nongame Species Program's Venomous Snake Response Team within the northern region was designed this year to include a lecture-style training and a separate handling training in an effort to minimize stress to the training snake. The hope was that the information previously supplied during handling trainings would be addressed during a lecture in an effort to decrease the time spent at each handling training. The handling trainings would then focus only on technique for safe capture, transport and release of the snake, limiting the time the training snake was exposed to people and a strange environment.
 - Fifty-one volunteers (44 returning, seven new members) attended one of two lectures held in the spring, 2009.
 - Nineteen volunteers (13 returning and six new members) attended one of five handling trainings during the summer, 2009. An additional training was held for staff of ENSP's conservation partner, the NJ Conservation Foundation, but no timesheets were submitted for this training.
 - The handling trainings took slightly less time than previous, but still seemed too long ranging from 1.5 – 3 hours depending on the group's size, abilities and number of questions.
 - Only six handling trainings were held due to difficulties coordinating the ENSP biologist (trainer) and volunteers while providing intervals of rest for the snake.
- No "local" coordinators or leaders were established as recommended in 2008. Volunteers seem overwhelmed by their current duties and requirements; no one was recruited to take on the additional responsibility of leading a team of responders.
- No large effort has been made to recruit citizens to report rattlesnake observations to help populate the Biotics database. The members of the Venomous Snake Response Team, many of whom are local animal control officers and park staff, are required to educate citizens and encourage citizen involvement in rattlesnake conservation by reporting observations and sharing their knowledge of snake behavior, needs and protection with friends and neighbors.
- Nine Venomous Snake Response Team members reported responding to 12 complaints on private lands during the 2009 field season, three were confirmed to be timber rattlesnakes in addition to two northern copperheads.

- Of the 66 active members of the northern Venomous Snake Response Team, 40 submitted official timesheets reporting their 2009 response time; 23 volunteers' time was extracted from response team training sign-in sheets.
- One adult rattlesnake (sex undetermined) died after becoming trapped in bird netting. The landowner did not report the snake until after it had died. A responder disposed of the snake, however this snake is not included in the numbers regarding snake response.
- No strategy has been developed to recruit law enforcement to monitor den locations for illegal collection. Due to limited staff, the Bureau of Law Enforcement (BLE) was again unable to monitor the areas ENSP biologists identified as potential collection sites. ENSP staff continued to consider the potential positive and negative effects of releasing den location data to those outside the Department of Environmental Protection.

Conclusions:

PINELANDS REGION

- The first steps in identifying rattlesnake mortality hotspots along roads in the Pinelands was initiated by ENSP and DOT crews will be collecting road-kill data for this species in 2010.
- The Pinelands region's minimal changes in topography and elevation increase the difficulty of locating snakes when tracked 2-3 times per week rather than every other day.

HIGHLANDS REGION & KITTATINNY RIDGE

- Although habitat differences exist (for both the snake-used and available habitats) between the Kittatinny Ridge and the Highlands Region, overall the snakes demonstrated they were/are selecting for particular habitats for both microhabitat and landscape-scale features.
- The ENSP's northern region's Venomous Snake Response Team continued to be effective at rapidly responding to rattlesnake reports made by the general public and providing additional distribution locations for the Biotics database.
- Additional surveys are still needed to validate and refine the den model.
- Unknown den locations and gestation and basking areas persist throughout the Highlands region.
- Basking areas and foraging grounds exist on both public and private lands within the Highlands region. The ratio of potential basking habitat on private versus public lands has not been determined. However, due to the inefficiency of GIS to identify all potential basking habitat, this may be an impossible task at this time.
- Increasing development and roads continue to impede travel between habitats, isolate populations, and limit habitat use.
- Obtaining completed timesheets from volunteers continues to be difficult.

Recommendations:

PINELANDS REGION

- Continue to maintain the Pinelands Venomous Snake Response Team.
- Continue to work with our conservation partner, the NJ Conservation Foundation, to identify critical habitats within their conserved lands and the development of management strategies.
- Identify stretches of roads where high mortality of this species occurs and develop a strategy for reducing snake mortality in these areas.
- Continue to track the two transmitter-implanted snakes to confirm their den locations. Future tracking schedule may need to be changed to track every other day, if resources permit.

HIGHLANDS REGION & KITTATINNY RIDGE

- Continue radio-telemetric research to identify additional critical habitats in areas where data gaps exist. Focus on areas that potentially will identify 1) links connecting populations throughout the northern edge of the Highlands region, 2) populations at risk of human encroachment and increased

human-rattlesnake interaction, and 3) populations using intrastate habitat (NY-NJ) for their summer ranges.

- Continue to recruit and train volunteers for the Venomous Snake Response Team in an effort to capture rattlesnakes from currently unknown populations or from areas where populations are known to exist, but critical habitats are undetermined, and to safely remove snakes from human-inhabited areas for the safety of the snakes and NJ citizens.
 - Reconsider coordinating team leaders for local areas that would be responsible for the collection of completed timesheets in mid-September and mid-November of each year in an effort to improve timesheet submission.
- Recruit dedicated volunteers to conduct den model validation searches. Continue to isolate volunteers to thoroughly survey smaller, more localized areas regularly rather than surveying larger areas sporadically.
- Review and test, when appropriate, additional landscape-scale features to refine the 2009 den model.
- Continue to develop methods to recruit NJ citizens to report rattlesnake observations to help populate the Biotics database.
- Identify stretches of roads where high mortality of this species occurs and develop a strategy for reducing snake mortality in these areas.

JOB 1D: Northern Pine Snake

Project leader: Dave Golden, Principal Zoologist

OBJECTIVE: To identify life history traits and conserve habitat for the state-threatened Northern pine snakes (*Pituophis melanoleucus melanoleucus*). Identifying critical habitats, monitoring trends in populations and habitat, and evaluating meta-population issues are key components of this job.

Key Findings:

- Endangered and Nongame Species Program continued data collection on a long-term (seven-year) study designed to evaluate the movements and habitat use of Northern pine snakes on, and around, the Stafford Forge Wildlife Management Area. During the past field season a total of 23 pine snakes were radio-tracked as part of this study. Thirteen of these snakes were moved from their natural den site in 2006 when a permitting decision was made to move the snakes to accommodate the capping and closure of a “leaky” landfill. The other ten snakes were captured in the area to where the “moved” snakes were relocated. This year we also carried out data analysis on the 2008 field season. Details of these activities are summarized below.
 - **Data Collection During the 2009 Field Season:** As part of the radio-tracking study we determined the location of each study snake every other day throughout the 2009 field season. Habitat characteristics such as percent cover, soil type, distance to nearest tree, and vegetative community composition were recorded each time a snake was relocated. However, data analysis has not yet been carried out on the 2009 field data.
 - **Data Analysis Conducted During 2009:** During this reporting period data analysis was carried out on the radio-tracking data originally collected during the 2008 field season. The activity ranges of the radio-tracked snakes are summarized below; habitat-use analysis of these snakes is still being carried out.
 - **Activity Range:** The mean activity range (using Minimum Convex Polygon) calculated for all snakes with >30 telemetry relocations (n=23) was 253.4 acres or 101.2 hectares. Male and female snakes exhibited very similar activity ranges, but “moved” snakes had considerable smaller activity ranges than “non-moved snakes (Figure 1).

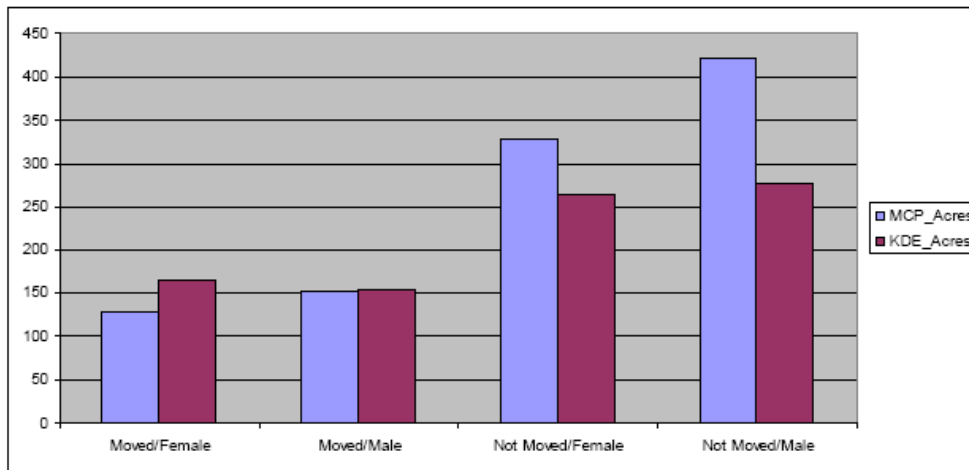


Figure 1. Activity ranges of radio-tracked snakes during the 2008 field season.

- Between September 2008 and August 2009, a total of 47 new pine snake records were reviewed by ENSP biologists and entered into the Biotics database. An additional 83 new records were entered into ENSP’s tracking database (preliminary database used prior to entry into the Biotics database) and are awaiting review by biologists before being added to Biotics.
- The proposed meta-analysis on pine snake data collected by consultants was not carried out this year. ENSP is continuing to work with the Division of Fish and Wildlife’s permits office to get consultants to collect and submit their data so that this analysis can be carried out.
- A species identification guide was developed for State Dept. of Transportation (DOT) maintenance crews to aid crew in collecting road-kill data. Northern Pine Snakes were one of the ten species described in this guide and over the next year DOT crews will begin to collect data on “dead on road” pine snakes in the Pinelands.

Conclusions:

- ENSP has taken several measures to address the impacts of roads on wildlife. Permit applications for road construction or improvements are now being reviewed for their impacts to snakes and recommendations on using wildlife underpasses are being included in responses. Additionally, work on identifying mortality hotspots along roads has been initiated.
- A long-term research project to examine the typical home range size and habitat use of the Northern Pine Snake is currently underway. Preliminary home range and habitat preference results have been reported. Once this study is complete, a final analysis on these data will be a crucial component in the testing and updating of ENSP’s existing pine snake models.
- The Biotics database continues to be updated with sighting records for Northern Pine Snakes and this information will ultimately make its way into the Landscape Project mapping.

Recommendations:

- Continue to collect and summarize findings from the pine snake radio-tracking study and use the data to test existing pine snake habitat models.
- Continue work to identify pine snake “mortality hotspots” along roads in the Pinelands and work to make these roads segments less of an impediment to pine snake movements.

1E: Northern Copperhead

Project leader: Kris Schantz, Principal Zoologist

OBJECTIVE: To determine the distribution of and conserve NJ's northern copperhead (*Agkistrodon contortrix mokeson*) populations through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review, and to identify northern copperhead dens and critical habitat use.

Key Findings:

- One additional northern copperhead location was identified through a random observation by an ENSP volunteer. The observation occurred in an area that can not be linked to any known den, but the snake was not captured for transmitter implant or attachment as the volunteer was not trained in safe capture. This observation has been submitted for approval and integration into the Biotic's database.
- No public call for observation submittals was made due 1) the public's dislike for snakes, venomous or non-venomous and 2) the difficulty in validating the public's observations as many citizens commonly misidentify eastern milk snakes and northern water snakes for copperheads.
- The radio-telemetry study was not conducted due to a lack of implantable snakes captured during spring emergence.
 - ENSP staff (one biologist and one seasonal technician) and volunteers installed a trap line around a known den using drift fence and 15 modified minnow traps (and removed it after snake emergence was complete). Reproductively mature male copperheads were targeted for transmitter implantation so that the weight of the transmitter was $\leq 3\%$ of the snake's body weight.
 - Volunteers and ENSP staff manned the site each day from April 24–May 26, 2009, to 1) ensure passing hikers did not enter the study area, 2) monitor the traps and area within the drift fence periodically throughout the day, and 3) search the grounds for snakes that by-passed the fence line. Six volunteers volunteered 92.6 hours of time at the northern copperhead study site.
 - No clearly identifiable basking areas exist at the site, but rather staff and volunteers observed the snakes in the area used very small, scattered outcrops and single rocks within the sparsely forested habitat for basking.
 - Fifteen - sixteen northern copperheads were located (one may have been a recapture); four within the traps and the remainder were located in the leaf litter and vegetation. Captures included seven females, four males (three subadults, one undetermined age class), five (or six) undetermined sexes including three young-of-year (born in 2008), one juvenile (likely born in 2007) and two undetermined age classes, one of which could have been a recapture.
 - No suitable-sized males were captured for inclusion in the study.
 - One adult female was fitted with an external transmitter and tracked to locate a potential transient area. She moved to a small outcrop where no other snakes were observed. The transmitter was shed.
 - Although the radio-telemetry study was not conducted, the ENSP biologist/project leader discovered additional data that exists regarding home range and habitat use for northern copperheads in Connecticut (Smith 2007 and Smith et al. 2009) and Pennsylvania (Philip Dunning, unpub. data 2006-2009), and has used this data to develop an improved *species occurrence area* (home range depiction) for use in Biotics database and Landscape Map. With the review of home range data collected by Philip Dunning and reported by Charles F. Smith (2007) and Smith et al. (2009), ENSP staff will recommend a revision to the home range buffer surrounding known dens and gestation areas to be increased from the current 177 meter radius to either 1.5 km or 2.0 km radius depending on statistical findings and final evaluation, currently in progress.

- Den search volunteers targeted potential timber rattlesnake dens. Although the two species often share den habitat, no copperheads were observed at the surveyed dens. Instead, volunteers focused their time and efforts at the study site in preparation for the anticipated radio-telemetry study.
- Only one agency (NJ Division of Parks and Forestry) at one location was recruited to assist in improving sightings reported by the public or staff. No other agencies or organizations were contacted due to time constraints. More staff time was required at the study site than anticipated and therefore, den searches took precedence over seeking data on possible historic locations.
- The Endangered and Nongame Species Program's Venomous Snake Response Team within the northern region was developed to respond to both timber rattlesnake and northern copperhead presence on private lands or human-occupied public lands. The majority of the calls warranting a responder to act are timber rattlesnakes. However, in 2009, members of the Venomous Snake Response team reported two confirmed observations of copperheads. For more details regarding the Venomous Snake Response Team and their trainings, please see Job 1C, Timber Rattlesnakes.
- The ENSP released one injured, gravid northern copperhead to experienced rehabilitator, Kathleen Michell, after it was delivered anonymously to a police station with no location information. Stress and capture-related injuries caused the snake to abort five stillborns; however at least two eggs/embryos remain within her.

Conclusions:

- Northern copperhead observations are still lacking:
 - There continues to be few reported or confirmed copperhead observations on private lands.
 - Alternate sources for observations are difficult to obtain, for a number of possible reasons. Lack of awareness of copperhead presence, or a hesitation to share location data; but also staff time constraints limit our reaching out to additional potentially knowledgeable parties.
 - Copperhead observations are limited, which may be in part due to their highly cryptic nature, often more difficult for the public to observe than rattlesnakes.
- Since literature is lacking regarding the home range and habitat needs of the northern copperhead, the additional data provided by Charles F. Smith and Philip Dunning has provided valuable insight into home range size and additional details regarding habitat needs.

Recommendations:

- Continue to obtain northern copperhead location data.
 - Recruit assistance from conservation organizations.
 - Recruit assistance from the Division of Parks and Forestry.
 - Continue to work with the Venomous Snake Response Team.
- Conduct radio-telemetry study on suitably sized copperheads observed in areas that cannot be linked to a known den to identify the den location and develop/implement protective management strategies.
- Provide revised *species occurrence area* (and habitat use) to necessary staff for integration into the Biotics database and Landscape Map.

JOB 2: State-Listed Amphibians

OBJECTIVE: To develop comprehensive, landscape-level conservation and management plans for all state-listed amphibians to ensure long-term viability of populations. These plans will contain concise delineations of critical breeding habitats, terrestrial habitats, and dispersal corridors, strategies and techniques for addressing threats, and long-term monitoring protocols for assessing population status over time.

JOB 2A: Longtail Salamanders

Project leader: Brian Zarate, Assistant Zoologist

OBJECTIVE: To identify viable populations of longtail salamanders (*Eurycea longicauda*), assess threats, and implement actions to protect the riparian and lacustrine habitats they inhabit.

Key Findings:

- Based on the predictive habitat map created last year, targeted surveys were conducted at 56 different locales.
 - New populations were discovered at 11 sites in three different counties (no new counties) and all during the first visit to the site. In seven of the 11 new observations, longtail salamanders (hereafter referred to as “longtails”) were found between crevices/cracks of wet, seepy rock outcrops. The remaining observations were made by flipping rocks and logs.
 - When longtails were not found during the initial visit, a subjective ranking (high, moderate, low) was assigned to each site based upon presumed probability of species’ presence which may help guide return visits the following season. Thirteen sites ranked “high” and this was based on the presence of wet rock outcrops within proximity to potential habitat for developing larvae.
 - All new populations were precisely mapped and integrated into the Biotics database.
- Three historic sites were visited that had been previously ranked as high probability sites, but no new records were documented. A consultant working on a related project did document the species in the general area during the same period so the sites will still maintain the high rank.
- Reference sites were visited to determine emergence dates, but no data on population dynamics was recorded due to staff limitations. With limited time, it was decided that surveying to document new populations was the priority.
- Landscape Project model updates depicting longtail salamander habitat use will be completed during the creation of the next version of the Project, most likely in 2010. While all new longtail observations were integrated into the Biotics database, updated habitat modeling for this species was not initiated.
- No public documents were authored to encourage public data submissions for longtail salamanders. Staff time limits prevented an article from being written for inclusion in the spring edition of the Conserve Wildlife Foundation newsletter.
- Volunteers assisted with surveys at 11 different sites and no new observations were made when volunteers surveyed on their own.

Conclusions:

- Additional populations of longtail salamanders exist in the state. During visits to unknown sites based upon areas identified by the predictive map, longtails were discovered 20% of the time. The majority were found in seepy rock outcrops, a habitat type/requirement observed consistently across many of the known sites as well. This particular habitat feature is difficult to identify using GIS technology, but the predictive map in conjunction with topography layers helped to target survey areas.
- Historic sites visited this year have not had longtails observed since 1991 or earlier. The observations of the species nearby to these known sites by a consultant were all based on single specimens and were only found after at least 2 visits. In this particular area, the density may be low or specimens relatively difficult to find. Due to the nature of the surrounding landscape, it is likely the species still persists in this area and has simply remained undetected during recent surveys.

Recommendations:

- Continue to use the predictive map to target future surveys. Apply additional GIS filters to target for specific habitat features.

- Target areas considered high probability for additional surveys. Multiple visits to the sites may be required to determine presence.
- Perform counts at a minimum of five reference sites to begin documenting population size.

2B: Amphibian Crossing

Project leader: Kris Schantz, Principal Zoologist

OBJECTIVE: To identify amphibian breeding migration corridors along county and rural roads in need of protection through raised roads, culverts, and/or temporary road closings.

Key Findings:

- The ENSP, New Jersey Audubon Society (NJAS) and Conserve Wildlife Foundation of NJ (CWF) partnered to conduct a temporary road closure at a high-density amphibian migration corridor, survey the aforementioned site and educate citizens in the area, and to recruit volunteers to survey and confirm targeted potential crossings.
- November and December 2008, staff of the ENSP, New Jersey Audubon Society (NJAS) and the Conserve Wildlife Foundation of NJ met with and recruited the participation of four adjacent towns (Independence, Allamuchy, Liberty and Frelinghuysen Townships of Warren County) to implement the road closure at a high-density amphibian migration crossing. The closure required alternate driving routes through neighboring towns.
 - A total of 37 volunteers were enlisted, trained and organized to assist with the amphibian crossing surveys at this study site. Many additional members of the public responded to newsletter and press articles about the project but were not enlisted due to their prohibitive distance from the survey location.
 - The road was temporarily closed on two nights and volunteers manned the 150-meter length survey site where the majority of amphibian crossings occur to identify species and count individuals.
 - March 8 (1830 hours) – March 9 (0430 hours), 2009: Predicted rain did not begin until 2230 hours lasting only a few hours and then rain was intermittent and very light between 0200 and 0420 hours. At 0420, lightening activity increased in the area and surveyors abandoned the site for safety. From 0430 – 0540 hours, heavy rains were accompanied by a high-density, but not counted, movement of amphibians.
 - Volunteers counted 396 amphibians crossing the road during the survey period with the majority (188) crossing from 0000 - 0230 hours when temperatures ranged from 7.4 – 7.0°C (45.32 – 44.6°F), respectively, and rain ranged from a steady drizzle to intermittent to no rain. One hundred sixty-eight (168) crossed from 2130 – 0000 hours when temperatures ranged from 9.7 – 7.9°C (49.46 – 46.22°F), respectively, and rain ranged from a steady drizzle to intermittent to no rain. These figures exclude approximately 15 spotted salamanders returning to the upland habitat.
 - Upon site breakdown from 0440 – 0500 hours, when heavy rains occurred, the project leader counted approximately 20-30 spotted salamanders, 15-20 wood frogs and 15-20 spring peepers traveling through the 150-meter long study site.
 - Four cars passed through the corridor during the road closure. Volunteers quickly removed crossing amphibians out of the cars path of travel.
 - March 26 (1830 hours) – March 27 (0230 hours), 2009: The site was closed early due to changing unfavorable weather conditions, no rain.
 - Volunteers counted 597 amphibians crossing the road during the survey period with the majority (241) crossing from 2130 – 0000 hours when temperatures ranged from 6.5 – 6.1°C (43.7 – 42.98°F), respectively, and rain ranged from a light mist to no rain/mist.

Two hundred thirty (230) crossed from 1900 – 2130 hours when temperatures ranged from 7.9 – 6.0°C (46.22 – 42.8°F), respectively, and rain ranged from a steady drizzle to a steady, hard rain. These figures exclude approximately 20-30 amphibians returning to the upland habitat.

- No cars passed through the corridor during the road closure.
- Staff and volunteers recognized that this temporary road closure and subsequent alternate driving routes increased traffic on two neighboring roads, each of which hosts amphibian migrations. Although no counts were conducted, it is likely this closure caused increased mortality at the other two locations.
- The majority of the amphibians at the study site appeared to have migrated to their breeding pools over five nights during the 2009 season, with an early migration in mid-February. Staff and volunteers were only able to identify and coordinate two closures using the available predicted weather conditions.
- After the Scope of Work for the conservation partners was developed, it was decided that the second intended stationary survey location would not be assigned a full volunteer team but would instead be better ground-truthed this year to determine the precise amphibian corridor boundaries and whether a more intensive survey effort would be warranted.
- An additional 17 teams of 2 were assembled and provided instructions, maps and equipment for conducting “drive-around” surveys at targeted locations where crossings may occur, with an emphasis on Warren and Sussex counties. These locations were identified through the use of the ENSP’s vernal pool mapping, aerial photographs and topographic maps. Six of these teams were made up of biology students from Sussex County Community College, a first-time partnership. Volunteer teams were assigned 38 survey points from the following townships, of which 27 were surveyed and an additional 12 new locations were located, including one in Kinnelon Boro, Morris County:
 - Liberty, Warren Cty. (2 teams)
 - Stillwater, Sussex Cty.
 - Edison, Middlesex Cty.
 - Allamuchy, Warren Cty.
 - Hampton, Sussex Cty.
 - Frelinghuysen, Warren Cty.
 - Lafayette, Sussex Cty.
 - Hope, Warren Cty.
 - Chester, Morris Cty. (2 teams)
 - Andover, Sussex Cty.
 - Rockaway, Morris Cty.
 - Fredon, Sussex Cty.
 - West Milford, Passaic Cty.
 - Survey of 27 potential crossings ranging from 0.03 km – 2.2 km lengths at 0.5-hour intervals during potential emergence nights when weather conditions were appropriate resulted in amphibians being observed crossing at 12 of the 27 assigned locations in addition to 20 new locations discovered by the volunteers (Table 1).
 - Volunteers visited assigned locations on four different nights under optimal weather conditions, unless they observed a high-density migration prior to the fourth survey night. However, of the 39 corridors for which data was provided, five were surveyed three times, twelve were surveyed twice and twenty-two were visited only once. None exhibited a mass migration and therefore, should have been surveyed more frequently.
 - The 32 migration corridors were located within ten towns in four counties (Warren, Morris, Passaic and Sussex).

Table 1. Confirmation of amphibian migration corridors.

County	Potential sites (assigned)	Assigned sites surveyed	Corridors adjacent to or at assigned potential sites	Newly discovered sites
Warren	12	8	4	5
Sussex	16	14	6	5
Passaic	2	2	0	7
Morris	4	4	2	3
TOTALS	38	27	12	20

- Of the 71 total volunteers enlisted in the 2009 Amphibian Crossing Survey Project, 35 were new to this effort and 36 were returning volunteers.
- No model has been developed to identify other potential crossings as we have been unable to confirm significant crossings through the “drive-around” surveys and obtain the necessary information. Failure to confirm locations was a result of amphibians traveling over multiple nights during a 2–3 week period in lower densities, rather than moving *en masse*, making it difficult to determine the crossings’ importance to the local population.
- ENSP has met three times with the NJ Department of Transportation and the DEP’s Division of Land Use Regulation to discuss possible resolutions and funding opportunities to implement a permanent management strategy (e.g., culverts, raised roads) at the stationary study site, in addition to discussing long-term solutions statewide for all wildlife crossings.
- Five organizations/ agencies, in addition to the Conserve Wildlife Foundation of NJ, the NJ Audubon Society, and the aforementioned, four towns, continued their partnership with the ENSP and assisted in surveys including the Schiff Nature Preserve and Land Trust, Mendham Twp. Environmental Commission, Morris County Park Commission, Montville Twp. Environmental Commission, and the Friends of Wallkill River National Wildlife Refuge (NWR) and the NWR staff.
- ENSP staff has prepared a draft set of guidelines for managing and protecting amphibian migration corridors. The text is currently under internal review. The end product will be available to the public to provide guidance for anyone interested in protecting migration corridors in their local area.
- A volunteer and former teacher, Mrs. Karen Lund, with assistance from CWF and NJAS, led educational programs at eight of the local elementary and middle schools to educate the children (and teachers) about the important role of amphibians in our natural world, threats they face, the impacts of roads and traffic on populations and our efforts to protect a local amphibian population. Attendance at the programs included 392 students and 21 adults.

Conclusions:

- Data collection continues to be complicated and limited as migration predictions are only as good as weather predictions and as they have often (2003-2009) occurred over the course of multiple nights in lower densities.
 - The difficulties in predicting every migration night in order to implement a road closure at the main study site for this project and the potential effects of diverting traffic from one area to another has demonstrated the need for more permanent management efforts (e.g., culverts, raised roads) that will not impede traffic nor negatively impact amphibian migrations.
- “Drive-around” surveys were a successful means of gathering general information about potential crossings and required minimal volunteer management. However, volunteers continue to limit their visits to survey locations, which may hinder our efforts to confirm crossings based on vernal pool presence and the topography.
- Predicting mass amphibian migrations continues to be difficult. Since 2002’s mass migration, under perfect weather conditions, there has been only one year (2004) when conditions were suitable for a

mass migration at the study area. Surveyors missed the migration was missed as it occurred in the early hours of the morning when no volunteers had been recruited to survey. All other years consisted of several nights of semi-suitable conditions, supporting migrations over multiple nights at lower densities.

- Road closure efforts and local notification must be improved to prevent vehicles from traveling through the sites during amphibian migrations. Additionally, alternate routes supporting road closures must be studied to ensure non-target amphibian crossings aren't impacted.

Recommendations:

- The ENSP must determine a means of protecting the amphibians at the major crossing site without negatively impacting other amphibian populations along the detour routes. This will likely require the road not be closed and surveyors on site to rescue and count individuals until a more permanent management strategy can be implemented.
- The ENSP must continue to work with the NJ Department of Transportation, the DEP's Division of Land Use Regulation and the local town to develop, fund and implement a permanent management strategy (e.g., culverts, raised road) at the study site. This site would be a pilot project to help better understand the requirements of implementing permanent measures and the needs for monitoring its success.

JOB 2C: Eastern Tiger Salamander/ Southern (Cope's) gray treefrog

Project leader: Dave Golden, Principal Zoologist

OBJECTIVE: To protect individual breeding sites, populations, and population connections, and to investigate other habitat requirements to assure long-term viability of the Eastern tiger salamander (*Ambystoma tigrinum tigrinum*) and Southern gray treefrog (*Hyla chrysoscelis*).

Key Findings:

- As part of a 21-year follow up survey of a tiger salamander breeding pond ENSP installed a 500-foot drift fence (containing 21 pitfall traps) around a vernal pool located in Cape May County, New Jersey. Traps were opened on June 5, 2009, and remained open through August 31, 2009, for a total of 1,848 trap nights (88 nights x 21 traps) during this reporting period. During this period, the pitfall traps captured 19 Eastern tiger salamanders, 207 marbled salamanders, 88 red-spotted newts and one redback salamander. A similar survey was conducted at this site in 1987 and 1988, prior to the construction of an Acme shopping center. In the late 1980s this pond was situated in a large forest complex. Today, the pond exists in an 18.5-acre forest remnant that is surrounded by extensive development. During the same survey period (June, July and August) in 1987 and 1988 pitfall traps captured 210 and 108 Eastern Tiger Salamanders, respectively.
- ENSP identified potential Eastern Tiger Salamander breeding ponds by reviewing aerial photography and scanning for unsurveyed "ponded" areas within the known NJ range for this species. Between December 2008, and February 2009, ENSP staff visited 10 unsurveyed ponds that appeared suitable for Eastern Tiger Salamanders and conducted surveys for this species. None of these ponds had previously been documented as containing this species. Eastern Tiger Salamanders were documented to be breeding at 1 of these ponds and over 100 egg masses were observed. This information was entered into the Biotics database.
- In the theme of developing a recovery plan for Eastern tiger salamanders in New Jersey, ENSP evaluated land-ownership and threats to each of its 14 documented tiger salamander sites (ponds or small complexes of ponds). Land ownership of these 14 sites had the following breakdown: State or Federal land = five sites (36%); private land with deed restriction = three sites (21%); private land with no restrictions = three sites (21%); Municipal land = two sites (14%); non-profit conservation organization = one site (7%). Over the past year, ENSP staff worked with New Jersey's Green Acres

Program and a mitigation banking company in an attempt to secure ownership of one of the three sites that remains in private ownership (without a deed restriction). These efforts appear to have been successful and the mitigation banking company currently has contractual “option” to purchase on this site. Green Acres could not offer the landowner the amount he was asking so the mitigation banking company stepped in to purchase the property. Their plans are to purchase the property, enhance it for tiger salamanders and then transfer ownership to the state. On two other tiger salamander sites it was determined that the greatest limiting factor to tiger salamander breeding success (or greatest existing “threat”) was the shallow annual water depth of the breeding ponds, which resulted in the premature drying of these ponds. ENSP initiated management projects (described below) to enhance these ponds for tiger salamanders.

- In cooperation with private landowners and the US Fish and Wildlife Service, ENSP planned and carried out a habitat enhancement project at one of the 14 known Eastern tiger salamander sites in New Jersey. The project, which was carried out in October 2008, consisted of mechanically deepening the pond to lengthen the hydro-period of this vernal pond. In previous years, this pond was always very shallow and would dry up completely by February or March. Eastern tiger salamander larvae would not have enough time to develop into adults as a result of this premature drying and evidence of desiccated larvae could be found on the dried pond bed during most years. Following the enhancement project, the pond filled to a record level during the 2008-2009 winter (depth = 45”) and a record number of Eastern tiger salamander egg masses were recorded (68 egg masses). Water remained in the pond throughout the summer of 2009. This is the first year since 2004 (when the Eastern Tiger Salamanders were first documented in this pond) that water remained in the pond late enough into the season for salamander larvae to successfully undergo metamorphosis into adults.
- A second, and similar, enhancement project is being planned for an Eastern Tiger Salamander located on property owned by The Nature Conservancy – New Jersey Chapter (TNC). ENSP submitted a project proposal to TNC in July 2009, and is awaiting their final approval to move forward with the project.
- The Eastern tiger salamander radio-telemetry pilot project that was proposed during this reporting period was not carried out. ENSP had second thoughts about this project due to concerns about how the transmitter attachment might harm the study animals.
- During the 2008-2009 reporting period no surveys for Southern gray treefrogs were performed and the proposed range-wide analysis of landownership of Southern gray treefrogs ponds was not carried out. Instead, all efforts under this Job (Job 2C) were put into management for Eastern tiger salamanders because it was determined that tiger salamanders were the species at more immediate risk in New Jersey.

Conclusions:

- Results of the drift fence study revealed that the relative abundance of Eastern tiger salamanders at the “Bayshore Mall” site greatly declined over the past 21 years. The low numbers of salamanders at this site in 2009 may suggest that the population is no longer viable.
- Egg mass surveys of suitable Eastern tiger salamander breeding ponds resulted in the documentation of 1 new occupied pond in Middle Township, NJ.
- A small, inexpensive enhancement project at a vernal pond in Lower Township, NJ greatly increased the suitability of the pond for Eastern tiger salamanders.

Recommendations:

- Continue the 21-year follow up drift fence study at the Bayshore Mall to verify the findings of low relative abundance during the 2009 survey.
- Work with private landowners (such as TNC) to carry out additional enhancement projects on marginal Eastern tiger salamander breeding ponds.
- Incorporate findings from the 2009 Bayshore Mall Study into the Biotics database.

JOB 3: NJ Herp Atlas Project

Project leader: Dave Golden, Principal Zoologist

OBJECTIVE: To document distribution and relative abundance of New Jersey's reptiles and amphibians through comprehensive citizen-based surveys and to integrate these atlas findings into the Landscape Project.

Key Findings:

- 2009 represents the 14th year of the New Jersey Herp Atlas Project. ENSP had hoped to generate a final (or at least interim report) of the findings from this project over the past 14 years. Unfortunately due to limited staff availability, this report was not initiated during the 2008-2009 reporting period.
- While all the data for the 2008-2009 Herp Atlas survey year have not yet been entered, ENSP staff did pull out all the sightings for endangered and threatened species. Herp Atlas volunteers submitted 11 endangered species sightings (including Timber Rattlesnakes, Corn Snakes, and Eastern Tiger Salamanders), and 121 sightings of threatened species (including Wood Turtles, Longtail Salamanders, Northern Pine Snakes and Pine Barrens treefrogs). These sightings were prepared for entry into the Biotics database.
- In cooperation with USGS, 63 calling amphibian survey routes were established in New Jersey in 2003. In 2009, volunteers surveyed a total of 25 of these routes. Many of the routes were surveyed multiple times resulting in a total of 64 surveys as part of this project. Fifteen anuran species were detected statewide during the 2009 CAMP surveys. These data were incorporated into NJDEP's Biotics database as well as into the North American Amphibian Monitoring Program's national database.
- A total of 308 volunteer hours were logged for this project over the past year. These are broken down as follows: fourteen Herp Atlas volunteers reported a total of 168 volunteer hours and 27 Calling Amphibian Monitoring Program volunteers reported 140 hours of volunteer time.
- Neither the northern leopard frog nor the Italian wall lizard is included on the list of New Jersey's Nongame Wildlife. However, it has been determined in recent years that breeding populations of both species occur in the state. The extent of the distribution and size of the population of these species in New Jersey remains unknown and ENSP had hoped to conduct more extensive surveys for these species in 2008-2009. These surveys were unable to be initiated, however, due to limitations on staff's time and an Agency prioritization on imperiled species.
- The online submittal form (which is part of a larger Endangered and Nongame Species Program-wide data submittal project) is still in development by the GIS staff and their contractor. It was not completed by the end of the SWG project year (August 2009) but may be by the end of the survey year in 2010.

Conclusions:

- After 14 years of data collection, the Herp Atlas Project is still producing results, however real consideration should be given to bringing closure to this project. The comprehensive report of findings that was planned for this year was not completed.
- The number of routes surveyed as part of the Calling Amphibian Monitoring Program (CAMP) remained constant at 25 during the past 2 years and slightly more surveys were conducted in 2009 than 2008 (64 in 2009 as compared to 59 in 2008).

Recommendations:

- Continue to recruit and train volunteers for the Calling Amphibian Monitoring Program so that each of the 62 New Jersey routes is surveyed in 2010.

- Contact all Herp Atlas volunteers to determine which volunteers are still interested in the participating in this project. Based on these phone interviews determine if the Herp Atlas Project should continue into the future in the same format as previously conducted or if modification to the format is needed.
- Consider developing a structured survey for Italian wall lizards to estimate the extent of its range in New Jersey.

EXECUTIVE SUMMARY

Project:	Invertebrate Conservation
Federal Aid Project:	T-1-5 (State Wildlife Grants)
Segment dates:	September 1, 2008 to August 31, 2009
Total Project Expenditures:	\$66,000 (\$33,000 Federal, \$33,000 State)

JOB 1: State Listed Mollusks

Project leader: Jeanette Bowers Altman, Principal Zoologist

This job is jointly supported by State Wildlife Grants and Section Six funding.

OBJECTIVE: To monitor populations and create conservation plans and strategies to aid in the recovery of listed species found throughout New Jersey, including the dwarf wedgemussel, brook floater, green floater, yellow lampmussel, eastern lampmussel, eastern pondmussel, tidewater mucket, and triangle floater.

Key Findings:

- We surveyed 17 stream sites totaling 34 station segments in seven counties for listed freshwater mussels during the survey period. Timed searches for mussels were conducted at historic locations and/or previously unsurveyed suitable habitats.
- We performed habitat assessments and/or preliminary searches at 18 additional sites in six waterways to determine if larger surveys were warranted.
- EPA Habitat Assessment Field Data Sheet scores (high and low gradient combined) ranged from 129 (Stow Creek, Salem County and Delaware River, Hunterdon County) to 171 (Musconetcong River, Warren County), out of a possible 200. Previous ENSP studies have shown that mussels occur in a range of 68-173, occurring most frequently at an average score of 121. All sites surveyed scored within the preferred habitat range.
- We compared 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. In 2009, an anomaly was encountered at Stow Creek, Salem County. The frequency of observation of a single species (Eastern elliptio) was estimated at more than 55 per minute. This site scored the lowest total habitat score for the 2009 sampling period (129.) Likewise, scores were low for riparian zone width, total vegetative cover, sediment deposition, epifaunal/available cover and velocity regime at this site. No other freshwater mussel species were observed at this site. This anomaly is probably directly associated with the high tolerance of this species to less than ideal conditions as well as a lack of predation, but is consistent with peak abundances observed at lower habitat scores (see above.)
- If Stow Creek is eliminated from the analyses as an outlier, mussel abundance was most closely correlated to total riparian zone width scores. Other parameter scores associated with mussel abundance included total vegetative cover and frequency of riffles. Of the above-mentioned associations, prior investigations from 2000-2005 showed that total riparian zone width score was most closely associated with freshwater mussel abundance.
- Water quality values were as follows: pH ranged from 6.3 to 8.8, water temperatures ranged from 13.0 to 24.0 Celsius, dissolved oxygen ranged from 6.5 to 10.3 ppm.
- Catch per unit effort (CPUE) for all species combined during time searches was highest in Stow Creek, Salem County, with 55.5 live mussels/minute and 8.35 shells/minute.
- We performed quadrat sampling at one site in the Pequest River, Sussex County to determine if buried Dwarf wedgemussels and other listed freshwater mussel species would be detected through

random excavations. Eleven 0.25 m quadrats (ten random, one selected) were collected from soft embedded substrates in the immediate area where Dwarf wedgemussel shells and Triangle floaters had been located earlier in the season.

- We attempted to access the SW Branch Rancocas Creek at numerous road crossings in an attempt to survey for Tidewater muckets. Unfortunately, access to the creek is severely limited due to private property, inability to park legally, or extremely deep water.
- We found nine species of freshwater mussels during field activities, including the Dwarf wedgemussel, Brook floater, Eastern elliptio, Eastern floater, Triangle floater, Alewife floater, Creeper, Tidewater Mucket, and Paper pondshell. The Eastern elliptio was by far the most prevalent and widespread mussel species documented. Species richness was highest in the Salem and Alloway creeks, Salem County, with five species recorded in each waterway.
- The federal/state endangered Dwarf wedgemussel was present at two locations along the Pequest River. We found two Dwarf wedgemussel valves at a new location in the Pequest River, Andover Township, Sussex County. A fresh dwarf wedgemussel shell was discovered at this location during spring habitat assessments. The site, which is located near the headwaters, has extremely suitable habitat; ideal flow, sandy substrate and an abundance of the host fish, tessellated darter. Surveys for dwarf wedgemussels were focused in this area instead of the Paulins Kill this season, where the population boundaries have previously been determined. In addition to the Sussex County site, one probable partial Dwarf wedgemussel valve was found at a new location in the Pequest River, Warren County, downstream of the Pequest River hatchery. The Triangle floater (two live, three shells), a state threatened species (T), was also present at the Andover site.
- The Brook floater, a state endangered species, was documented in the form fresh shells at two locations (Lamington River, South Branch Raritan River).
- We found two Tidewater mucket (threatened) shells at a new location in Alloway Creek, Salem County. One of the shells was fairly new, with a shiny nacre and little weathering.
- We recorded Triangle floaters (T) at six survey locations and two sites assessed for habitat suitability. Creepers (SC) were documented at only one survey location this season.
- One Eastern pondmussel shell was recorded in the Raritan River, Middlesex County, during a habitat suitability assessment.
- Eighteen Eastern elliptio were collected during quadrat sampling (11 live, seven shells), with two shells observed on the surface and sixteen found subsurface (11 live, five shells). Eastern elliptio were found on the surface in one out of 11 samples, and subsurface in eight of 11 samples. No other species were documented during the quadrat sampling effort, despite previous findings of other species present at the same location using timed searches.
- Volunteers continued to identify and survey freshwater mussels as part of the freshwater mussel atlas effort. The volunteers are covering Salem, Cumberland and Atlantic counties. Volunteers were given copies of the draft field guide, along with other information and sample shells of common species. To date, volunteers have collected data from three river systems.
- All new locations found to have federal and/or state listed mussels 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 Riparian Landscape Project mapping to identify critical areas for listed mussel populations.
- ENSP began developing a methodology to streamline the Category 1 site selection process based on the presence of listed freshwater mussels and other aquatic obligate species. We used the Highlands Region (which contains a stream layer) as a pilot area to determine if the C1 site selection process could be streamlined using Landscape Project mapping as an initial screening tool. Once finalized, the method will be presented to the DEP's Bureau of Water Monitoring and Standards for staff input and approval.

Conclusions:

- Based on habitat suitability assessments and preliminary searches, nine out of 18 sites warrant further survey work to determine freshwater mussel species composition and abundance.
- Habitat characteristic analyses are consistent between the 2009 dataset and the 2000-2005 observations; riparian zone width is most closely correlated to mussel abundance, followed by total vegetative cover.
- The new Dwarf wedgemussel sightings in the Pequest River expand the upper population boundary by approximately six miles and into the river's headwaters. Based on previous sightings, Dwarf wedgemussels may occupy a stream segment of approximately 22 miles in length.
- Discovery of Dwarf wedgemussels in a new area of the Pequest River underscores the need for more surveys in New Jersey. It is possible that other populations occur in the previously unsurveyed streams with suitable habitat and appropriate host fishes present.
- The Lamington River site, which was last surveyed in 2001, appears to still support a reproducing population of Brook floaters. The shell recovered during this season's survey efforts was fresh and from a young individual (44 mm x 25 mm).
- Quadrat sampling does not effectively sample mussels that are rare. In softer substrates, more Eastern elliptio may be hidden under the surface than are found above it. Quadrat sampling increased the estimates of abundance density of Eastern elliptio by almost 9-fold. These findings are consistent with previous quadrat sampling efforts in the Lamington River, Barton Run and another Pequest River location.
- Quadrat sampling is clearly not appropriate to use to determine which species exist in a stream since it does not sample enough of the bottom. Our findings indicate that quadrat sampling is only appropriate to use in soft substrates to better estimate densities of abundant species.
- Based on SWG funded and previous ENSP freshwater mussel surveys, Triangle floaters are widespread but not abundant, indicating that the Threatened status is still warranted.
- Landscape Project mapping may be limited in its usefulness as a tool for selecting potential C1 stream segments. For now, it appears as though using Landscape should be the initial step in alerting biologists to areas where obligate aquatic species occur.

Recommendations:

- Continue surveys for listed species in previously unsurveyed suitable habitats to document distribution.
- Continue collecting and analyzing habitat data to determine relationships with freshwater mussel abundance and diversity.
- Continue focusing survey efforts in the Pequest River to determine Dwarf wedgemussel population boundaries and size.
- Continue searches in Alloway Creek to document distribution of Tidewater muckets.
- Continue searches the Lamington River to document distribution of Brook floaters.
- Request permission from landowners to allow biologists access to the SW Branch Rancocas Creek to survey for Tidewater muckets.
- Perform a status assessment using the Delphi process for all native freshwater mussels within the next year. The status assessment for mussels has been delayed somewhat within the past two years by time constraints and the prioritization of other species groups that had not been previously reviewed using the Delphi method.
- Continue to refine Category 1 site selection process based on the presence of aquatic obligate species. Work with DEP's Water Monitoring and Standards to recommend stream classification upgrades in areas with listed mussels using the new methodology.
- Continue work on atlas and solicit assistance from additional Wildlife Conservation Corp (WCC); train volunteers to identify and survey for mussels; assign specific areas for survey work where data are lacking.

- Continue refining methodology for selecting potential Category 1 stream segments using listed freshwater mussels and other aquatic obligate species. Present method to Bureau of Water Monitoring and Standard's staff for input and approval.

JOB 2: Federal and State-Listed Lepidoptera

Project co-leaders: Dave Golden, Principal Zoologist and Robert Somes, Assistant Zoologist

OBJECTIVE: To identify, survey, protect, and manage for listed Lepidoptera populations and habitats in New Jersey. Species include arogos skipper, Mitchell's saytr, bronze copper, Appalachian grizzled skipper, checkered white, silver-bordered fritillary, and frosted elfin.

Key Findings:

- We visited nine out of the 11 documented Silver-bordered Fritillary sites in the state at least twice between April and August of 2009. Two out of the seven sites surveyed were positive for Silver-bordered Fritillary with a total of five individuals observed during the survey period. Several Silver-bordered Fritillaries were observed at sites they were absent from during the 2008 season. Surveys were also conducted at sites possessing suitable habitat for this species. Surveys were conducted at six new locations that were recently discovered in the Delaware Water Gap on four different dates. Silver-bordered Fritillaries were observed on all dates with a range of one to 14 individuals observed.
- Intensive surveys were conducted at all known, public Arogos Skipper sites. Arogos Skippers were found to be present at all historic locations. Potential new sites were surveyed in the vicinity of known locations without any success in locating Arogos Skippers. One site had six Arogos Skippers observed in it and all of the other locations had one to two skippers observed in them. These low numbers are comparable to all previous surveys where the Skippers appear to inhabit all of these locations at low population densities.
- Arogos Skipper surveys in the Pinelands yielded only an observation of one female skipper. Previous surveys have always shown there to be a very small but persistent population at these sites with never more than 6 skippers observed during a single visit. Habitat conditions are deteriorating in several locations due to succession but several sites remain unchanged.
- All species occurrences were mapped through the Biotics database and the Landscape project.
- A new Checkered White location was found in Southern New Jersey. There were approximately 30 individuals observed during a single visit in the fall of 2008. During the 2008 season the site was fallow farmland but during the 2009 season the site was actively being farmed in soybeans and no Checkered Whites were observed by the end of the period applicable to this report. It should be noted that most of the 2008 observations were made during late September through early October. The location is in a large mosaic of mixed farmland and fields and further survey efforts will be conducted in order to locate further populations.
- We were unable to conduct habitat or metapopulation studies due to a lack of staff and time.

Conclusions:

- Silver-bordered Fritillaries continue to persist in several historic locations. The presence of a large undiscovered metapopulation in Northern New Jersey shows that further survey efforts are required to locate new populations.
- Arogos skipper continues to persist in historic locations and does not appear to have occupied any new sites.
- Currently there is only one population of Checkered whites in New Jersey around the Newark Airport (northern New Jersey). A reproducing population in Southern New Jersey would be significant for this once widespread species.

Recommendations:

- Continue surveying of historical sites and conduct further surveys of other sites that contain suitable habitat. Continue surveying newly found sites to determine their extent.
- Expand survey efforts in Northern and Central New Jersey for Silver-bordered Fritillary to find new populations.
- Work together with utility companies and Morris County MUA to insure that the Arogos skipper habitat is protected and enhanced if possible. Morris County MUA is working on native grassland management in several nearby potential sites for Arogos skipper and it is hoped that the skippers will occupy the sites if they are suitable.
- Survey during the fall of 2009 to see if Checkered whites are still present at the newly found Southern New Jersey site where habitat has been altered.

JOB 2B: Frosted Elfin

Project co-leaders: Dave Golden, Principal Zoologist and Robert Somes, Assistant Zoologist

OBJECTIVE: To survey suitable habitat for this species and manage habitats for the proliferation of its host plant when appropriate.

Key Findings:

- In 2009, very limited survey efforts were made due to a staff transition for invertebrate work. No management or other research activities could be conducted due to this reason and lack of personnel.
- One day of surveys was conducted under poor conditions to familiarize new personnel with current Frosted Elfin sites.
- Wildlife Conservation Corps volunteer unofficial reports found Frosted Elfin at most of the 12 historic locations, and one official report showed a new location.

Conclusions:

- Frosted elfin continue to persist at many of the historic sites in the state despite minimal habitat management.

Recommendations:

- Conduct surveys of historic sites and other potentially new sites that contain suitable habitat to determine current distribution of Frosted Elfin populations.
- Work with utility companies to determine best management practices on rights-of-way where frosted elfin habitat is present.
- Reinitiate habitat enhancement/creation activities in areas where soil characteristics are suitable for the planting of wild indigo.

JOB 3: Rare Odonata Conservation

Project leader: Jeanette Bowers Altman, Principal Zoologist

OBJECTIVE 1: To monitor the progress of an effort to reintroduce the state endangered Gray Petaltail (*Tachopteryx thoreyi*). This effort began during 2007 with the collection of larvae out of state. An effort will be made to collect more larvae for transportation to the reintroduction site in Sussex County.

OBJECTIVE 2: To monitor populations and create conservation plans and strategies to aid in the recovery of state-listed species found throughout New Jersey, including 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.

OBJECTIVE 3: Develop information to ascertain range distances for priority species from breeding waters.

Objective 1, Job 3a: Gray Petaltail (*Tachopteryx thoreyi*)

Key Findings:

- The Gray Petaltail (*Tachopteryx thoreyi*), which is soon to-be-listed as state Endangered, was once reported sporadically from the Highlands, Ridge and Valley, and Northern Piedmont areas of NJ. Surveys over the past several years have failed to locate individuals of the species.
- Suitable habitat was surveyed throughout Sussex, Warren and Morris Counties during June. No additional populations can be reported though poor weather conditions hampered much of the survey efforts.
- Surveys at suitable habitat within 1 mile of the reintroduction site were conducted. No adults were observed.
- The reintroduction of the Gray Petaltail, undertaken during May 2007, at a large woodland seepage in Trout Brook WMA, Sussex County, NJ, continued to be monitored in 2008 and 2009. The site chosen for the reintroduction is a large woodland seepage draining into Quick Pond in Sussex County and is protected as part of Trout Brook Wildlife Management Area. The site was selected based on the following criteria: 1) the seepages are not easily accessible and are unlikely to be disturbed 2) the seepages are directly adjacent to the Delaware River National Recreation Area, thus allowing colonization throughout a large area of contiguous, protected habitat and 3) there are other suitable petaltail habitats nearby, therefore there is potential for additional colonies to be established.
 - In 2007, 31 Gray Petaltail larvae were collected at a large seepage complex in State College, PA and transplanted at the reintroduction site. Eleven adults were observed during weekly monitoring through mid-July. Individuals were marked to establish an estimate of total number present. Based on markings, seven discrete individuals were recorded.
 - In 2008, five live adults (four males, one female) were observed between late May and early July, with one dead male discovered in early June. The female was observed ovipositing (egg laying), suggesting that breeding had commenced within the population.
 - During the 2009 season, no adults were observed at the Quick Pond site through much of June. This is likely due to adverse weather conditions throughout much of the month, resulting in later than normal adult emergence. This weather related impact was observed with most early season Odonata species in the region.
 - Six adult males were subsequently recorded during 17 visits to the site. No evidence of adult breeding activity was observed during the 2009 flight season. The presence of adults indicates that the transplanted colony is persisting, however. An attempt was made to search for larvae in late August. Two early instar larvae were located in the main seepage, providing further evidence that the colony may be persisting.
 - No additional adults were translocated from neighboring states during this funding year. ENSP and odonate expert contractor determined there was no value to introducing additional larvae at this point, but rather it was more important to use resources to monitor the results of the introduction as is and learn from the current situation.

Conclusions:

- The presence of early instar larvae suggests that Gray Petaltail breeding is occurring at the Quick Pond site. The extent to which the colony thrives will be known over time with further observation. Since all larvae originally introduced to this habitat were ultimately instar or close in age, the larvae observed this year are no doubt the result of onsite breeding.

Recommendations:

- Continue to monitor the reintroduction site during May-July 2010 to determine whether a population is becoming established.

- Monitor nearby suitable habitat within a radius of one mile from the reintroduction site for the presence of stray adults, though due to their localized nature this is highly unlikely.
- Continue to identify suitable habitat elsewhere and conduct surveys for the presence or absence of this species.

Objective 2, Job 3b: State-listed Odonata (Statewide Surveys and Monitoring of Soon-To-Be Listed Odonata)

Key findings:

- Surveys for soon-to-be listed and rare Odonata were conducted throughout the state. A total of 78 sites were sampled during the project period. Of the 78 sites sampled, 37 previously surveyed sites were visited for monitoring purposes and 41 new sites were surveyed. All sightings data will be submitted for inclusion in the NJ DEP's Biotics (Biotics) database. This data will ultimately be incorporated into the Riparian Landscape Project.
- An attempt was made to locate breeding habitat for some records of casual fly-by or foraging individuals. Poor weather hampered these efforts greatly. No records were successfully associated with breeding habitat.
- Sampling was primarily conducted via the collection and identification of larvae and exuvial shells. Adult observations were also used to survey for Odonata.
- The State threatened Robust Baskettail (*Epithea spinosa*) appears to still be viable based on sampling at several sites along the Maurice River (Cumberland/Salem County).
- A new colony of the State threatened Brook Snaketail (*Ophiogomphus aspersus*) was located on the Musconetcong River in Hunterdon County. This discovery is significant as two other previously documented populations appear to be declining.
- New populations of the globally imperiled New England Bluet (*Enallagma laterale*) and Spatterdock Darner (*Rhionaeschna mutata*) were located in Warren County. Both populations are considered highly viable and offset recent losses of other populations.
- Monitoring was conducted at the States only known population of Kennedy's Emerald (*Somatochlora kennedyi*). This State threatened species appears to be relatively secure at this site though the population is small and in-breeding may be occurring.
- A large population of Sable Clubtail (*Gomphus rogersi*) was documented in the headwaters of Blair Creek in Warren County. This species has seen severe declines at two known locations in recent years. Another known population in Morris County is considered extirpated.
- Based on larval sampling and adult observations the Cobra Clubtail (*Gomphus vastus*) is locally abundant around Bulls Island State Park and Washington Crossing State Park. This species may also be breeding in limited segment of the Delaware and Raritan (D&R) Canal.
- The globally imperiled Scarlet Bluet (*Enallagma pictum*) was documented at 30+ sites throughout the Pine Barrens. Many of these sites were visited to verify continued stability of known populations. New sites were surveyed as well resulting in the discovery of additional populations.
- A single female Forcipate Emerald (*Somatochlora forcipata*) was captured and released at Catfish Pond in Warren Co. This constitutes only the second record for this species in New Jersey. It is unknown what the breeding status of this species is at this site.

Conclusions:

- Much remains to be learned about the Odonata fauna of New Jersey. It is unclear as of yet what all the factors are impacting our rarest species, whether they are natural or manmade. It is quite clear however that the value of many of the more sensitive species as environment indicators is great.
- Many small populations of rare Odonata (e.g. Brook Snaketail, Sable Clubtail, and New England Bluet) appear to be declining or in general are unstable. Of the five previously documented Brook Snaketail populations two are declining. Further monitoring is needed to establish a better trend and ascertain the causes for these declines.

- While the overall metapopulation of Scarlet Bluet does appear secure, twelve previously documented component populations appear to have failed completely while six others are declining. A more comprehensive study of this species is planned for 2010.
- The State threatened Robust Baskettail remains secure in the Maurice River watershed. This conclusion is based on a large sample of fresh exuvial shells collected over a long segment of this river.

Recommendations:

- Continue to monitor known populations of rare Odonata throughout New Jersey.
- Occurrences not associated with breeding habitat or where no breeding activity was confirmed need further study.
- Continue to identify and survey new habitats in an effort to locate further populations of rare Odonata.
- In cases where known populations are declining continue monitoring and attempt to ascertain possible cause(s) of the decline.

Objective 3, Job 3c: Occurrence Area Buffer Improvement (Range Distances for Priority Species – Mark and Recapture Study)

Key Findings:

- During mid-to-late May, a total of 180 newly emerged Snaketails (76 Brook, 92 Maine, and 12 Rusty) were captured adjacent to the Big Flat Brook within Walpack Wildlife Area (Figure 1).
 - Each Snaketail was marked on its hindwings with a large white patch created with “Whiteout” that could be easily observed when the marked individual took flight. Individuals were released at the same location once markings were affixed on the hindwings. A GPS reading was taken for each individual released.
 - To ensure that affixing markings to the wings of Snaketails was not injurious or stressful, four marked adults were collected as controls. The control subjects were released into a large mass enclosure with ample vegetation, water and prey insects available, and observed daily for signs of stress or unusual behavior. No such behavior was observed; the control subjects survived an average of two weeks. It is arguable, however, that the controlled situation may have provided more security than under natural circumstances.
 - Surrounding foraging fields were subsequently searched with a low rate of visual recaptures at four sites: a) Walpack Center, approximately 2.6 miles from the capture area b) Quick Pond, approximately 3 miles from the capture area c) Arctic Meadows TNC Preserve, approximately 2.4 miles from the capture area and d) a rocky bald area at the top of the Kittatinny Ridge, approximately 3.5 miles from the capture area (Figure 1). A GPS reading was taken after each visual re-capture. It is worth noting that sites b and c are on the opposite site of the initial capture site.
 - All resulting movement data has been mapped in GIS. Tentative buffers are currently being calculated.

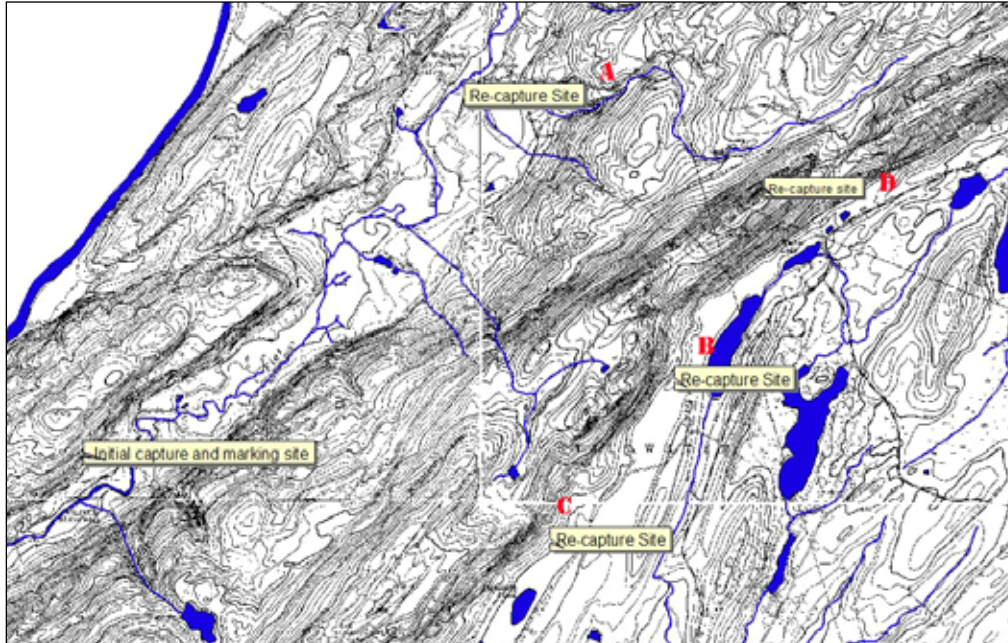


Figure 1. Map of study area showing the initial capture site and recapture sites a) Walpack Center b) Quick Pond c) Arctic Meadows TNC Preserve and d) Ridge top site.

Conclusions:

- Anecdotal information suggests that Odonata range far from their breeding sites while foraging for prey, seeking shelter or reproducing. There have been no significant studies, however, with the intent of quantifying distances traveled or elevations surmounted.
- While this is an initial study, our data would suggest that Snaketails will fly relatively long distances to visit preferred foraging sites.
- Further study using mark recapture methods may support the need to increase the size of protective buffers around known breeding sites for the soon-to-be listed Brook snaketail (*Ophiogomphus aspersus*).

Recommendations:

- Continue mark-recapture study for two years to determine if consistency is observed regarding dispersal patterns of Snaketails.
- Place second marking on forewings of all future recaptures so that adults returning to the breeding site might potentially be identified as such.
- Conduct similar studies on other priority Odonata species from other families. Ultimately, it may be possible to recommend scientifically based protective buffers (and Species Occurrence Areas as represented in the Biotics database and the Landscape Project) that take into account not only breeding habitat but crucial field and forested uplands.

Job 4. Rare Coleoptera Conservation

Project leader: Robert Somes, Assistant Zoologist

OBJECTIVE: To determine the status and distribution of New Jersey's native Coleoptera species, particularly those that may be rare or threatened on a state or global level, and take steps to stabilize and recover species as necessary.

Key findings:

- Surveys were conducted at the Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*) reintroduction site (the only remaining site for this species in New Jersey) located at Sandy Hook. This species had been extirpated from the State until a USFWS project to reintroduce them at Sandy Hook from 1994 through 2006. Surveys during July 2009 on four different days failed to locate any individuals of this species, although during the summer of 2008 just seven individuals were observed. Large numbers of *Cicindela hirticollis* (another rare tiger beetle species) were observed during each site visit.
- Consultations with state experts and a compilation of our existing data were used to generate a list of potentially rare tiger beetle species in New Jersey. Insufficient data on many species will hamper generating an official Endangered Tiger Beetle Species list. Potentially rare tiger beetle species in New Jersey were found to be *Cicindela dorsalis media*, *Cicindela hirticollis*, *Cicindela marginata*, *Cicindela limbalis*, *Cicindela marginipennis*, *Cicindela ancocisconensis*, *Cicindela patruela consentanea*, *Cicindela lepida*, and *Tetracha virginica*.
- All species occurrences were mapped through the Biotics database and the Landscape project.

Conclusions:

- Following each reintroduction effort, *C. dorsalis dorsalis* has gone through cycles of population establishment, population growth, and population decline and extirpation on several occasions. The lack of any individuals observed could signal the decline of the latest reintroduction effort, or it could have been the result of a cooler than usual summer. Also, this species is capable of long distance dispersal and could still be present on other, unsurveyed beaches. Human disturbance will continue to be a detriment to this population, but fortunately a large portion of the site is protected by exclosures during the piping plover nesting season.

Recommendations:

- Survey efforts for *C. dorsalis dorsalis* should be continued and expanded to include suitable beaches not surveyed during 2009.
- Surveys should be conducted for other rare tiger beetle species in order to provide baseline data for species status decisions in the future.

EXECUTIVE SUMMARY

Project:	Species Status Review
Federal Aid Project:	T-1-5 (State Wildlife Grants)
Segment dates:	September 1, 2008 to August 31, 2009
Total Project Expenditures:	\$16,000 (\$8,000 Federal, \$8,000 State)

JOB 1: Species Status Review and Listing

Project leader: Kathleen Clark, Supervising Zoologist

OBJECTIVE: Determine the status and distribution of endangered and threatened wildlife, and wildlife species of special concern.

Key Findings:

MARINE MAMMALS:

- The status review of 36 species in this group was continued with 13 reviewers participating. Reviewers were chosen based on their expertise in pinniped and/or cetacean biology and behavior and represented such organizations as the National Marine Fisheries Service, the NJ Division of Fish and Wildlife (ENSP and Bureau of Marine Fisheries), Delaware Division of Fish and Wildlife, NY Department of Conservation, Rutgers University Marine Field Station, Riverhead Foundation for Marine Research and Preservation, Richard Stockton College, New England Aquarium, University of Rhode Island and Mingan Island (Quebec) Cetacean Study.
- For the review, the panel was asked to choose a status and confidence level for 36 marine mammals. Definitions for status (endangered, threatened, special concern, undetermined, not applicable or no opinion) were provided to panelists, along with a numeric scale reflecting confidence level. Reviewers were asked to provide comments supporting their status selections. Species were chosen for review based on the existing list of NJ nongame species and other sources documenting presence within state waters.
- The species being reviewed include 15 whales, 15 dolphins, one porpoise, four pinnipeds and the West Indian manatee. Reviewers were provided with various sources of information pertaining to the species under review, including NOAA stock assessments, recovery plans, distribution maps and reports from New York and Canada. Information was provided to each reviewer via CD and a secure website.
- Round 4 was compiled during the SWG project period. Upon completion of the fourth and final round, consensus was achieved on 25 out of 36 species as follows: Endangered (3 species) – fin whale, humpback whale and northern right whale; Special Concern (2 species) – bottlenose dolphin and harbor porpoise; Secure/Stable (2 species) – gray seal and harbor seal; Undetermined (2 species) – short-finned pilot whale, striped dolphin; Not Applicable (16 species) – beluga whale, Blainville’s beaked whale, clymene dolphin, Cuvier’s beaked whale, dwarf sperm whale, Gervais’ beaked whale, killer whale, melon-headed whale, northern bottlenose whale, pantropical dolphin, pygmy killer whale, pygmy sperm whale, spinner dolphin, True’s beaked whale, West Indian manatee and white-beaked dolphin. No consensus was achieved on the following 11 species: Atlantic spotted dolphin, Atlantic white-sided dolphin, blue whale, common minke whale, harp seal, hooded seal, long-finned pilot whale, Risso’s dolphin, sei whale, short-beaked common dolphin and sperm whale.
- Those species for which consensus could not be reached fall within three general groups: (1) Species that remain globally vulnerable to extinction and yet are neither documented nor suspected to occur within New Jersey waters (blue, sei and sperm whales). These three species have been included on New Jersey’s list of endangered species due to their federal listing and because they do occur within the North Atlantic. However, while they occur within the North Atlantic, only sick, dying or dead individuals have been documented within New Jersey waters. (2) Species that are largely thought to

be globally secure and yet are neither documented nor suspected to occur within New Jersey waters (Atlantic spotted dolphin, Atlantic white-sided dolphin, common minke whale, long-finned pilot whale and Risso's dolphin. (3) Species that are globally secure and NJ waters represent the latitudinal or inshore extreme of the species range (harp seal, hooded seal and short-beaked dolphin).

- Marine mammal Delphi process results were presented to the Endangered and Nongame Species Advisory Committee (ENSAC) during the November 2008 meeting. Committee members were given all relevant information, including voting tallies, percent consensus, and panelists' comments to review before the next ENSAC meeting.
- Results were again presented to ENSAC during the January 2009 meeting. After reviewing all Delphi process information distributed at the previous meeting, committee members voted to recommend status based on the results of the Delphi review as presented with the following changes: 1) the species listed in Group 1 (blue, sei and sperm whales) are to be removed from the list of NJ species; 2) the species listed in Group 2 (Atlantic spotted dolphin, Atlantic white-sided dolphin, common minke whale, long-finned pilot whale and Risso's dolphin) are to be removed from the list of NJ species.
- Recommendations for Group 3 (harp seal, hooded seal, and short-beaked common dolphin) are as follows: 1) harp seal and hooded seal are indigenous to NJ waters and the populations are stable; 2) short-beaked common dolphin population is undetermined.

TERRESTRIAL NONGAME MAMMALS:

- No progress was made on the terrestrial nongame mammal status review during the current project year due to staff time constraints. The staff administering the terrestrial mammal status review was heavily involved in dealing with White Nose Syndrome and bat issues during the project year. White Nose Syndrome was confirmed at several New Jersey sites and as a result staff was required to dedicate an inordinate amount of time that was unplanned.

Conclusions:

- The Endangered and Nongame Species Program staff has affirmed the Delphi technique (Clark et al. 2006) is an appropriate, objective method for determining species status, which should continue to be the method used by the Division.

Recommendations:

- Compile the results of the Delphi process of review and present them to the Endangered and Nongame Species Advisory Committee for recommendations on new status assignments.
- Proceed with new status assignments through the regulatory (rulemaking) process.
- Begin the administration of the status review of terrestrial nongame mammals, and complete the iterative assessment rounds as necessary to reach consensus on status of species under review.
- If the status review process for terrestrial nongame mammals is completed by the end of the project year, compile the results of the Delphi review and present them to the Endangered and Nongame Species Advisory Committee for recommendations on new status assignments.

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