Report
State Wildlife Grants
T-1-4

Endangered, Threatened and Rare Wildlife Conservation Projects

Report for Project Year
September 1, 2006 – August 31, 2007

NJ Department of Environmental Protection

DIVISION OF FISH AND WILDLIFE

ENDANGERED AND NONGAME SPECIES PROGRAM

EXECUTIVE SUMMARY

Project:	**Bird Conservation**
Federal Aid Project:	T-1-4 (State Wildlife Grants)
Segment dates:	September 1, 2006 to August 31, 2007
Total Project Expenditures:	$467,500 ($350,625 Federal, $116,875 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

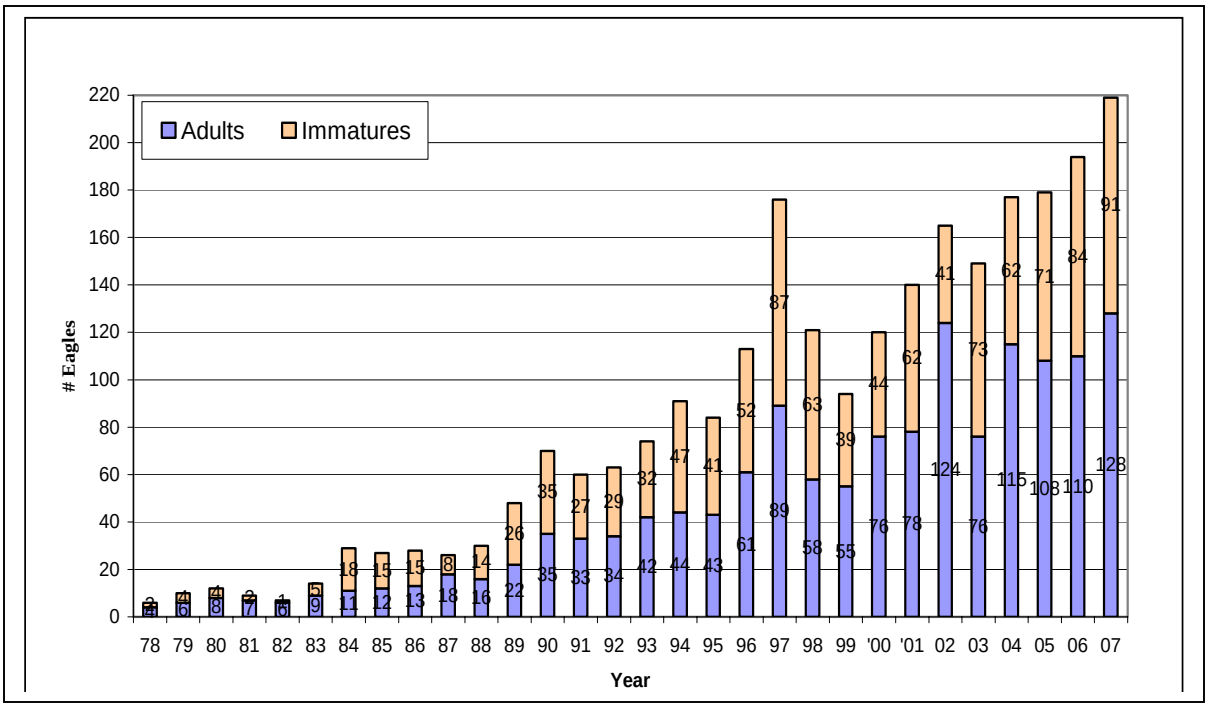
OBJECTIVE: To conserve and manage a self-sustaining bald eagle population in New Jersey; to determine the threat of environmental contaminants to survival of bald eagles along the lower Delaware River and upper Delaware Bay; and to monitor and conserve the wintering population of bald eagles in New Jersey.

Key Findings:

- ENSP biologists monitored all known nesting pairs, with the essential assistance of 55 eagle project volunteers. Nests were monitored approximately weekly from January through fledging in July.
- In 2007, 64 eagle pairs were monitored, 59 of those were active (with eggs), two were territorial (maintained a nest area), and three were not relocated when they moved between 2006 and 2007 (Figure 1).
- During the 2007 nesting season 41 nests were successful in producing 62 young, for a productivity rate of 1.05 young per active nest. This productivity rate is much reduced from the last five years when productivity has averaged 1.33. In 2007, several nests were damaged or destroyed during April storms, causing losses at early chick stages. Predation was also suspected at several nests that lost eggs and young (<2 week old) nestlings. Nest success was thus reduced to 68%, down from the previous average of 75%.
- In 2007, a high of 17 active nests failed to produce young. As previously mentioned, storms and predation were likely responsible for many of the failures this season.
- Four new eagle nests were discovered: one in north Jersey in Sussex County, two in central Jersey (Monmouth and Burlington counties) and one in southern Cumberland County. Continued expansion in central and northern NJ may be expected as suitable habitat becomes occupied.
- ENSP biologists visited a sample of nests to band young with federal and color leg bands, and take blood samples. In 2007 we banded 23 eaglets, and fostered 2 orphaned eaglets from Maryland, at 15 nests. We took blood from 22 eaglets, which were stored for future analyses. One egg was collected this season from a Delaware River nest after incubation continued two weeks past the normal period.
- In 2007 most nests (38, or 59%) were located on private land, with the balance on state, federal, county and conservation 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 Mid-winter Eagle Survey that took place January 13-14, 2007. A total of 219 bald eagles was counted by volunteers and staff, a new high count in New Jersey since the survey began in 1978 (Figure 2). Most eagles (198) were observed in southern New Jersey,

primarily in the Delaware Bay region; northern New Jersey had 21 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.

- In August 2007, the U. S. Fish and Wildlife Service officially removed the bald eagle from the federal list of endangered species. The State assesses the eagle population separately with regard to the population status and trends within New Jersey, and the status of endangered remains in effect.



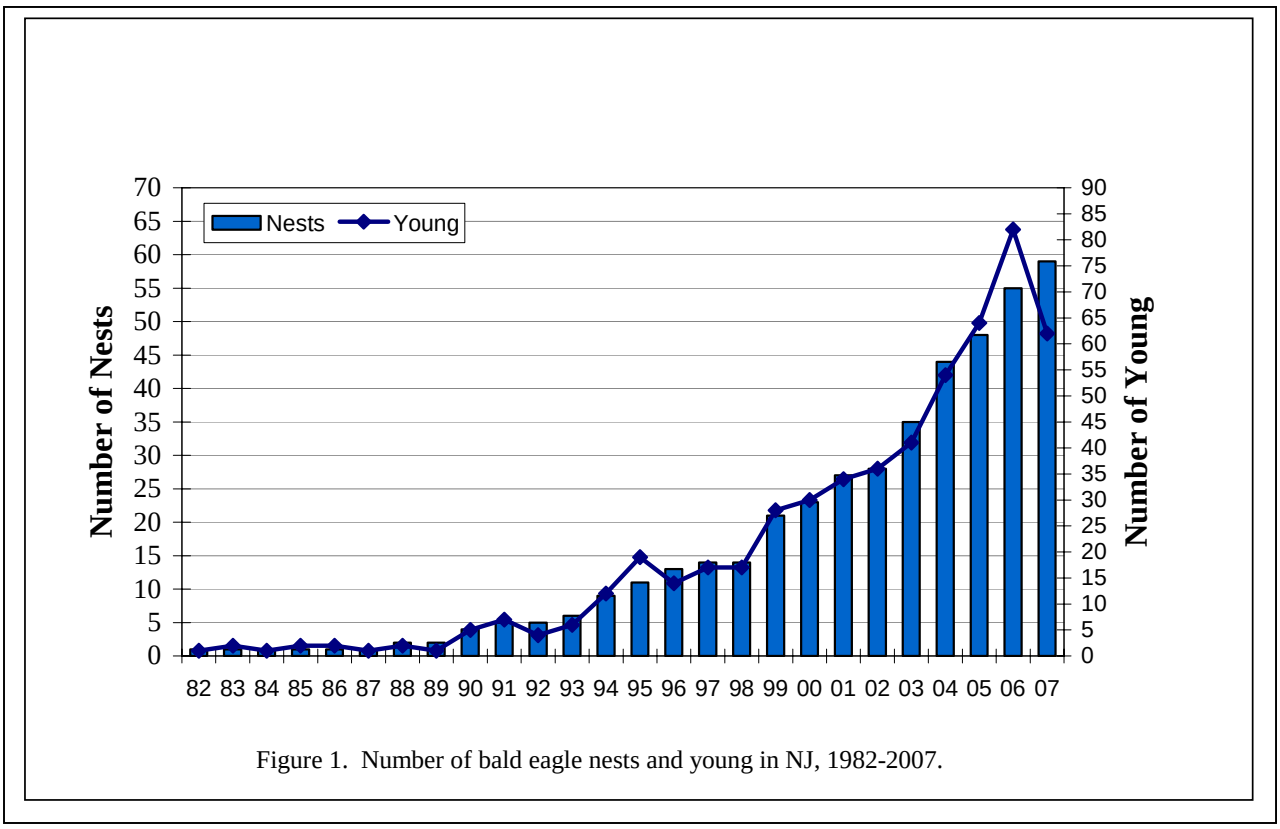


Figure 1. Number of bald eagle nests and young in NJ, 1982-2007.

Conclusions:

- The New Jersey bald eagle population has increased each year and continues to maintain nest productivity well 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. Management by biologists that includes nest-site protection in cooperation with landowners has been key to this success. In 2007, four new eagle nests were discovered, and this 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 care. 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 any recovery.
- As evidenced by 2007 results, harsh weather conditions during sensitive incubation and early hatching periods can have a significant effect on nest success. It will be 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. In addition, conduct surveys and report results to the U. S. Fish and Wildlife Service in accordance with the (future) final post-delisting monitoring recommendations.
- Continue to monitor the New Jersey wintering population through the annual Mid-winter 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.
- Develop proactive planning to identify and conserve suitable bald eagle habitat in anticipation of a fully recovered eagle population.

JOB 1C: Beachnesting Birds (Black Skimmer and Least Tern) Population Monitoring, Threat Assessment Studies and Management Planning

OBJECTIVE: To protect and restore nesting black skimmers (*Rynchops niger)* through continued monitoring of nesting sites and by studying the effects of watercraft on their reproductive success. To protect and restore least terns (*Sterna albifrons)* and other beach nesting birds through development of targeted predator management strategy.

Key Findings:

- Black skimmer breeding surveys were conducted approximately every 2 weeks from the beginning of June until the end of August at back bay islands along the entire length of Barnegat Bay. Five (5) active black skimmer nesting sites were identified during the surveys. A total of 528 adults were present at these sites (based on a cumulative total of peak counts). The vast majority (78%) of the breeding adults were present at one site – Mordecai Island. A peak total of 232 nests were found during the surveys, with the majority of the nests (185) being at Mordecai Island. Productivity was low at the Barnegat Bay island sites with just 68 fledges being produced from all the colonies combined. Tidal flooding and heavy rain, which resulted in significant loss of both nests and young, were the cause of low reproductive success.
- 2007 was the third year that the effects of watercraft on breeding black skimmers were studied in Barnegat Bay. Impacts were investigated during all breeding stages, including pre-egg-laying, egg-laying, incubation, hatching, and when chicks (both small and large) were present. Other variables examined included speed and direction of boat approach, as well as the size of the colony. The key metric appears to be the breeding phase with the distances at which skimmers responded varying during different stages. Skimmers were least tolerant of boat disturbance (responded when boat was further away) during the early season stages, especially pre-egg-laying, and most tolerant (responded when boat was closest) during the hatching and young chick stages. Skimmers responded to both direct and tangential approaches of boats, but they allowed a closer approach when boats moved tangentially to the colony rather than directly at it. Smaller colonies appear more vulnerable to boat disturbance (i.e. birds flush sooner at smaller colonies), but again reproductive stage of a given colony regardless of size was more telling factor.

Conclusions:

- The number of black skimmers nesting on Barnegat Bay islands fell significantly in 2007 compared to 2006 (528 total adults versus 974, respectively), although the number was still well above the 10-year low of 198 adults in 2001. The decrease in the number of breeding skimmers in this region in 2007 did not appear to be offset by gains in other parts of the state. One large colony (Mordecai Island) accounted for nearly the entire Barnegat Bay population, which reflects the recent NJ trend of concentration of the population into fewer colonies. Even though Mordecai Island was, by far the largest colony in the Barnegat Bay region, its size dropped steeply this year (420 total adults vs. 900 in 2006). Productivity was poor throughout the entire Barnegat Bay region in 2007, but was especially distressing at Mordecai Island (44 young fledged from 185 peak nests) because that site had been highly productive in the previous four years (producing 245, 340, 535, and 320 fledges from 2003-2006, respectively). Little can be done about the flooding and rain events, which resulted in the low reproductive success at the site, but it does illustrate the vulnerability of the regional and state population when nearly the entire population is concentrated in just a few colonies.
- The differences in responses by black skimmers to boat disturbance at various stages during the breeding season poses challenges in determining an appropriate buffer/set-back distance. Skimmers are likely more tolerant of boat disturbance during hatching or when they have small chicks, because they need to be more protective of their emerging/young chicks during this period (to avoid heat stress or depredation). Disturbance during the pre-egg-laying stage (when they are least tolerant) may not seem like it would impact productivity as much as disturbance during the critical incubation and chick rearing stages, but it may adversely impact site selection or timing of egg laying, and thus

ultimately reproductive success. Varying the disturbance buffers during different stages of the breeding cycle would not be effective for a number of reasons, including the fact that nesting is not necessarily synchronous within a colony. Furthermore, changing the buffer distance during the season is likely not practical – is it easier to implement and enforce a single distance throughout the season. Thus, the disturbance buffer should reflect the greatest distance at which skimmers respond to boats at any given stage of the breeding season.

Recommendations:

- Continue to annually monitor population and productivity at black skimmer nesting sites within Barnegat Bay once every 2-3 weeks during the breeding season, as part of a statewide assessment of population trends.
- Continue to incorporate breeding data into the Landscape Project and Biotics databases.
- Determine if additional management protection is necessary at Mordecai Island as that site presently hosts nearly the entire black skimmer population within Barnegat Bay.
- Explore options of making other island sites within Barnegat Bay more suitable for black skimmer nesting as a means to decrease the species' over dependence on just one site (Mordecai Island).
- Island nesting sites are especially important to black skimmers, as they are relatively free of mammalian predators and intense human disturbance found at their barrier beach breeding sites. Maintaining these islands as nesting sites free of human disturbance has become increasingly difficult as boat and personal watercraft usage has incrementally risen in recent years. Data collected during this study should be used to determine optimal buffer distances for boat disturbance from black skimmer breeding sites, both within Barnegat Bay and throughout the state. Depending on whether first response or first flight by skimmers is used as an indicator and what level of disturbance is deemed critical, resource managers will have a variety of distances to choose from as a result of this study. However, based on data available, the most conservative strategy would be a buffer distance of at least 120 meters from the colony edge. Increasing the buffer distance (50 meters) to protect especially sensitive colonies and/or in heavily used boating areas should be considered.

JOB 1D: Osprey Monitoring and Management Planning

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

- NJ Division of Fish and Wildlife biologists and volunteers conducted ground surveys in June and July, 2007. Two hundred eighty-eight nests, 72% of the 2006 statewide population of 400, were checked for nest success (Table 1), providing good estimates of regional productivity. The statewide population, tracked by ground and aerial surveys every three years, is next scheduled for 2009.
- ENSP determined the outcome of 238 nests, a similar number as in 2006 (Table 1). Nest success averaged 1.78 young per active nest, but may have been biased toward successful nests because most nest checks occurred in June-July only. Average nest success was higher in Delaware Bay compared to Atlantic coast (2.00 vs. 1.72), but was high statewide as it varied from 1.38 in Raritan Bay to 1.93 in northern Cape May County. All study areas showed relatively good success compared to other years when all nest checks were done in the same time period.
- During ground surveys 270 nestlings were banded with USGS leg bands for future tracking.
- 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 was also updated with new information.

Conclusions:

- The productivity rate found at all nesting colonies was well above average, indicating conditions (e.g., weather, prey resources) were optimal in 2007 nesting season.

- ENSP coordinates and works closely with volunteers to collect data from all major osprey colonies to accurately describe the condition of the population. The volunteers working on this project are essential to ENSP's ability to continue this level of data collection.
- Ospreys' reliance on human-made structures for nesting emphasizes the importance of building and maintaining nests. This is a long-term job necessary to maintaining the osprey population in the state. In 2007, the concentration was on replacing old platforms vulnerable to ground predators with new platforms that will last well into the future.

Recommendations:

- Conduct a population census every three years (next survey due in 2009) to monitor population changes statewide and regionally. Maintain integrated databases on the population and nest locations on an annual basis.
- Continue to measure annual productivity of ospreys to monitor regional conditions and changes (e.g., Atlantic vs. Delaware Bay regions, and Atlantic subregional comparisons). Recruit and train more volunteers to assist with 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.
- Gather information on fisheries trends (particularly menhaden and flounder species) for potential correlation with osprey population parameters.

Table 1. Osprey nesting and productivity in 2007 in major nesting areas. Productivity determined by ground surveys in June-July. Productivity rates in 2003-2006 provided for comparison (*italics*=small sample size).

Nesting Area	#Nests Surveyed	Known-Outcome Nests	#Young	#Banded	Prod. Rate 2007	2006	2005	2004	2003
Raritan Bay area	22	13	18	5	1.35	1.35	1.91	1.15	1.07
Sedge Islands WMA	28	27	31	11	1.15	1.57	1.33	1.70	0.83
Barnegat Bay (except Sedge Is)	19	16	33	9	2.06	*0.00*	n/a	n/a	n/a
Great Bay, Atlantic City, LEH	31	21	41	21	1.95	1.56	1.91	1.91	0.78
Great Egg Harbor/Ocean City	32	25	38	23	1.52	1.65	1.44	1.06	0.87
Sea Isle City	12	12	21	10	1.75	2.10	1.22	1.20	1.13
Avalon/Stone Harbor Bays	57	43	83	56	1.93	1.64	1.28	1.81	0.48
Wildwood Bays & Cape May	30	28	53	36	1.89	1.89	1.89	1.67	0.46
Maurice River & Del Bay	47	43	89	89	2.07	1.84	1.37	2.00	1.09
Salem & Cohansey River	10	10	17	10	1.70	2.00	n/a	n/a	1.00
Delaware River	0					*1.00*	n/a	n/a	n/a
Other-Atlantic (no area designation)	0					1.29	n/a	n/a	n/a
Total of all study areas	**288**	**238**	**424**	**270**	**1.78**	1.66	1.54	1.56	0.86
Atlantic Coast only	231	185	318	171	1.72	1.61	1.53	1.57	0.73
Delaware Bay only	57	53	106	99	2.00	1.88	1.37	2.00	1.09
Statewide population estimate (triennial)						400			366

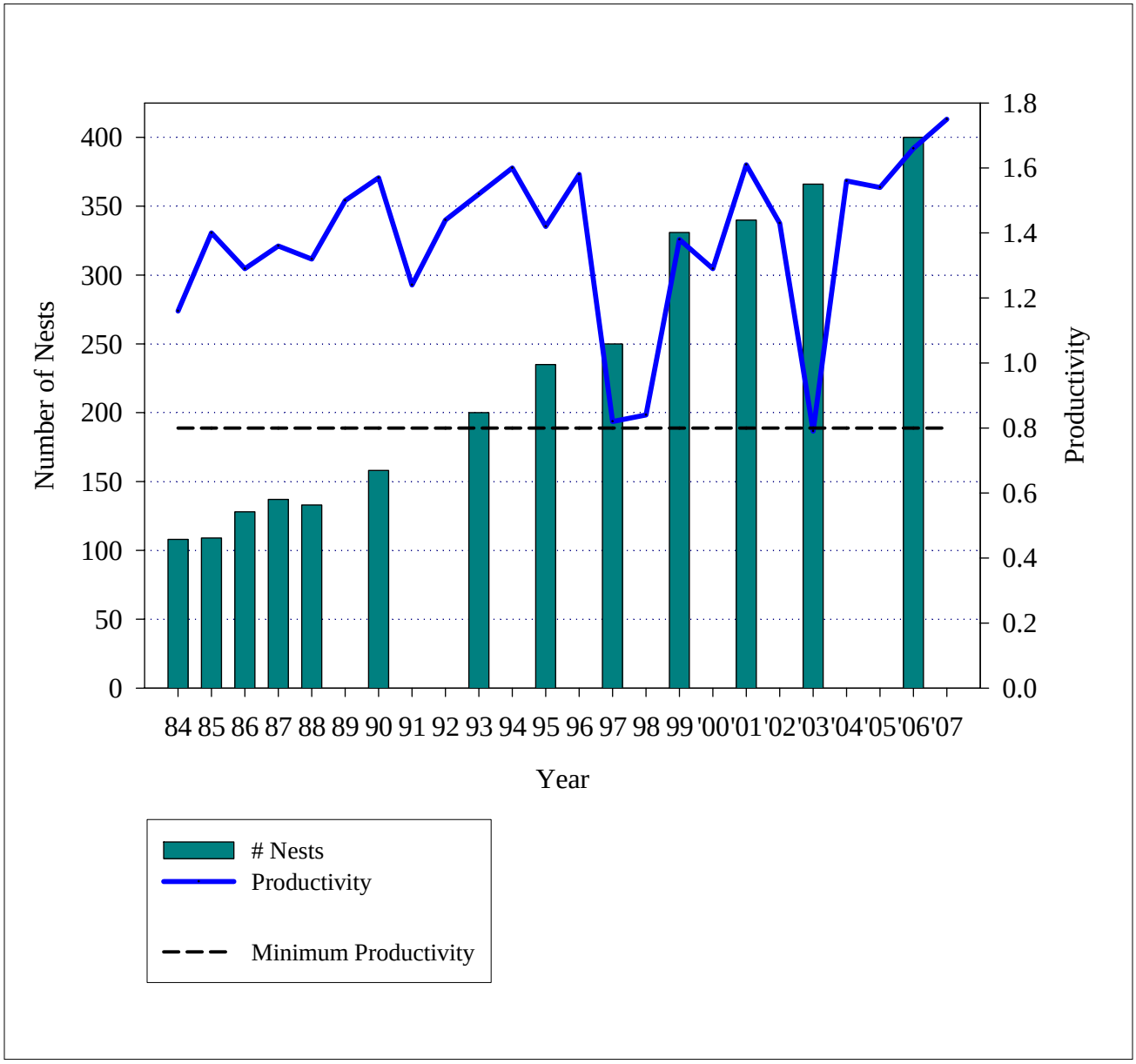


Figure 1. Osprey nesting population and productivity in New Jersey, 1984-2007. The population was last censused in 2006. Productivity rate was at a new high in 2007, at 1.75 based on 232 nests visited in June and July.

JOB 1E: Colonial Waterbirds

OBJECTIVE 1: To study and analyze population distribution and trends for nesting populations of colonial waterbirds. Particular attention will be given to New Jersey's state endangered and threatened species, species of species concern and regional priority species, such as yellow-crowned night-herons (*Nyctanassa violacea*), tri-colored herons (*Hydranassa tricolor)* and snowy egrets (*Egretta thula*).

Key Findings:

- The populations of the coastal marsh gulls and terns are tracked on the aerial surveys that are conducted every 3-5 years. Graph 1 shows the survey results for each species in 1985 and 2007 (one of the earliest and the most recent surveys, respectively). The y-axis is in the log scale, since the population differences by species are so great that they can not be represented on the same linear scale. The untransformed survey data is in Chart 1.

Graph 1. Number of gull and tern individuals: 1985 vs. 2007

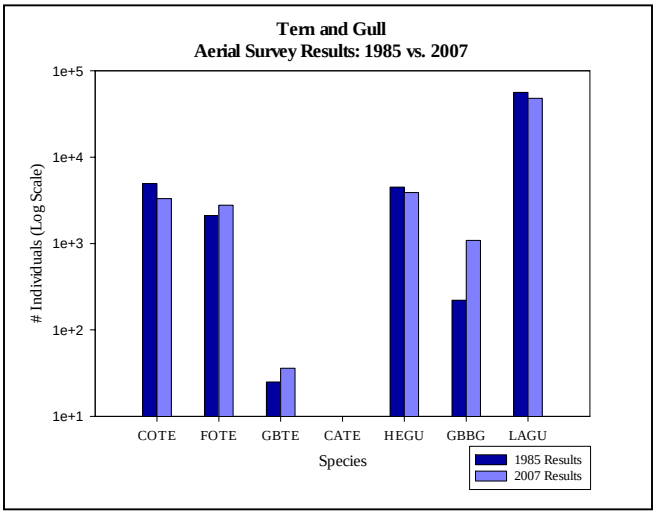


Chart 1. Number of gull and tern individuals: 1985 vs. 2007

Species	1985 Individuals	2007 Individuals
Common Tern	4,940	3,308
Forster's Tern	2,101	2,776
Gull-billed Tern	25	36
Caspian Tern	0	0
Herring Gull	4,497	3,897
Great Black-backed Gull	221	1086
Laughing Gull	56,290	47,919

- Although the populations of many Larid species do not appear to be suffering the types of declines experienced by the long-legged wading birds (see 2005-2006 State Wildlife Grant Report) they share nesting habitat with (coastal marsh islands), many of them are experiencing declines in the number of colonies. Chart 2 depicts the change in colonies from 1995 to 2007 (the data prior to 1995 used a different protocol to define colonies and is not easily comparable to more recent data). Observe the decline among herring and great black-backed gull colonies. This decrease is not surprising, as these two species primarily nest at the perimeter of long-legged wading bird colonies, which are experiencing similar declines in number of colonies (see Chart 3). Additionally, the distributions of many of the focal species are clustered into just a few major colonies. For example, 36% of the common terns counted on the 2007 aerial survey were located in just 2 colonies (3% of the total number of colonies). For laughing gulls, 79% of the individuals counted on the aerial survey were located in just 11 colonies (10% of the total number of colonies).

Chart 2. Number of colonies in gulls and terns 1995 vs. 2007

Species	1995 Colonies	2007 Colonies
Common Tern	51	58
Forster's Tern	74	62
Gull-billed Tern	8	8
Caspian Tern	4	0
Herring Gull	129	84
Great Black-backed Gull	74	66
Laughing Gull	125	105

Chart 3. Number of colonies in colonial waterbirds: 1995 vs. 2005

Species	1995 Colonies	2005 Colonies
Great Egret	25	18
Snowy Egret	26	16
Little Blue Heron	19	11
Tricolored heron	18	6
Cattle Egret	4	0
Glossy Ibis	20	12
Black-crowned Night-heron	27	23
Yellow-crowned Night-heron	17	12

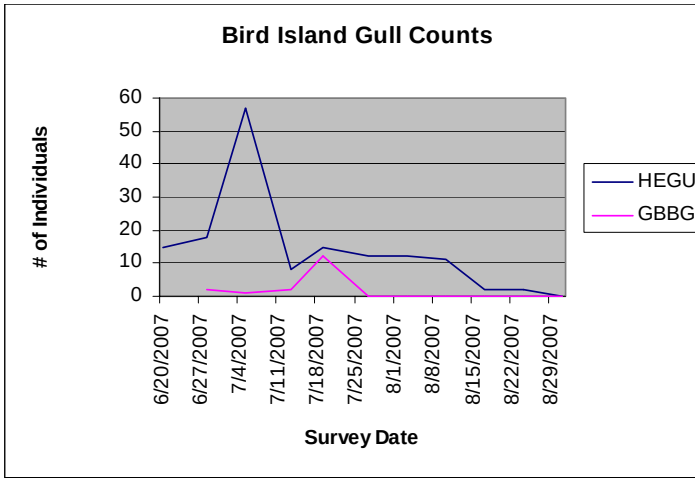
- Ground surveys were conducted at three gull and tern colonies to determine whether this method was a viable alternative to aerial surveys. Ground surveys have the benefit of being more cost effective than aerial surveys, and may be able to act as a supplement to the non-aerial survey years. The ground surveys this year took place at three coastal marsh islands: Peck Island, Bull Thorofare and Bird Island. The results of the ground surveys were mixed. In some instances, the count differences between the ground and the aerial were quite similar. For example, the aerial survey detected 26 common terns, while the ground count detected 30 common terns. At other times the counts were very different. For example, the aerial survey recorded no birds on Bull Thorofare while the ground detected four species.

Chart 4. Results of ground survey for gulls and terns: 2007.

Species	Bull Thorofare		Peck Bay		Bird Island	
	Aerial	*Ground*	*Aerial*	*Ground*	*Aerial*	*Ground*
Forster's Tern	0	3	0	0	0	0
Common Tern	0	2	26	30	0	0
Gull-billed Tern	0	0	3	0	0	0
Laughing Gull	0	15	0	7	0	0
Herring Gull	0	3	1	0	18	57
Great black-backed Gull	0	0	0	0	18	12

- Bird Island was surveyed once a week from late June to late August. The number of individuals varied from week to week, further highlighting the issue of the aerial survey capturing just a "snapshot" image of the colony.

Graph 2. Results of weekly Bird Island counts for two gull species.



- The evaluation of digital photography did not occur due to bureaucratic obstacles that prevented the purchase of the equipment by the beginning of the aerial survey. Although ENSP made every possible effort, the digital camera and zoom lens did not arrive in time for the survey. The equipment did eventually arrive and will be utilized in future surveys.

Conclusions:

- The populations of the species surveyed on the 2007 aerial survey (common tern, Forster's tern, gull-billed tern, Caspian tern, herring gull, great black-backed gull and laughing gull) have generally remained stable over the twenty-plus years that this survey has taken place, with the exception of great black-backed gull, which has significantly increased.
- The number of colonies for many species of gulls and terns has declined. Although the populations themselves do not appear to be declining precipitously this is a cause for concern because if something catastrophic happens (i.e. flooding or predation event) to one of the major colonies there is very little that can be done to remedy the situation and the reproductive success for the entire season could be compromised. The same concern holds for the uneven distribution of the Larids into a few major colonies.
- Of the declining populations, they only appear to be decreasing to a small degree. However, the long term effects of these decreases may be cumulative and cause problems to the population viability of these species in the future. Some of the species appear to be adapting to a human modified landscape, such as laughing gulls and herring gulls. Others, like common and Forster's terns, do not appear to gain any benefit from existing in a human dominated environment and these are the species that should garner the greatest scrutiny in future surveys.
- Ground counts for terns and gulls are much more difficult than ground counts for long legged wading birds. Unlike wading birds, most gulls and terns do not nest in tight, discrete assemblages within a marsh island. They are more likely to be found in loose groups or spread evenly throughout the entire site along all suitable habitat (wrack mats for terns, wrack mats or grass mats for laughing gulls, etc.). Herring gulls and great black-backed gulls typically nest at the perimeter of heron colonies, but they can both also be located throughout the marsh island landscape. This survey revealed that this distribution does not lend itself well to a ground survey. Unlike with the long legged waders, where one can conduct surveys along the perimeter of the colony (often 3'-8' off the ground in shrubs) without disturbing the inhabitants, the Larids nest so close to the ground and are so spread out that it is difficult to survey them without causing a lot of undue disturbance. There is also the potential to step on eggs, or even more likely, chicks that are hiding under the grass and wrack. Therefore,

Ground counts are not an efficient or useful method to survey gulls and terns. Aerial surveys remain the best method to count Larids.
- There are no conclusions to report on the digital photography results, since we were unable to complete this part of the approach.

Recommendations:
- Continue the aerial survey effort as it represents one of the longest, most consistently completed surveys for nongame species in New Jersey. Discontinue ground surveys as alternative method.
- Restore or enhance marsh island habitat to attract additional marsh nesting birds to NJ. Although loss of habitat does not appear to be the primary factor in the decline, habitat improvements should always play an integral role in recovery efforts.
- Increase efforts to locate and map populations of species that nest in the interior sections of the state.
- Collaborate with other agencies along the eastern seaboard to coordinate survey and research efforts.
- Investigate the recovery efforts that other regions are undertaking for the declining species.
- Continue to post colonies with explanatory signage to reduce or eliminate any human disturbance.
- Determine the limiting factor to population increase for the species that are experiencing declines. Possible channels to investigate include predation rates, contamination issues, quality of nesting habitat and emigration to nesting sites in other states.

JOB 1F: Shorebirds - Conservation of Red Knot, Delaware Bay, New Jersey, USA

OBJECTIVE: Protect critical habitats and resources on the Delaware Bay stopover for migratory shorebirds through reduction/reversal of horseshoe crab population decline, reduction of anthropogenic disturbance to shorebirds, enhancement/creation of coastal habitat and impoundments, and monitoring abundance and condition of red knots and other shorebird species of regional priority.

Key Findings:
- ENSP constructed several models describing the relationship between crab eggs densities and shorebird weight gains, a critical need in the development of a larger model that will ultimately predict the number of horseshoe crabs that can be safely harvested without negative impact to the stopover. Program biologist working with staff from USGS and British Trust for Ornithology, the Royal Ontario Museum and five other organizations created a paper entitled "Effects of horseshoe crab harvest in Delaware Bay on red knots: Are harvest restrictions working?" The paper successfully underwent a peer review managed by the USGS and was subsequently submitted to BioScience for review which is now pending. The paper summarizes all the data collected on the red knots on the Delaware Bay, creates targets for population numbers, recruitment, survivorship, horseshoe crab egg density and weight gain.
- This paper will also be submitted to the joint shorebird and horseshoe crab technical committees of the Atlantic States Marine Fisheries Commission who will meet in October. The purpose of the meeting is to begin the development of a model to inform the Horseshoe Crab Management Plan and in the setting of harvest quotas. Work on these models is likely to continue into late 2008.
- Weekly surveys on the Delaware Bay continued to reflect a decline in the baywide population of red knots, now lower than at any other time of the survey (Figure 1).

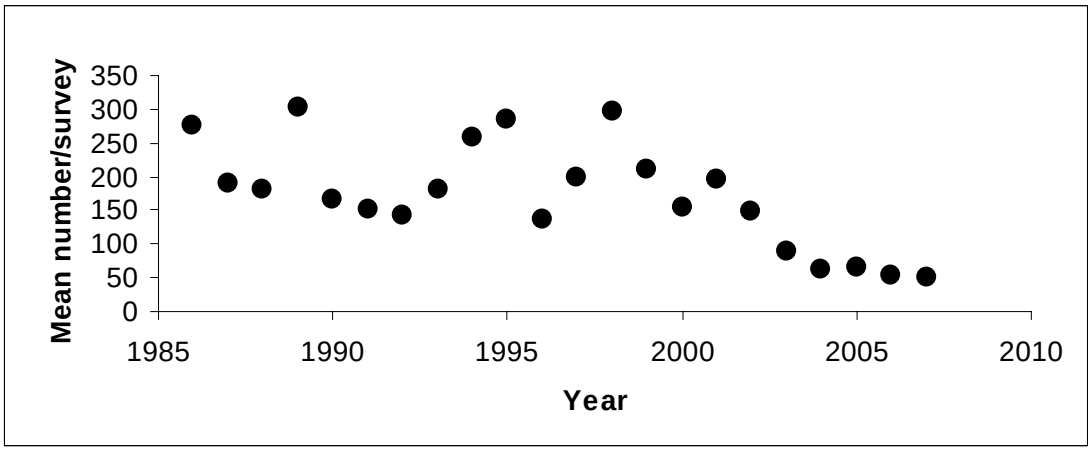


Figure 1. Mean number of red knots per survey segment (n=81) during weekly aerial survey of Delaware Bay Migratory Stopover 1986 – 2007. The 2007 survey was the lowest recorded in the 22-year history of the survey.

- Over the entire period of intensive monitoring on Delaware Bay (1997–2007), mean catch weights from 1997–2002 were generally at or above the mean for the entire period, while mean catch weights for 2003–2007 were generally below the mean for the period (Figure 2).

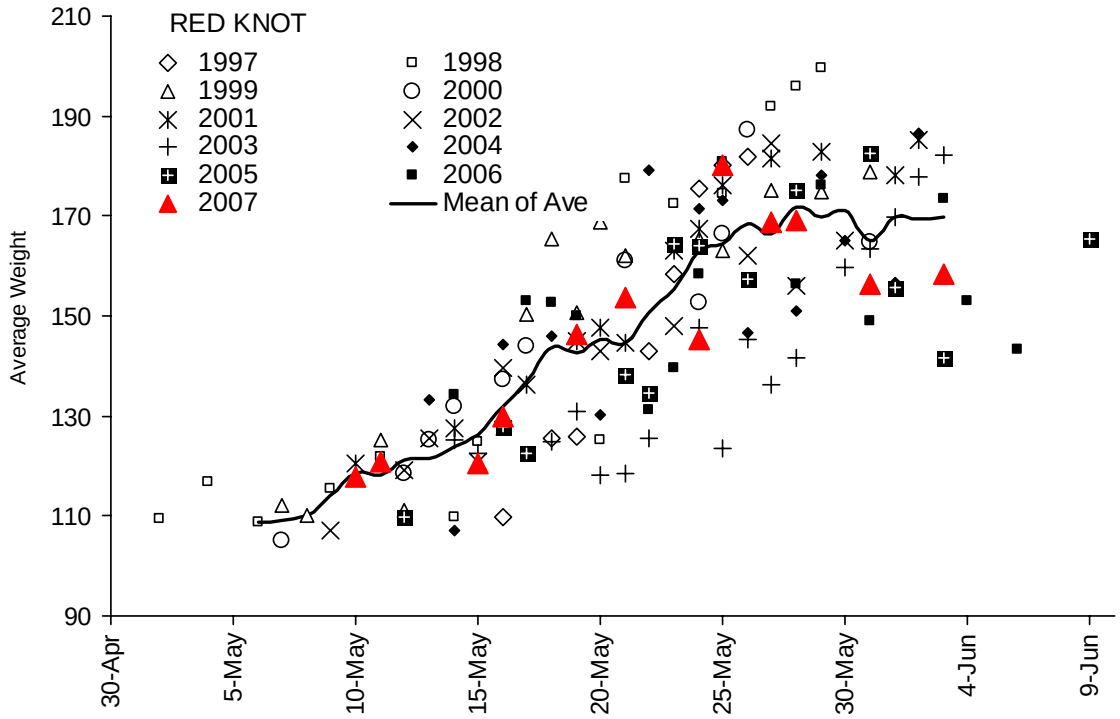


Figure 2. Mean weight per catch of red knots on Delaware Bay during spring migration 1997–2007.

- The most important measure of the health of the Delaware Bay stopover is the ability of shorebirds to gain weight. Red knots must attain weights of at least 180 grams ("Threshold Departure Weight") to have sufficient energy to reach the Arctic and initiate nesting. Using weight data and aerial survey of knots referenced above, we calculated an index of the number of knots reaching threshold departure weights from 1997–2007 (Figure 3). Overall the proportion of birds reaching 180 grams dropped dramatically falling from a high of over >37,000 birds in 1998 to a low of just over 1,500 in 2003. In

2003 both the number of red knots reaching Delaware Bay and threshold departure weight fell dramatically and remained low from 2004 to the present.

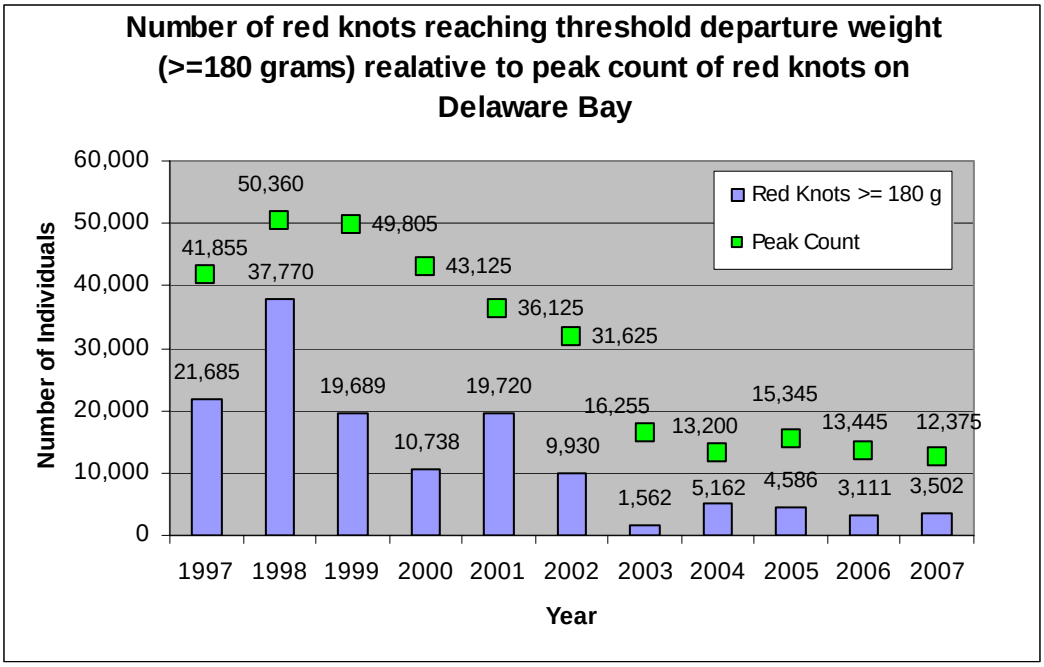


Figure 3. Number of red knot migrants reaching threshold departure weight (≥180 g) on the Delaware Bay stopover.

- Weekly ground counts were conducted during spring and fall migration for shorebirds on the Atlantic coast and impoundments. (See NJDFW report under T-7-2, Job 1E, for results.)
- Again in 2007, ENSP engaged state biologists along the Atlantic Flyway (GA, SC, NC and VA) to conduct aerial surveys during the peak of spring migration. This coast-wide count coincided with the weekly aerial count on Delaware Bay. We asked each state to fly a coastal survey on May 22, 2007, to derive a "snapshot" of red knot distribution on Atlantic coast stopovers and an estimate of the red knot migrant population size. Tables 1 and 2 are the number of red knots counted on May 22 and 23 (peak migration on east coast) and May 29/30 (peak migration in Delaware Bay), respectively. In 2006, the two counts were roughly similar, suggesting that most of the birds counted on Delaware Bay and Atlantic coast ultimately came to Delaware Bay. However, it is not known if this is the case. It is possible that additional birds arrive on Delaware Bay directly from Brazil and are counted after May 22. It is also possible that some portion of birds hopping up the Atlantic Coast may depart directly from Virginia for Arctic breeding grounds, as happened in 2006 (according to telemetry studies by Virginia Polytechnic Institute), bypassing Delaware Bay. A high density of surf clams (*Donax variabilis*) on VA barrier islands may account for this observation in 2006. In 2007, it appears that the latter scenario is more probable as >4,000 knots were still in VA on May 30 and very few birds were counted in Delaware Bay the following week (the first week of June). We do not have information from VPI's 2007 telemetry effort to verify if knots departed directly from Virginia. Intensive resightings efforts in Virginia, begun in 2006 and continued in 2007 [by the Nature Conservancy and the College of William and Mary], together with intensive resightings in Delaware Bay, will help elucidate differences, if any, in annual migration distribution and chronology of the three red knot wintering populations (Tierra del Fuego, Florida/southern US, northern Brazil).

Table 1. Aerial counts of red knots, Atlantic Coast, May 22, 2007 (Peak migration Atlantic Coast).

Date	State	Count
22-May-07	NJ	4,445
22-May-07	DE	2,950
22-May-07	VA	5,939
23-May-07	NC	304
22-May-07	SC	125
22-May-07	GA	2155
total		15,918

Table 2. Aerial counts of red knots, Delaware Bay (NJ & DE) and Virginia on May 29 and 30, 2007 (Peak migration Delaware Bay)

Date	State	Count
30-May-07	VA	4,111
29-May-07	NJ	2,915
29-May-07	DE	9,460
Total		16,486

- The viability of Delaware Bay remains impaired because low density of horseshoe crab eggs. The result is an inadequate availability of eggs on Delaware Bay necessary to allow birds to refuel and go on to breed in the Arctic. Surveys of horseshoe crab eggs conducted over the last seven years show no signs of improvement – 2007 densities are the lowest recorded, (D. Hernandez, personal communication, Richard Stockton College, October 2007) (Figure 4).

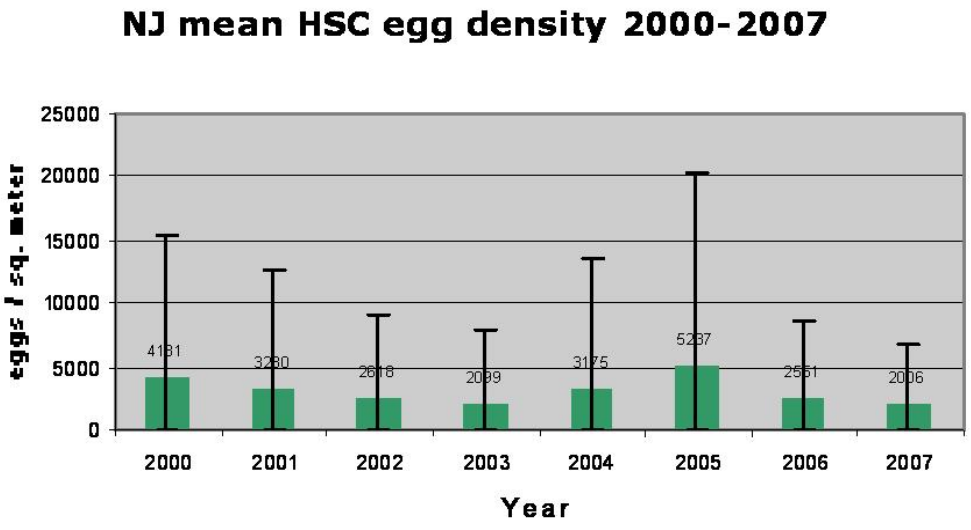


Figure 4. Mean density of eggs/m^2 counted on NJ side of the Delaware Bay 2000 to 2006.

- All current data substantiate the prediction that the red knot will be extinct within this decade.
  - Baker et al. (2004) estimated the extinction probability of the red knot based on survival rates and weight gain from Delaware Bay that predicted extinction of the red knot by about 2010 (Figure 5).

- The winter population counts from Tierra del Fuego roughly track the predicted extinction curve and validate the model (Figure 5).

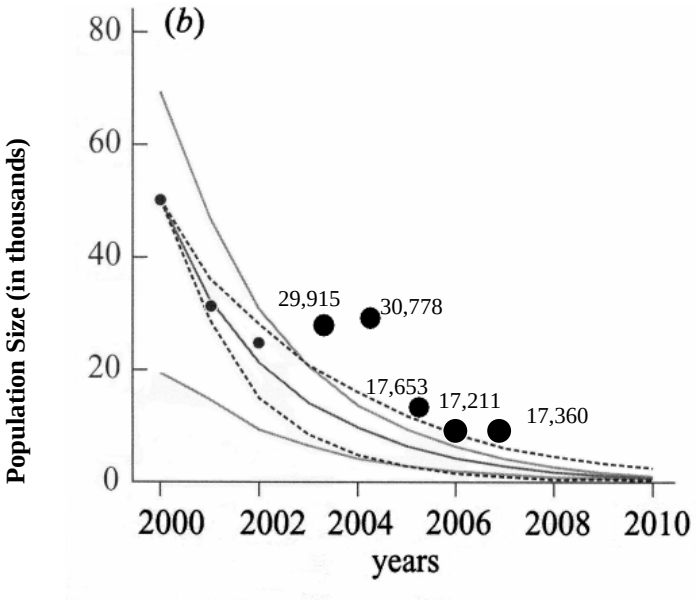


Figure 5. The projected population of red knot (2000 to 2010) based on survival rate determined by resightings of marked birds. The model predicts extinction by 2010 because of decline in adult survival. Large dots represent surveys of red knots from South American wintering sites in Tierra del Fuego. The 2007 survey remains near the model prediction.

- 2007 was the 4th year red knots have been individually marked. Preliminary update of survival estimates was made from resightings of individually marked birds. Mean adult survival for the period 2003–2006 is approximately 0.84. Combined with low recruitment in three of the last four years, adult survival is insufficient to maintain or increase the population (Phil Atkinson, personal communication, British Trust for Ornithology, Thetford, UK, September 2007). 2007 marks year three of individually marking ruddy turnstones and sanderlings. Preliminary estimates of adult survival will be forthcoming for turnstones and sanderlings in late 2007–early 2008.
- 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.
  - Since 2003, all important beaches on the Delaware Bay were closed to human use to prevent the disturbance of feeding shorebirds.
  - Protection was expanded to include two Atlantic coast areas important for roosting and foraging -- Stone Harbor Point/Hereford Inlet and Malibu Beach Wildlife Management Area (a.k.a., Longport sod banks).
  - Volunteer Shorebird Stewards explained the reasons for closure to the public and conservation officers were available to help stewards maintain the beach closures. 2007 marked the 5th year of this protection program with fewer problems and greater cooperation from residents and the public each year. Separate grant funding paid for the steward program.

- ENSP did not carry out a fifth year of telemetry work on red knot movements in Delaware Bay. In 2007, we opted to complete the analyses and report (in progress) of the previous four years and begin telemetry work on the other major species using Delaware Bay. In May 2007, in collaboration with the Southeastern Cooperative Wildlife Disease Study (SCWDS), University of Georgia, we initiated a telemetry project on ruddy turnstones to assess habitat use and daily movements relative to Avian Influenza risk factors. This project was funded by SCWDS with some logistical support from ENSP staff.

Conclusions:

- The red knot population on Delaware Bay declined slightly in 2007 and may still be in decline. Current numbers are consistent with the model predicting extinction in 2010.

- Horseshoe crab egg densities remain at record lows despite significant harvest reductions.
- Current egg densities (2,006 eggs/m^2) are insufficient to support even a greatly-reduced migrant shorebird population and must be increased to a minimum of 50,000 eggs/m^2 to begin recovery of the stopover. Therefore, it is reasonable that closure of crab harvest and/or significant coast-wide harvest reductions, will be necessary to put more eggs on the beach.
- Moreover,
- Other shorebirds, including the ruddy turnstone and semipalmated sandpiper, appear to be following declining trends similar to red knot.
- Analogous to red knot, semipalmated sandpipers have declined in their ability to gain mass while on Delaware Bay. (David Mizrahi, Personal Communication, August 2007, New Jersey Audubon Society).

Recommendations:

- Recovery and maintenance of Delaware Bay horseshoe crab egg densities at levels sufficient to sustain stopover populations of all shorebirds including 100,000 red knots. In part this will be supported by:
  - Continuation of all current yearly studies of shorebird numbers, weight distribution and rate of mass gain, horseshoe crab numbers and egg densities, as continuing inputs for models.
  - Development and testing of a predictive model for use by managers to determine the egg densities appropriate to support the existing stopover population and the gradual increase necessary as shorebird numbers recover.
- By 2008, development of a system for the yearly determination of population demographic status based on survey results, capture data and resightings of banded individuals. This will involve:
  - Creation of a survival and population status model using existing data, and updated annually with new data.
- Development of annual estimates of productivity and juvenile survival as inputs for population models using the framework established for waterfowl population assessments Determine key southbound and northbound stopovers that account for at least 80% of stopover areas supporting at least 100 red knots, and develop coastwide surveillance of birds as they migrate. This will require:
  - Setting up survey, resighting, and banding programs to determine importance of individual stopovers relevant to associated wintering and breeding areas in places other than the Delaware Bay, including James Bay, the Mingan Islands in the Gulf of St Lawrence, at least two sites each in New Jersey, Virginia, South Carolina, Georgia, Maranhao (Brazil) and Patagonia (Argentina).
  - Use of WHSRN site-assessment tools to determine threats and management needs at each site and develop a plan to meet them.
- Control impact of disturbance at all stopovers and wintering areas, particularly in high-importance, high-disturbance areas like Delaware Bay and the west coast of Florida
  - Identify, through site-assessment tools, all sites where human use is impacting birds by preventing access to key resources and/or roost sites.
  - Restrict access to all beaches using methods developed in Delaware Bay as outlined in this report.

JOB 1G: Shorebirds - Conservation of Red Knot Breeding Areas, Nunavut Territory, Canada

OBJECTIVE: Monitor nesting density of red knots (*Calidrus canutus rufa*) and American golden plover (a non-Delaware Bay migratory shorebird) on Arctic breeding grounds to assess the relative impacts of predator pressure in the Arctic and impacts related to the decline of the Delaware Bay stopover.

Key Findings:

- In 2007, ENSP biologists, in collaboration with Rutgers University Center for Remote Sensing and Spatial Analysis (CRSSA), completed the predictive model of red knot breeding habitat in the Arctic. The model identifies suitable breeding habitat based on vegetative cover, elevation, and distance from

the coast. The basis of this model is the red knot telemetry work carried out on Delaware Bay and the Arctic by ENSP and partners during the period 2000 to 2006. A manuscript (in review) will be submitted to a peer-reviewed journal in 2007.

- In 2007, biologists from ENSP and the Royal Ontario Museum carried out field work near Cambridge Bay, Victoria Island, to establish a western study site to monitor red knot breeding. Red knots had been documented breeding near Cambridge Bay from 1999 to 2003. Using the predictive model, potential breeding areas were identified and searched. Previous red knot nesting locations were unoccupied as were other areas searched. Victoria represents the western edge of red knot breeding range in Canada. We believe that as the red knot population has declined, breeding range has contracted.

Conclusions:

- Our survey indicates that red knot breeding range may be contracting at its western margin. Range contraction, together with hypothesized separation of wintering populations on breeding grounds, increases the degree of threat to an already-dwindling population. Smaller effective population sizes make red knots more vulnerable to genetic drift and inbreeding [characteristic of small populations], and random shifts in productivity and survival [characteristic of arctic breeding shorebirds].

Recommendations:

- By 2007, identify all important breeding locations in Canada, and recommend protection needs for the top ten sites. This will require:
  - Use of radio telemetry to determine the arctic breeding areas of each winter population (Florida, northern Brazil and Tierra del Fuego).
  - Use of GIS to determine suitable breeding habitat and extent of important breeding areas (completed).
  - Formulation of recommendations to national governments on protection designations for most important breeding areas

JOB 1H: Shorebirds- Conservation of Red Knot Wintering Areas, Tierra del Fuego, Chile and Argentina

OBJECTIVE: Monitor population trend of red knots (*Calidrus canutus rufa*) and other shorebirds on wintering grounds in Tierra del Fuego, Chile, and Argentina; assist South American countries' biologists obtain WHSRN (Western Hemisphere Shorebird Reserve Network) and RAMSAR [Convention on Wetlands (RAMSAR Iran 1971)] designations for important wintering and stopover sites in South America.

Key Findings:

- The number of red knots in Tierra del Fuego continued to decline slightly this year. While the number of knots in Bahia Lomas remained relatively stable (Figure 6), the number in Rio Grande fell for a second year in a row (Figure 7).

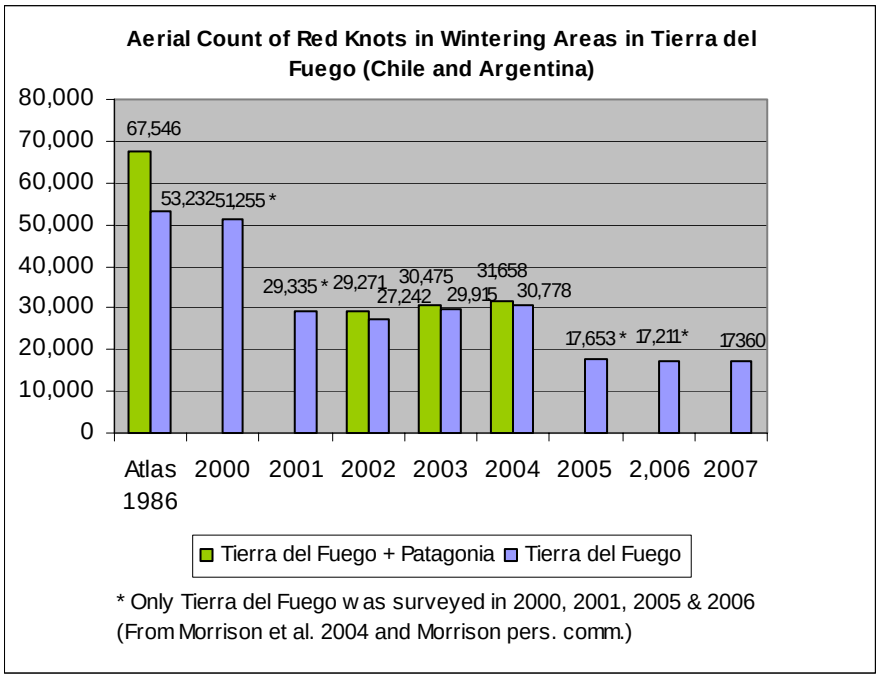


Figure 6. Number of red knots in South American wintering areas 1985, 2000-2007.

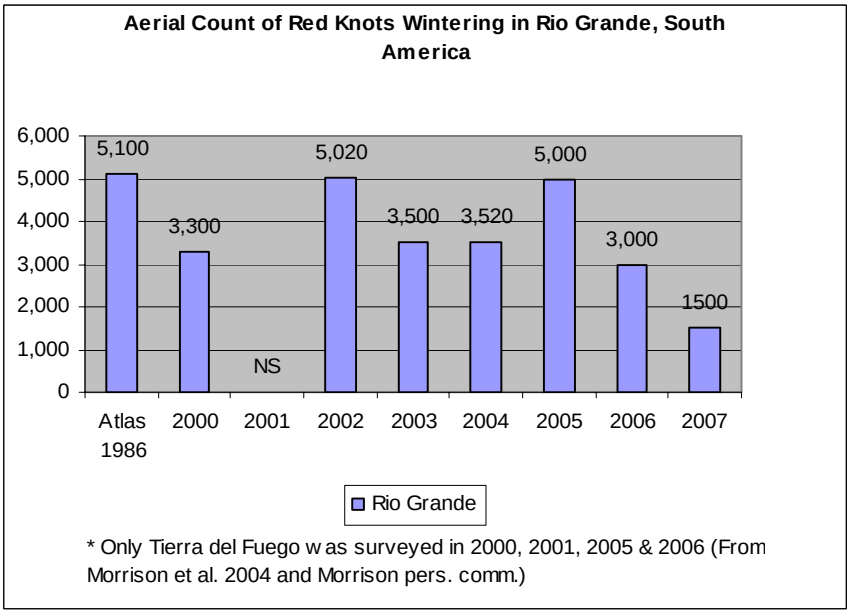


Figure 7. Number of red knots in the Rio Grande wintering area 1986, 2000– 2007. The wintering population, formerly stable, declined for a second year in a row.

- The population of Hudsonian godwit, wintering together with red knots in Tierra del Fuego, has increased over the period 2000 to 2007. This indicates that the cause for decline of the red knot wintering population is not connected with the wintering grounds (e.g., oil spill, food shortage, etc.).

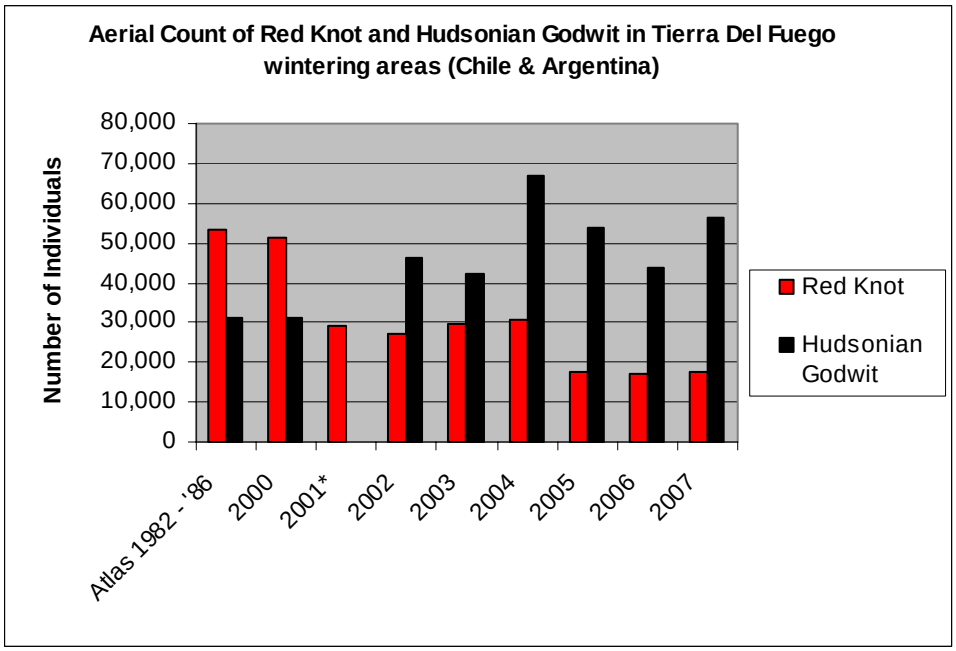


Figure 8. Comparison of red knot and Hudsonian godwit winter population numbers. Red knot population declined while Hudsonian godwit numbers increased.

- The number of knots in Tierra del Fuego is consistent with the model predicting extinction by 2010 (Figure 5, above, under *Job 1F: Shorebirds - Conservation of Red Knot; Delaware Bay*).
- Work conducted on the three main wintering sites, including Tierra del Fuego (17,250), Brazil (est. 7,500) and Florida (est. 3,000 – 7,000), suggests a total maximum red knot population of approximately 30,000 birds, much lower than an original estimate of over 150,000 birds.
- Stable isotope analyses of feathers from knots captured on Delaware Bay and resighting of birds banded on various wintering and stopover locations indicate the impact of diminished horseshoe crab resources falls primarily on knots wintering in Tierra del Fuego. However, the red knot population wintering in Florida and the southeastern US may be suffering mainly from reduced overwinter survival caused by a combination of factors including: habitat loss, a high frequency of human disturbance on foraging and roosting sites, a high frequency of beach replenishment activities that eliminate invertebrate prey populations reducing food availability.

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 in the US. This wintering population is 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.

Recommendations:

- By 2008, determine the genetic and breeding status of the three main wintering populations (Tierra del Fuego, Maranhao and Florida). This will involve:
  - Identifying the arctic breeding area associated with each wintering subpopulation.
  - Determine subspecific status of each wintering population.
  - Determine the migration routes used by each wintering population
- By 2011, create a hemisphere-wide system of protected areas for each significant wintering, stopover and breeding area.
- By 2009, complete site assessment, using Western Hemisphere Shorebird Reserve Network (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. This will lead to:
  - The development of management plans and their integration into local and national conservation systems.
  - The identification of survey and research needs for each site.
- By 2009, 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. This will involve:
  - Conducting intensive surveys and determining areas of greatest importance within each site.
  - Creating maps of each site and determine chief threats and management needs using WHSRN site assessment tools.
  - In conjunction with national and local government agencies, create management plans for each wintering area that identify actions necessary to improve conditions and protect sites. Conducting site-specific research necessary to determine important-use areas as well as existing and emerging threats.
  - Conducting site-specific research necessary to determine important-use areas as well as existing and emerging threats.
    - Carrying out studies of food resources.
    - Carrying out studies of habitat-use using radio telemetry

JOB 1I: Piping Plover

OBJECTIVE: To improve piping plover (*Charadrius melodus*) reproductive success by creating and maintaining additional foraging opportunities (artificial ponds) for chicks in areas sheltered from human disturbance. This project meets recommendations of the USFWS Piping Plover Recovery Plan, where one goal is to “draw down or create coastal ponds to make more feeding habitat available”.

Job 1I, Part 1 : Piping Plover Artificial Foraging Areas
Key Findings:

- Plots (10’ x 25’) lined with a thick plastic liner and then covered with approximately 6” of sand) proved effective for :
  - Preventing water from percolating through the sand and allowing it to pool, whereas last year the unlined plots were unable to accomplish this task.
  - Preventing new vegetation shoots from filling in the plot, potentially increasing its effectiveness.
  - The liner was relatively easy to install and remove.
- “Jetting” continued to be the best option for installing the wells. This year two types of wellpoints were used. Both were made of PVC pipe (a change from the galvanized pipes used last year); one had a 1.5” diameter and the other had a 4” diameter.
- Two types of pumps (neither of which were the same as the ones used last year) were utilized this season and their efficacy was untested, therefore the number of sites was reduced from four to two sites to eliminate wasteful purchase of pumps that might not work.

- 2-Mile Beach, Lorentz submersible pump, 4” diameter wellpoint:
  - 2-Mile Beach is a site that is closed to the public during the breeding season. For the first time in at least 20 years, a pair of piping plovers nested at this site (following a mini-restoration project that occurred during the winter of 2007). The site was chosen because of its limited human presence, thereby reducing the chance of potential of human interference to the equipment. No disturbance of the equipment was noted.
  - The 4” diameter pipe was jet in at 2-Mile Beach with no difficulty but the gauge of the slits in the wellpoint were unexpectedly too large for the substrate, allowing large amounts of sand to enter the well. This was somewhat perplexing since the gauge of the slits on the larger wellpoint were only slightly larger than the ones on the smaller wellpoint. However, the slightly larger size was ultimately responsible for the failure of this system, since all the sand in the well rendered it useless. By the time it was determined that the well would not function, it was too late to rectify the situation because the site’s vehicle closure had commenced and the equipment needed to install the well required a truck.
  - There was one pre-treatment invertebrate sampling that yielded a small number of invertebrates (n=6). Since the pump was never installed, there were no post-treatment surveys.
- Ocean City, Conergy surface pump, 1.5” diameter wellpoint
  - Ocean City is a municipal beach whose summer population swells with tourists enjoying the coastal environment. Unlike 2-Mile Beach and TRACEN (the previous sites used for this experiment) this site is not closed to the public during the breeding season. Therefore, this was the first foray of this experiment to a location where human interference with the equipment (solar panels, pump and LCB) was a legitimate concern. Over the course of the 5 months that the equipment was able to be seen (although inside the same light fencing that protects the plover nests and nesting areas) there were never any incidents. The pump was mounted in a locked box, but would still have been easy for someone to break into, should that have been their desire.
  - The 1.5” diameter pipe was jet in at and installation was flawless. The 10’x25’ plot was lined with plastic and filled with wrack to help retain moisture, which worked well.
  - The 2507 Conergy surface pump pumped at a far greater rate (roughly three times higher) than the 1310 Conergy surface pump used last year. The increase in flow, coupled with the plot being lined, allowed water to puddle, creating the desired effect of an artificial foraging area mimicking an ephemeral pool.
  - After a short (but successful) stint, the pump failed in the harsh coastal environment. It was expected to do well in the sandy conditions it was graded for, but the substrate proved to be too much despite the various filters that were attached to the pump.
  - Prior to failure, it appeared that shorebirds were using the artificial foraging area since many tracks were found in the plot. The species identity was confirmed during a site visit when an employee observed and photographed a piping plover foraging in the plot. Although no formal invertebrate analysis was completed at this site, flying insects were often observed. The decision not to survey for invertebrates was made so as to not interrupt any foraging or nesting plovers, both of which occurred either in or in close proximity to the artificial foraging area.
  - The municipality and school system of Ocean City were both supportive and helpful with this project.

Conclusions:

- Lining the plots with plastic played an integral role in water retention.
- The larger Conergy surface pump used this year met water flow needs, but was too sensitive to the coastal environment to be considered an ideal pump for this application.
- The submersible Lorentz pump was left untested this year due to the failure of the wellpoint, but will be tested next year.
- A 4” diameter wellpoint may not be useful if the larger size allows too much sediment to enter the well during the jetting process.

- PVC pipe was an excellent replacement for the galvanized pipe that was used last year. It performed just as well as the metal pipe, but was easier to handle due to its lighter weight, and was considerably cheaper to purchase.
- The solar power configuration continued to be a great success. It had a straightforward operation, and the panel worked well during the season, sustaining no damage or obvious wear.
- There was no verification as to *which* prey species were present as surveys could not be conducted without disturbing nesting plovers. Piping plovers foraging at the plot indicated that suitable prey items were attracted to the site. This was a significant milestone for this experiment, as it confirms that piping plovers will use artificial foraging areas. Since the technical aspects of the system did not operate as long as would have been necessary to determine if the plots increase survival rates for chicks, this portion of the experiment remains untested. However, next year should supply the answer to this question.
- The transition of using sites that are closed to the public to those that are open (federal refuge versus municipal site) was easier than anticipated. This experience proved that municipal locations can be used with little fear of interference from public. This is especially promising because municipal sites are where artificial foraging areas are likely to be most effective.
- A strong working relationship with the municipality where the artificial foraging area is located is paramount to the success of the project.

Recommendations:
- Due to the quantifiable improvement to the retention of water in the plot, continue to line the plots with heavy plastic liners.
- Due to their high sensitivity to the coastal environment, cease the use of surface pumps and place all efforts into configurations employing submersible pumps.
- Decrease the slit gauge size of the 4" wellpoint from a size 10 to a size 6 to determine if this will eliminate the problem of copious amounts of sand entering the well.
- Refine invertebrate surveys around the foraging stations to ensure the best method for collecting invertebrates in the area is utilized while not interfering with nesting and foraging piping plovers (or other nongame species in the area). Strive to categorize the species in the area down to the smallest taxon possible.
- Continue and increase the use of municipal sites, concentrating on those where plovers are present and municipal support exists.

Job 1I, Part 2: Piping Plover Spatial Distribution
Key Findings:
- This is a two year project and as such there are only preliminary results to reports at this time. Final results will be made available in the 2007-2008 SWG report.
- This project will be best suited as a joint effort between ENSP (who has taken the lead), the Coastal Research Center (CRC) at Stockton College and the Center for Remote Sensing and Spatial Analysis (CRSSA) lab at Rutgers University.
- The Weights of Evidence (WOE) Model has been chosen as the method to analyze the data. This method will allow for determining spatial patterns based on environmental "features". This will help determine whether and/or which physical properties are responsible for the distribution of piping plovers throughout New Jersey.
- Initial variables that have been identified for further analysis include location of inlets, level of protection a site receives, ownership of site, history of beach replenishment, height of dunes and width of berm. Ultimately, these variables may not prove to be useful, or others may be chosen as the project moves forward.
- Multivariate analysis of variance (MANOVA) methods have been chosen as the method to statistically analyze reproductive success and other variables as they relate to the spatial distribution of nesting piping plovers.
- Light detection and ranging (LIDAR) and aerial images will both be utilized in analyses.

Conclusions:
- There are no conclusions during this interim period.

Recommendations:
- Continue collaboration with Stockton College CRC and Rutgers's CRSSA personnel to ensure that work continues at a rate that will allow project analysis to be completed at the designated date.
- Remain open to new methods and additional types of analysis as the project moves forward.

JOB 1J: Raptors

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*). 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 species the common barn owl (*Tyto alba*), and other inhabitants including the great horned owl (*Bubo virginianus*), e. screech owl (*Megascops asio*), and the n. saw-whet owl (*Aegolius acadicus*); and develop baseline data for long-term monitoring of owl populations, distribution, and habitat selection.

Woodland Raptors
Key Findings:
- ENSP staff contracted with Dr. Edward Green from Rutgers University to assist in conducting an analysis to evaluate the population trend of NJ's woodland raptors in relation to the changing landscape.
  - An initial meeting was held in the late-winter of 2007 to discuss the project and potential difficulties of/ barriers to analyzing woodland raptor data in comparison to land use coverage spatial data layer (e.g., land use coverage is available for 1986, 1995, and 2002 only; pre-2002 data not precise due to GIS capabilities).
- ENSP reviewed data generated by Rutgers University's Center for Remote Sensing and Spatial Analysis (CRSSA) that reviewed changing landscapes/ habitats through satellite imagery interpretation; data categorized by watershed and broad habitat types (e.g., forest, wetland) for possible use in analysis.

Conclusions:
- ENSP biologists must determine appropriate means to analyze the woodland raptor data to evaluate the effects of the landscape on their populations. It may be necessary to include Dr. Rick Lathrop, Rutgers University, CRSSA lab in these discussions to identify possible options.
- CRSSA data was not suitable for this analysis as it does not differentiate between forested wetland, emergent wetlands, and tidal wetlands.

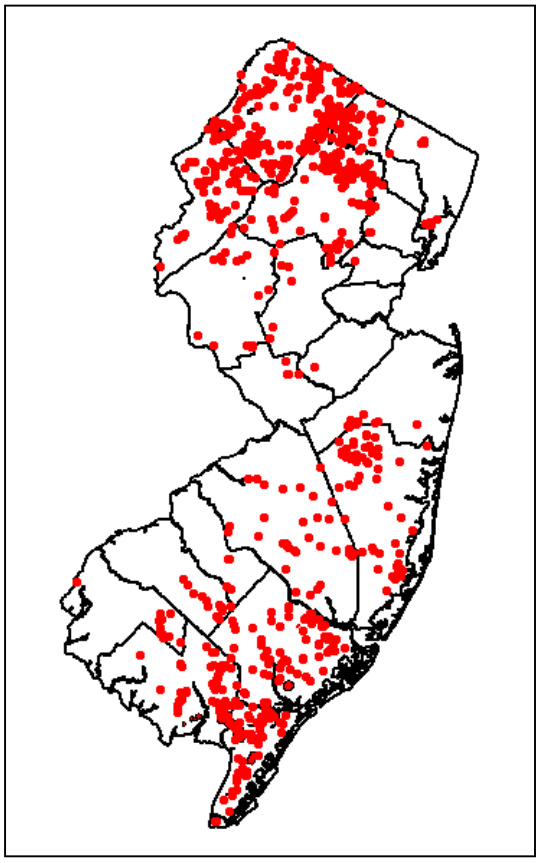
Recommendations:
- ENSP should continue to evaluate appropriate methods and meet with experts in statistics and geographic information systems to develop an analysis that will provide the most precise information regarding woodland raptor population trends in relation to a changing landscape.

Owl Distribution
Key Findings:

- Efforts were made to identify potential data sources (e.g., contacting local universities/colleges, local non-government organizations, and experienced volunteers and consultants).
- On-line report system was not attempted this year due to concerns for validating observations and/or accurately evaluating the observers' identification skills.
- Eighteen experienced volunteers and consultants were contacted for owl observation data.
  - Fourteen agreed to participate, but due to their personal time constraints, data was received from only three volunteers.
  - Data gathered from volunteers and consultants identified 7 point locations and 13 areas (identified as polygons) where owls were observed since 2000:
    - 7 point locations included:
      - 5 eastern screech owl locations (1 location shared with great-horned owl)
      - 2 great-horned owl locations (1 locations shared with eastern screech owl)
    - 13 areas (precise location not confirmed) included:
      - 1 barred owl location
      - 3 eastern screech owl locations
      - 9 great-horned owl location
- NJ Audubon Society's Breeding Bird Atlas data was recorded as presence/ absence by USGS 1:24,000 - 7.5 Minute Quadrangle, identifying almost every NJ Quadrangle as having an owl observation.
  - Data was too broad for incorporation in this distribution map or to use to identify areas where data gaps exist.
- ENSP compiled identified owl locations from ENSP's Biotics database (as of February 2007, excludes woodland raptor survey data, 2006), ENSP's 2006 woodland raptor survey data, observations made by experienced volunteers and consultants, and NJ Audubon Society's Breeding Bird Atlas.
  - ENSP's Biotics database provided 706 point locations of owl observations and 15 aerial delimited polygons:
    - 706 point locations included:
      - 681 barred owl locations
      - 15 long-eared owl locations
      - 6 short-eared owl locations
      - 3 barn owl locations
      - 1 northern saw-whet owl locations
    - 15 aerial delimited polygons included:
      - 7 barred owl locations
      - 4 long-eared owl locations
      - 3 short-eared owl locations
      - 1 barn owl location

        ** 1 area was valued for 1 observation each of long-eared, short eared, barn, and barred owls
  - ENSP's woodland raptor survey data provided 244 point locations of owl observations (data on non-barred owls, 1988-2006; and barred owls, 2006, that were not entered into Biotics as of February 2007):
    - 180 barred owl locations (1 location shared with eastern screech owl)
    - 1 long-eared owl location
    - 46 great-horned owl locations
    - 17 eastern screech owl locations (1 location shared with barred owl)
  - Figure 1 illustrates the results of the data compilation.

Figure 1. Statewide distribution of owls in NJ (barred, long-eared, short-eared, barn, great-horned, screech, and northern saw-whet owls) as of February 2007.



Conclusions:

- ENSP must contact volunteers who agreed to participate but were unable to so within the allotted time. Staff should simplify the information submittal process (e.g., one-on-one with maps, focus on rare species first).
- Review of the distribution map (Figure 1) clearly shows a data gap of information through the Piedmont Plains Region Landscape.

Recommendations:

- ENSP to continue to identify potential sources and compile data to populate the owl distribution database and map and the Biotics database, where appropriate.

JOB 1L: American Kestrel

OBJECTIVE: To halt and reverse the decline of the newly 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.

- A total of 208 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 the boxes and suitable locations where we did have landowner cooperation. Boxes were concentrated in two major study areas (identified as Clinton and Amwell Valley), with a small number of boxes in a third study area (Assunpink) and a few placed outside of the study areas. The following is a summary of kestrel habitat within the study sites and nest boxes installed within each of the three patch sizes:

1995 LU/LC Base layer

Patch Size	# Patches	Total Ha of Kestrel Habitat	# Boxes
0-250 hectares	4,666	40,248ha	54
250-1000 hectares	39	19,112ha	59
>1000 hectares	11	31,993ha	95

- The NJDEP updated their LU/LC data using imagery from 2002. This dataset was recently made available, allowing ENSP staff to rerun the patch model using this base layer. Below is an updated (and accurate as of 2002 land use/land cover) summary of kestrel habitat within the study sites and nest boxes installed within each of the three patch sizes:

2002 LU/LC Base layer

Patch Size	# Patches	Total Ha of Kestrel Habitat	# Boxes
0-250 hectares	5,807	43,343ha	70
250-1000 hectares	40	17,998ha	72
>1000 hectares	10	19,633ha	66

- Each nest box was monitored once every 12-15 days from April through August. Of 208 nest boxes, 24 were occupied by American kestrels. Eight (33%) boxes resulted in failed nesting by kestrels, while 16 were successful.
- A total of 80 kestrels were banded: 64 young (26 female, 38 male) and 16 adult (13 female, 3 male) were banded at 19 nest boxes.
- A total of 7 volunteers checked 53 nest boxes, and over 40 volunteers helped to build boxes.
- All data collected were entered online through a Google documents online interface.

Conclusions:

- Nest box installation was delayed by a slow process of gaining permission from a major NJ power company (JCP&L) for use of existing power poles. To test the GIS habitat model effectively, we need to expand the number of nest boxes in each of the patch sizes to better populate the model area.
- Rerunning the patch model from the 1995 LU/LC to the 2002 LU/LC was effective to demonstrate the continued fragmentation and loss of habitat within New Jersey's landscape. Within the study areas, the results are summarized below:
  - Available kestrel habitat decreased by 10,379 ha, a decrease of 11.4%.
  - The largest patch size category, >1,000 ha, decreased by one patch, overall area decreased by 12,360 ha (39%), and mean patch size decreased by a third, from 2,909 ha in 1995 to 1,963 ha in 2002.
  - The middle patch size category, 250-1000 ha, increased by one patch, overall area decreased by 1,114 ha (6%), and mean patch size did not change appreciably.
  - The smallest patch size category, <250 ha, increased by 1,141 patches, overall area increased by 3,095 ha (8%), and mean patch size decreased from 9 ha in 1995 to 8 ha in 2002.

Recommendations:

- Continue to monitor kestrel nesting in ENSP study sites to determine occupancy (by kestrels and competitors), kestrel productivity, and causes of mortality and nest failures.
- Work with the two other major utility companies (PSE&G and Atlantic City Electric) to get permission to use their utility poles, to increase study area size and reduce the time required to hang nest boxes.

- Continue to install nest boxes in suitable kestrel habitat to expand the study populations. Limit the Assunpink study area to the largest patch size to maximize use by kestrels.
- Attend annual Raptor Research conferences to foster collaboration and advancement on this species decline.
- Continue to target areas (preserved farmland, state owned land and lands enrolled in conservation programs) that are not in jeopardy of development pressure.
- Recruit and train a group of dedicated Citizen Scientist volunteers to monitor nest box activity throughout the breeding season.
- Develop adequate funding sources to investigate the cause of failed nesting attempts.
- Develop framework and funding to investigate use of and potential loss of kestrel migration habitat.
- Develop survey protocols to determine habitat use by kestrels to be used in environmental review process.
- Develop a radio telemetry study to accurately define kestrel home ranges and their relationship to patch size and habitat quality.

JOB 1M: Secretive Marsh Birds

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

Key Findings:

- The Landscape Project was used as a starting point to determine where survey routes should be located. 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.
- Fifteen routes were created throughout the Highlands area of the state. Each route had between 3-8 survey points, located at least .25 mile away from one another. Most of these routes and survey points were determined through a combination of GIS mapping and contacts with local birders who had knowledge of where secretive marsh birds were likely to occur.
- The Meadowlands portion of the secretive marsh survey did not occur this year due to the loss of a key employee in that region. The employee left in the early stages of planning and the position has not been filled; no staff members available to conduct this part of the survey.
- 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 experience of volunteers was lower than expected. This survey requires volunteers to possess a high degree of skill in audio identification of bird calls. Unfortunately, volunteers were less than forthcoming or perhaps just overestimated their skills and there was low confidence in their birding abilities.
- 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.
    - Volunteers surveyed six of the fifteen routes.
    - One ENSP biologist surveyed one of the fifteen routes.
    - The remaining eight routes were not surveyed, but since this is a two year project, those routes can be utilized next season.
- The Conway protocol worked well, especially relating to the information on how to conduct the actual survey. It was not as useful in determining where the survey routes should be located. This is because the Conway protocol focuses on discrete areas (such as a national wildlife refuge) where the survey goal is 100% coverage. Although the Highlands and Meadowlands do have political boundaries, covering the entire range was not a realistic goal. 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.
- The Conway protocol required 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.
- Of the seven routes surveyed, only one survey point on one route yielded any results. On that route a least bittern responded to a black rail call.

Conclusions:
- GIS tools provided a good starting point to determining where routes should be located, although on a large scale the maps were more difficult to deal with. Surveying local birders and ground truthing were also important components to determine routes. The combination of these three, as well as knowledge of the region by the coordinator, is the best way to create routes.
- The training day was necessary to ensure that all volunteers followed the protocol and conducted the survey in the same way.
- The relatively low skill level of some of the volunteers probably did not affect the results of the survey. This is because volunteers were asked to report any bird calls (whether they could identify them or not) that were heard during the survey. The majority of the datasheets did not report *any* species of bird, alleviating concerns that birds were being misidentified
- In an effort to keep the routes easily accessible for volunteers, many of the routes followed roads that were drivable and had wetlands on their boundaries. These routes may not have been far enough away from human disturbance/development, and may explain the low numbers of focal birds recorded during the surveys. Another explanation for the low response rate could be that the populations of these species are so low that confirming their presence at different locations is a difficult task.

Recommendations:
- Consider finding another organization to take ownership of the Meadowlands portion of this survey so that ENSP can honor its obligation to finishing this survey in a timely manner.
- Recruit higher skilled volunteers or conduct the survey in-house with seasonal technicians. Alternately, contract the survey to an organization better equipped to recruit skilled volunteers and efficiently carry out the survey.
- Create new routes that 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 birder's and GIS tools to create future routes.
- Continue to focus on those sites that are not otherwise protected by state and federal regulations to ensure that vulnerable habitat is identified and protected.

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

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: common nighthawk (*Chordeiles minor*), least flycatcher (*Empidonax minimus*), horned lark (*Eremphila alpestris*), golden-winged warbler (*Vermivora chrysoptera*), yellow-breasted chat (*Icteria virens*), and whip-poor-will (*Caprimulgus vociferus*). Goals include: inventorying and monitoring species populations, specifically to conduct a monitoring program to track population trends not covered by the Breeding Bird Survey, the identification and preservation of critical habitat (important breeding sites), the

identification of specific threats at these sites, and the provision of guidance/recommendations to landowners.

Key Findings:

- A statistician was contracted to perform statistical analyses on the golden-winged warbler habitat data and identify habitat parameters that indicate characteristics of source habitat for GWWAs. However, the contract was approved the end of July so another year of productivity research was conducted. There was not enough time to compile the 2007 data and do analyses before the end of the SWG fiscal year.
    - John Confer was contacted in attempt to pool his data, but due to publishing conflicts, we have not received any data from him.
    - Habitat management recommendations were not created because the data have not been properly analyzed.
- In 2007, biologists continued surveys along utility rights-of-way (previously surveyed from 2003-2006) in four study areas located in Sparta Mountain and Weldon Brook Wildlife Management Areas and parts of the Pequannock Watershed.
    - From April – July 2007, twelve individual male golden-winged warblers were identified: one individual had been banded in 2003, one in 2004, one in 2005, three in 2006, three were banded in 2007, and three were unbanded.
    - Four known golden-winged warbler breeding pairs (both parents golden-winged warblers) were observed while the other eight males were either unmated or transients. Seven nests from four pairs were located and two pairs fledged eight young total. One of the nests that failed was parasitized by cowbirds. No mixed pairs (blue-winged warbler mated to golden-winged warbler) or hybrids were observed in 2007.
    - Thirty-six blue-winged warbler males were observed within the study sites in 2007.
        - One blue-winged warbler nest was located which failed days before fledging.
    - Six nests of four species (other than golden-winged and blue-winged warblers) were located and monitored in 2007.
        - Four (67%) of the six nests fledged 14 young total, one was depredated during incubation, and the other one had and unknown outcome. None of the six nests was parasitized by cowbirds.
    - Golden-winged warbler territories in 2007 tended to be in wet areas (χ^2=17.42, P<0.001) with greater dead vegetation cover (χ^2=4.89, P=0.027) and vegetation height (χ^2=14.29, P<0.001) than unoccupied areas (Fig. 1).
        - Blue-winged warblers tended to occupy areas with greater shrub cover (χ^2=59.50, P<0.001) and less dead vegetation cover (χ^2=79.29, P<0.001) than unoccupied areas (Fig. 2).
    - The number of golden-winged warblers decreased from 2003 to 2004 (Fig. 3) but has remained stable through 2007 while blue winged warblers have an increasing trend (Fig. 4).
    - All of the golden-winged warbler locations were entered into the Biotics database and the to-be-released version of the Landscape Project.
- Cooperation with land managers and utility companies has been limited to advising on timing restrictions for management in areas where golden-winged warblers occur on utility rights-of-way because the habitat data have not been properly analyzed.
- The Golden-winged Warbler Working Group was idle this past year.

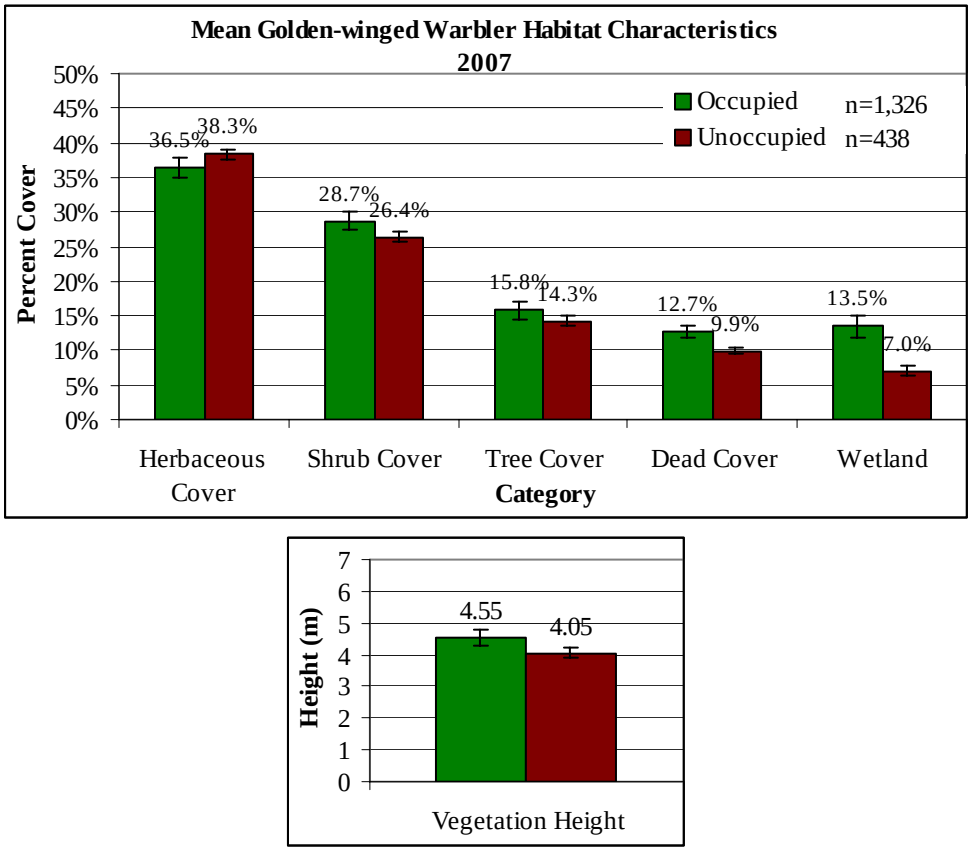
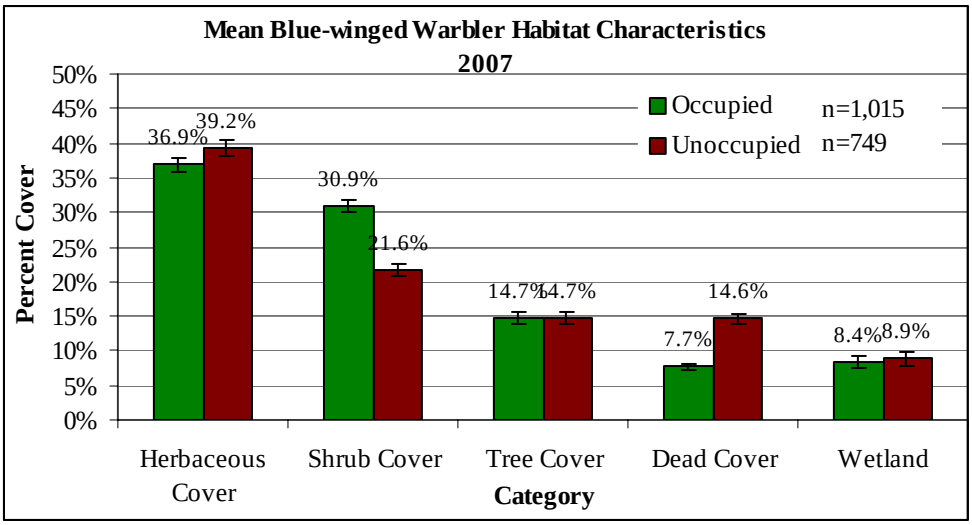


Figure 1. Mean vegetation characteristics of golden-winged warbler habitat in 2007.



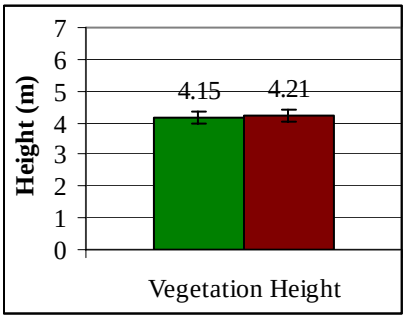


Figure 2. Mean vegetation characteristics of blue-winged warbler habitat in 2007.

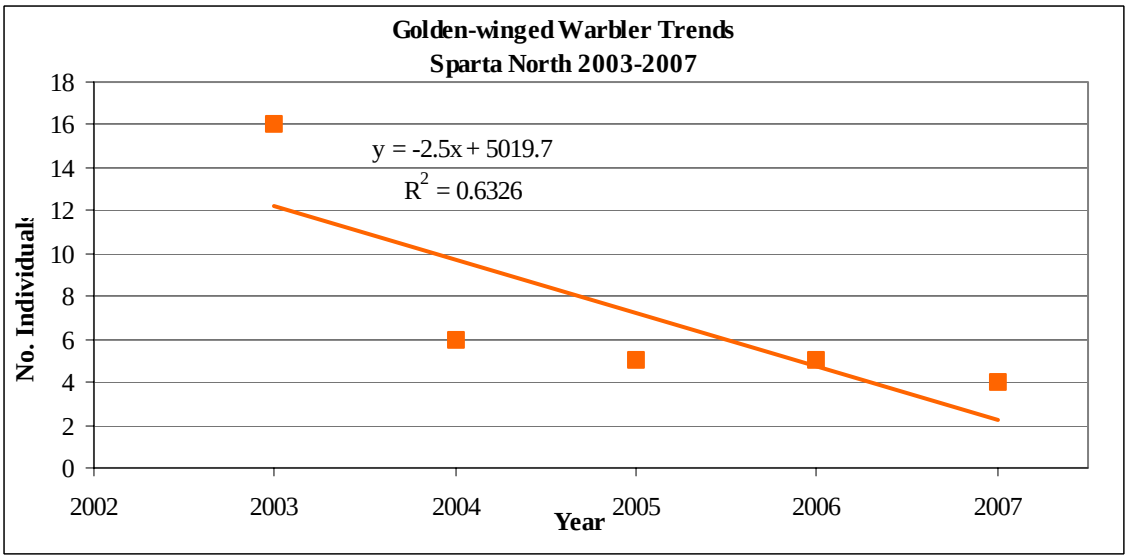


Figure 3. Number and trend of golden-winged warblers on Sparta North from 2003 through 2007.

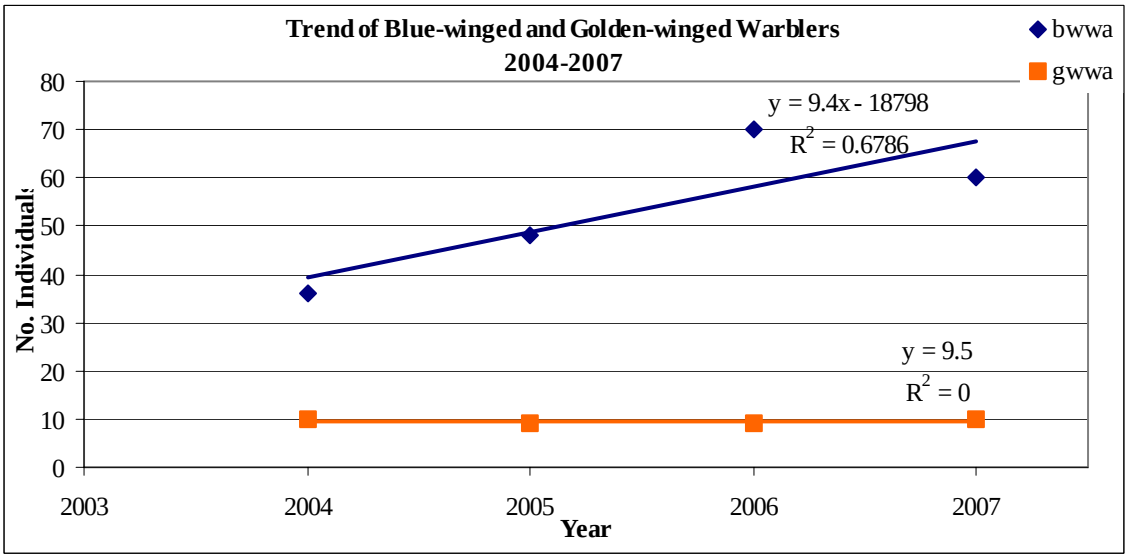


Figure 4. Number and trend of blue-winged warblers and golden-winged warblers on Sparta Mountain and Weldon Brook WMAs from 2004 through 2007.

Conclusions:

- Although there has been little recovery in the population of golden-winged warblers using the Sparta Mountain area since the population decline in 2003, these data continue to show that the utility rights-of-way are not population sinks in terms of golden-winged warbler productivity.
- Site fidelity in golden-winged warblers is high regardless of blue-winged warbler presence, and in some cases, lack of females, even if the habitat has been drastically altered.
- The lack of golden-winged warblers immigrating into this area could be a result of an overall population decline, a shift in the species range, subtle changes in the habitat composition of the study sites, increased numbers of blue-winged warblers, or a combination of these factors.
- Site fidelity has as much, if not more influence on golden-winged warbler presence than vegetation cover.

Recommendations:

- Begin analyzing the habitat data from 2003 through 2007 and create management recommendations for source golden-winged warbler habitat based on the analyses.
- Determine current distribution of golden-winged warblers in New Jersey and assess habitats used.
- Work with utility companies and 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.
- Collaborate with the golden-winged warbler working group to create Best Management Practices for utility companies and land managers to improve existing habitat for golden-winged warblers and discourage blue-winged warblers.
- Begin looking at golden-winged warbler habitat use in scrub-shrub wetlands, particularly in areas where bog turtle management will be implemented, to determine any affects management may have on golden-winged warbler populations.

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

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 the causes of population declines, formulate strategies to reverse declines and maintain healthy populations, and evaluate the effectiveness of the strategies.

Key Findings:

- In 2007, two trained volunteers, with assistance from one staff and four untrained volunteers, mist-netted in Bear Swamp, Cumberland County for approximately 600 net hours on eight different days from May through August. This is the 14th consecutive year of operation at this station.
  - 114 individual birds of 21 different species were mist-netted, 106 of these were new captures (98 banded) and eight were recaptures from previous years.
  - The majority of the birds netted were common grackles (36), followed by wood thrushes (17) and ovenbirds (17), tufted titmice (8), Acadian flycatchers (7), red-eyed vireos (5), Carolina chickadees (4), and black-and-white warblers (4).
  - The mean species abundance in Bear Swamp from 1995 – 2007 is 70.86 (± 9.18); mean species richness is 17.57 (± 1.30)
  - 2007 had the highest species abundance and richness since 1995 (Fig. 1). When removing the flock of 36 grackles, 2007 had the second highest species abundance and highest species richness.
  - Productivity was also the highest in 2007 with 37 (32%) of the 114 aged individuals being hatch year birds (Fig. 2). When removing the flock of 36 grackles (25 of which were hatch year birds), however, only 15% of the aged individuals were hatch year birds (Fig. 3).
- All data were submitted to the Biotics database for inclusion in the Landscape Project.

- There was not enough staff or volunteer interest to add another MAPS banding station in NJ.

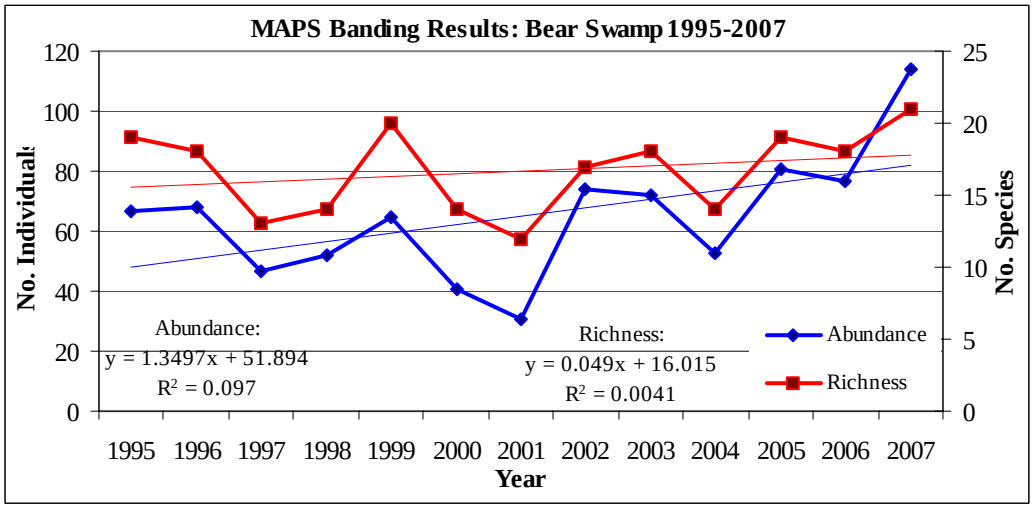


Figure 1. Species richness and abundance at the Bear Swamp banding station from 1995 – 2007 (1994 banding results were omitted due to inconsistencies/bias of being the first year).

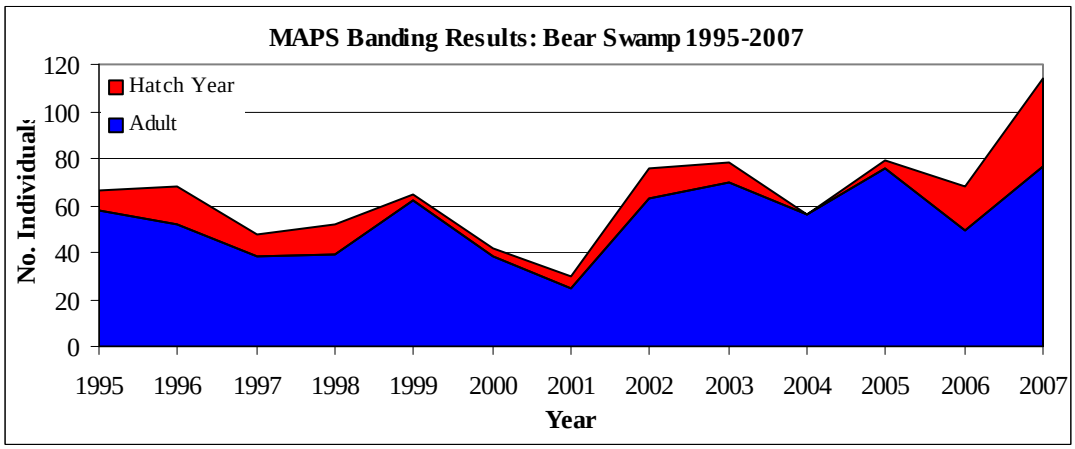


Figure 2. Number of adults and hatch-year birds at the Bear Swamp banding station from 1995 – 2007 (1994 banding results were omitted due to inconsistencies/bias of being the first year).

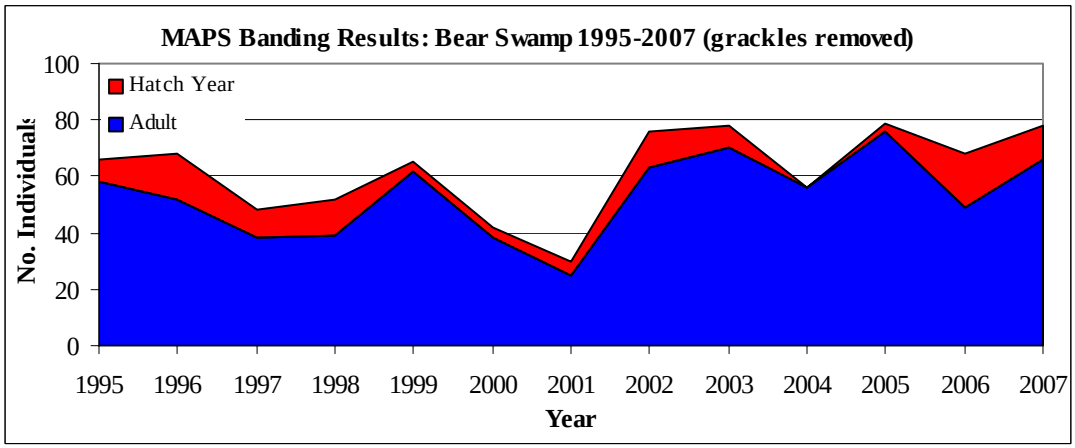


Figure 3. Number of adults and hatch-year birds at the Bear Swamp banding station from 1995 – 2007 (1994 banding results were omitted due to inconsistencies/bias of being the first year).

Conclusions:

- Bear Swamp continues to be a stable community for forest birds. This year was a very productive year at the Bear Swamp, but this was attributed to the flock of grackles coming through the site. When removing the flock of grackles from analyses, the population still appears to be increasing but productivity was slightly below average.

Recommendations:

- Continue the long-term monitoring project and supplement the Institute for Bird Populations with data.

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

OBJECTIVES: Determine statewide distribution of wintering and nesting populations of American oystercatcher (*Haematopus palliates*), threats and protection strategies.

Key Findings:

- American oystercatcher breeding surveys were conducted 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. Surveys were completed in conjunction with piping plover breeding surveys (conducted at least 3 times weekly) and through research projects conducted by Rutgers University.
  - 60 nesting pairs were identified at 20 beach nesting sites.
    - Most (80%) of the state's beach nesting pairs were located in the southern coastal area (Holgate to Cape May Point).
    - Just under a quarter (23%) of the beach nesting pairs hatched young.
    - Productivity was 0.22 chicks fledged per beach nesting pair.
    - All (100%) of the chicks fledged from beach nesting habitat were produced from the southernmost portion of Cape May County (Hereford Inlet to Cape May Point).
    - Predation and flooding were the primary causes of nest failure, although the exact circumstances varied by site. Fox predation was a significant problem at several sites, including Sandy Hook, Island Beach State Park (Dike), Holgate, and Stone Harbor Point.
  - Classification and regression tree (CART) models were created for breeding American oystercatchers based on spatial habitat characteristics derived from land use classifications included in Rutgers University's Center for Remote Sensing and Spatial Analysis (CRSSA) database. Dependent variables included the presence or absence of breeding oystercatcher pairs and the density of pairs in a given area. Predictive variables thought to be important in oystercatcher nest site selection included the percent cover of sand, *Spartina alterniflora* marsh, *S. patens* marsh and tidal flats in a 1km radius surrounding nest sites, which is based on the mean distance traveled by oystercatchers for foraging in New Jersey. Other predictive variables include the percent cover of human development, distance from human development, distance of potential nest sites from foraging areas, distance from tidal waters and indicators of the level of

human use at potential breeding areas. Training data for site-specific explanatory models was based on data collected for nests monitored at the following oystercatcher breeding sites during 2006: Hereford Inlet including Stone Harbor Point and Champagne and Nummy Islands (Stone Harbor), the Holgate Division of the Edwin B. Forsythe NWR (Holgate) and the southern natural area of Island Beach State Park including the Sedge Island Marine Conservation Zone and Gull and Pelican Islands (Island Beach). The explanatory models were used to create landscape-scale predictive models meant to identify potential breeding sites in back bay areas and other locations within the state. Detailed analyses of the results of the predictive CART models are ongoing at this time.

- Extensive surveys for oystercatchers were conducted in back bay areas of New Jersey from Sandy Hook to Cape May over a 30-day period from May 10 to June 10, which is the peak period of breeding for oystercatchers in the state. These surveys were initiated to test the CART predictive model as well as to provide a more complete assessment of the statewide breeding population. Four hundred (400) random points were generated based on CART models stratified across 10 habitat classifications, which included both barrier beach and salt marsh habitat. Weather and tides affected the surveys resulting in 321 of the random sites being visited. Most random points were visited once during the survey period, either by boat following shoreline transects or by walking line transects on barrier beaches. Approximately 25% of random points were surveyed a second time to measure detection probabilities; the detection rate for this sub-sample was nearly 98% indicating that one-time sampling of random points was sufficient to detect all breeding pairs.
- One hundred twenty-seven (127) breeding pairs of oystercatchers were observed at 321 random survey points visited during the survey period. Oystercatcher pairs were considered breeding pairs if the researcher found an active nest or observed behavior indicating a nest was present but not found; nests were located approximately 53% of the time. An additional 85 breeding pairs were reported at locations other than random survey points during the surveys; data was collected on these incidental pairs consistent with data collected at the random survey points. In total, 212 breeding pairs and 68 floaters (juveniles or adults not exhibiting breeding behavior) were identified during the surveys. Eight (8) pairs (4%) were found breeding on barrier beaches and 204 pairs (96%) were found breeding in salt marsh or inlet islands. It should be noted that the survey results exclude known high-density breeding sites such as Stone Harbor, Holgate and Island Beach, which were used as the training data for the CART models. In past years these sites have reported the highest densities of barrier beach-breeding oystercatchers in the state. Also excluded from the survey results are known barrier beach pairs monitored by ENSP. Oystercatcher breeding sites were concentrated near inlets in the southern portion of the State. High densities of breeding pairs were reported at Great Egg Harbor Inlet (16 pairs), Corson Inlet (12 pairs), and Townsends Inlet (30 pairs). High densities were also reported in the salt marsh near Little Egg Inlet including parts of the Edwin B. Forsythe NWR and the Great Bay WMA (50 pairs).

- A survey of wintering oystercatchers, targeting known high tide roost locations from Barnegat Inlet to Cape May (Canal) Inlet, was conducted December 10-15, 2006. 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. Similar ground surveys were conducted in December 2004 and 2005 and aerial surveys of the coast were conducted during the same general time period in 2002 and 2004.
  - A total of 636 birds were counted during the 2006 winter ground survey, an increase from the 2005 survey (493 birds), but still well below counts from other previous surveys -- 2004 ground survey (807 birds); 2004 aerial survey (840 birds); and 2002 aerial survey (973 birds).
  - A total of 8 high tide roost flocks were identified during the 2006 ground surveys, ranging in size from 2 to 336 individuals, the largest flock being found at Absecon Inlet.
    - The Absecon Inlet flock has consistently been one of the state's largest wintering flocks, ranging in size from 196 to 336 birds during the years surveyed.

        - Hereford Inlet was the site of the state's other significant wintering flock (190 birds) in 2006, an increase from the 2005 ground survey (95 birds) and more on par with previous surveys when the flocks ranged from 193-370 birds.
        - The Absecon and Hereford Inlets hosted the vast majority (82%) of the state's wintering population in 2006.
    - For the second year in a row, additional ground surveys were conducted later in the season (January and February). Considerably fewer birds were found statewide during the January and February surveys (especially in February), although the largest flock at Absecon Inlet remained consistent in size throughout the period.
    - The location of high tide roost sites has remained very similar year to year and during multiple surveys in any given year. In fact, more often than not, flocks have been found at exactly the same location, suggesting wintering birds have high fidelity to their roost sites.
- Thirty-four (34) oystercatchers, including 11 adults and 23 juveniles, were marked with color (orange) bands during the breeding season following 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 just prior to fledging. In addition, 4 oystercatchers, including 2 adults and 2 hatch-year juveniles, were captured during the fall migratory period using a cannon net and marked with color bands. This brings the total number of oystercatchers banded in New Jersey since 2004 (when the banding program began) to 123 individuals.
- Resighting data for all oystercatchers banded in New Jersey since 2004 was collected and summarized, including records from ENSP, Rutgers University, various state agencies along the Atlantic coast, and the American Oystercatcher Working Group. Fifty-eight (58) records of oystercatchers banded in New Jersey were obtained from six states including Florida, Georgia, Massachusetts, North Carolina, South Carolina and Virginia. An additional 698 records have been reported in New Jersey to date. Site fidelity for oystercatchers breeding in New Jersey is very strong with all known surviving breeding birds returning to within 100m of prior year nest sites to breed in subsequent years.

Conclusions:

- The number of breeding pairs of oystercatcher on barrier/beach strand (beach nesting portion of the population) has been nearly the same the past three years (60 in 2007 and 59 in both 2006 and 2005), and fairly constant since monitoring began in 2003, ranging from 53-60 pairs.
- Productivity for beach nesting oystercatchers was down slightly in 2007 compared to 2006 (0.22 fledglings per pair versus 0.28, respectively), and has been fairly consistent since monitoring of the beach nesting population was begun, ranging from 0.22 to 0.31 fledglings per pair from 2003-2007.
- Results of the more comprehensive survey conducted to test the CART predictive model indicate that the breeding population of oystercatchers in New Jersey is substantially higher than previously known. Adding the 212 breeding pairs identified in the surveys to the approximately 120 breeding pairs already monitored at select sites by ENSP and Rutgers University brings the total known breeding population for the state to 332 breeding pairs. An additional 68 floaters present during the survey brings the total known oystercatcher population in New Jersey to 732 individual birds, highlighting the state as an important part of the breeding range for this species. Furthermore, the total population of oystercatchers breeding in New Jersey is likely even higher as significant portions of potential breeding habitat remain unsurveyed at this time.
- As expected, the surveys supported the hypothesis that the majority of oystercatchers breeding in New Jersey are utilizing salt marsh and back bay island habitat rather than barrier beach habitat for nesting. Of the 332 known breeding pairs, only 69 pairs (21%) breed on barrier beaches and 263 pairs (79%) breed in salt marsh or back bay island habitat.
- With such a high proportion of the State's oystercatchers using salt marsh and back bay habitat to breed, and given that reproductive success is only being tracked on a small subset of the population, it

is imperative that we determine productivity of more birds breeding at sites in back bay habitat in order to accurately evaluate the status of the New Jersey population. It has been shown in previous research and monitoring that predation and flooding appear to be the major factors influencing oystercatcher nest success in New Jersey, and it is possible that some of the high density sites identified in the 2007 surveys may be protected from predation and/or flooding and thus could be important sources of recruitment for the state's oystercatcher population. Research has already demonstrated that bay islands, which are relatively free of mammalian predators, are especially productive for oystercatchers.

- Beach nesting oystercatchers are primarily located where other beach nesting bird species (e.g. piping plover, least tern, and black skimmer) are also present; therefore, they already receive a high level of protection from human disturbance by means of fencing and signage erected for those species. Many marsh nesting oystercatchers are located in areas without such protection at this time, and with the high level of boat and personal watercraft usage in the coastal zone they remain vulnerable to disturbance.
- The state's wintering population has varied since 2002-03 when surveying began, although the state continues to harbor a significant portion of the Atlantic/Gulf coast population at the northernmost extent of its wintering range. Reasons for the variability in state's wintering population are not clear, although the marked increase in the number of birds banded may offer more clues about winter distribution and movements. Winter flocks generally become smaller or disperse entirely later in the season in New Jersey suggesting weather plays a factor. Fidelity to specific high tide roost locations remains strong, which means they prefer specific conditions or habitats and protection of those sites is especially critical.

Recommendations:

- Continue to monitor breeding population and productivity of beach nesting oystercatchers on an annual basis. Continue research of productivity of oystercatchers at other important breeding sites, including Hereford Inlet, Holgate, and the Island Beach area. Oystercatchers are long-lived and productivity is known to be variable across years making it important to monitor trends over long-term studies in order to properly estimate demographic parameters.
- Expand monitoring of breeding population and productivity of oystercatchers breeding in other habitats including salt marsh and back bay islands, particularly in the high density areas identified in 2007 surveys.
- Conduct a statewide breeding survey across all habitat types along the Atlantic coast and Delaware and Raritan Bays sometime in the next several years. To the extent practical, surveys should be coordinated with other Atlantic coast states to also help determine regional and/or range wide populations. Surveys sites could be identified based on the predictive CART models in order to reduce survey effort, pending final analysis of these models.
- Identify key foraging areas for oystercatchers at important breeding sites in New Jersey and study the relationship between foraging dynamics and productivity.
- Establish protocol for annual breeding surveys of oystercatchers to obtain consistent resighting records of marked individuals. As the banded population of oystercatchers in New Jersey increases there will be an increased opportunity to collect demographic data that can be used to assess oystercatcher survival with mark-recapture methods.
- Continue to annually track wintering population and distribution by completing at least one statewide ground survey each winter (December). Repeat winter surveys in January and February, if resources are available.
- Continue efforts to mark (band) oystercatchers as part of an Atlantic coast initiative to track and study movements of birds and gather other key demographic data. Intensify effort to mark breeding birds outside the current study areas to enable investigation of movement of local breeders between habitats, perhaps focusing efforts on banding birds at high density sites identified in 2007 surveys and/or birds in the vicinity of current study areas.

- Continue threat assessment at selected sites with emphasis on effects of predators on breeding success. Expand assessment to other portions of the population as feasible.
- Continue including oystercatchers in management efforts (i.e. fencing and posting, predator control) at sites where other beach nesting birds (i.e. piping plover, least tern, black skimmers) are present. Continue including oystercatchers in beach nesting bird management plans being developed for some barrier island municipalities. Consideration should also be given to protecting important breeding areas in other habitats (i.e. salt marsh and back bay islands) from human disturbance by means similar to those now being used for beach nesting birds or colonial water birds.
- Continue to incorporate breeding and wintering data into Biotics and Landscape Project databases, and use that information as part of regulatory reviews and other environmental assessments.
- Continue working with the American Oystercatcher Working Group and using the American Oystercatcher Conservation Plan for the Atlantic and Gulf Coasts of the U.S. (June 2006) to help direct monitoring, management, and research efforts within the state.

JOB 3B: Regional & National Bird Coordination

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

Key Findings:
- In 2007, 27 out of 28 of the USGS Breeding Bird Survey (BBS) routes in New Jersey were run.
- A biologist from NJ Division of Fish and Wildlife (NJ DFW) attended the Cerulean Warbler Summit held February 12 – 15, 2007 in Morgantown, WV.
  - Participants provided feedback on the cerulean warbler conservation plan, developed conservation actions, and formed regional working groups for the conservation of cerulean warblers.
- A biologist from NJ DFW attended the Appalachian Mountain Joint Venture meeting on August 7 -9, 2007.
  - Participants created habitat and population objectives for priority bird species in BCR 28 and identified region-wide priority areas for birds of conservation concern.
- Biologists from NJ DFW provided feedback for revisions to a region-wide nightjar survey protocol and assisted in carrying out the survey in NJ.
- As part of the NJ Coordinated Bird Monitoring Plan, biologists from NJ DFW collaborated for the third year to conduct a joint waterfowl BPI and E&T waterbird survey.
  - A total 31 state-listed species were observed and 210 new locations were recorded in the three years of the survey.

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.
- Collaborating waterfowl and waterbird surveys within-state provides results and should be continued.

Recommendations:
- Continue to collaborate on waterfowl and waterbird surveys in NJ and analyze the efficiency of the survey protocol at estimating populations of waterbirds in NJ.
- Continue to participate in the Northeast Coordinated Bird Monitoring Working Groups and other regional coordination efforts.

JOB 4: Migratory Stopover Research and Planning

OBJECTIVE: To identify, monitor, conserve and improve key migratory corridors and stopover locations for migrant land birds that each spring and fall stop in New Jersey seeking food, cover and water.

JOB 4A: Oases Along the Flyway: Critical Stopover Habitat for Migrating Songbirds in the Northeast

OBJECTIVE: The goal of this project is to refine management strategies that help conserve stopover habitats used by songbirds as they travel through New Jersey during north and southbound migrations using migration data. Specifically, our objectives are to: (1) identify specific areas that support high concentrations of migratory songbirds during stopovers in New Jersey, (2) link areas identified as important stopover sites with specific habitat types, and (3) assess how landscape features (e.g., size of habitat, distance to similar habitat, fragmentation) affect which areas are used by migrants.

Key findings:

- Analyses of 2006 data continue to indicate that stopover occupancy (SO) and non stopover occupancy (NSO) model areas differ most significantly with respect to forested wetlands and conifer-dominated forest. SO areas for both sites on average contained significantly more forested wetland habitats than NSO areas. Additionally, forested wetland patches were generally larger, more complex in shape, and more traversable in SO compared to NSO areas.
- Conversely, conifer-dominated forest area was greater in NSO compared with SO areas for both central and southern NJ regions we examined. Conifer forest patches were larger and more traversable in NSO than SO areas.
- Results from analysis of 2006 data continue to indicate that the abundance and occupancy rates of songbirds during migration stopover are affected by the matrix of development and agricultural lands. Generally, moderate and high density development was greater in NSO compared to SO models in spring. However, this difference was not apparent in fall. Similarly, differences between SO and NSO areas for several agricultural landscape metrics in both "row crop" and "pasture/hayfield" land cover types were variable depending on season.
- Models developed for spring and fall 2006 were spatially correlated with models developed for the same areas using 2003-2005 data. Generally, seasonal models, depending on threshold, showed between 50 and 80 percent spatial correspondence.

Conclusions:

- Radar data collected during the period when landbirds are departing on nocturnal migration are useful for delineating areas that are important during stopover periods.
- Our analyses continue to indicate several key relationships between stopover site use and habitat and landscape features. Importantly, many of these relationships are consistent across central and southern New Jersey and the mid-Atlantic coastal plain physiographic region. Our findings will be useful in determining other important stopover areas in the state that are not covered by National Weather Service Doppler radar.
- Areas identified by our study show persistent use by migrants during northbound and southbound passage through New Jersey. This finding is critically important to protection and management of stopover habitat for migrating birds, especially for species that migrate long distances between Neotropical wintering areas and breeding areas at northern latitudes.

Recommendations:

- Continue to collect and analyze National Weather Service Doppler radar data to develop more robust abundance and occupancy models and to better quantify persistent use of stopover areas by nocturnally migrating landbirds.

- Import stopover area threshold model data in Landscape Project to evaluate overlap with areas designated as high rank patches for endangered, threatened and conservation concern species
- Validate SO and NSO threshold models by using data collected in the field about the relative abundance and occupancy of birds in these areas. Investigate microhabitat variables that are determinates of differential abundance and occupancy patterns. Investigate physiological differences between birds using SO and NSO areas to determine potential effects on fitness (e.g., survival).

JOB 5: New Jersey's Important Bird Areas

OBJECTIVE: Important Bird Areas seek to conserve sites critical to migratory, wintering and breeding birds internationally, under the direction of National Audubon Society and New Jersey Audubon Society (NJAS). The objectives of the NJ Important Bird Areas are to 1) identify a network of key places (Important Bird Areas, or IBAs) that will help sustain naturally occurring populations of birds and birding sites in NJ, 2) ensure the continued viability of these sites, and 3) to raise public awareness about the value of habitat for birds and other wildlife.

Key Findings:

- The Important Bird and Birding Areas (IBBA) Program finalized and updated a complete inventory of NJ IBAs and IBA data. New IBA nominations and additional site information continues to be collected to maintain an accurate, comprehensive inventory of IBAs in NJ.
  - IBBA Program staff completed the widely available, online, searchable database hosted by National Audubon Society (http://iba.audubon.org/iba/siteSearch.do). The online database allows users to search among NJ's IBAs based on as many as three categories including IBA criteria, habitat, conservation issues and species. Comprehensive site reports can also be generated and printed. This process involved careful review of existing and new IBA data submitted by IBBA Program volunteers and interns. The database is regularly updated to reflect site changes and recent bird observations.
  - The process of submitting individual bird observations recorded by volunteers at IBAs to the Natural Heritage Database has been identified and initiated. IBBA Program staff will compile bird records into a GIS layer provided by ENSP GIS staff for review and incorporation into revised versions of the Landscape Project.
  - The IBBA Program website is regularly updated to provide current program and IBA information, promote program progress, encourage contribution of additional IBA data, invite volunteer participation in restoration activities and promote informational workshops hosted by the IBBA Program.
- The IBBA publication, "Important Bird Areas of New Jersey," is complete and will be available in December, 2007, through the IBBA Program website as a searchable compilation of concise, informational site summaries. Readers can obtain information about the location, IBA criteria, habitat, birds and conservation issues of each of NJ's 122 IBAs. Once sufficient funding is received from a variety of sources, the publication will be printed and distributed. This publication is used to educate stakeholders and the community about the importance of wildlife habitat and conservation.
- ENSP and IBBA Program staff finalized the process for incorporating IBA boundaries into Version 2.1, 3.0 and future versions of the Landscape Project. A GIS model is being developed to delineate IBAs using current data from the NJ Department of Environmental Protection's 2002 Level III Land Use/ Land Cover classification, Landscape Project, Natural Heritage and NJAS's Habitat Analysis. The final GIS layer will be incorporated into all future releases of the Landscape Project and NJ DEP's iMap as a stand alone layer beginning in May 2008. IBBA Program staff completed a preliminary GIS layer of IBA boundaries. This layer provides preliminary IBA boundaries and maps to guide conservation planning by IBBA Program staff, local and regional planners and partners within priority IBAs.

- Preliminary IBA boundary layer was incorporated into the South Jersey Bayshore Coalition's South Jersey Bayshore GIS Inventory, a natural and cultural resources inventory for NJ's Delaware Bayshore Region.
- Digital boundaries of IBAs in Salem County, NJ were provided to the Morris Land Conservancy, a nonprofit land trust that developed the Salem County Open Space and Farmland Preservation Plan.
- Maps of IBAs in Salem County were provided to the State Planning Commission as well as local community leaders to assist with information gathering associated with developing the State Plan.
- Maps showing IBA boundaries were regularly shared with partner organizations such as the American Littoral Society, D&R Greenway, Mannington Preservation Citizens Committee, Cohansey Area River Protection, NJ Conservation Foundation and the South Jersey Land and Water Trust to facilitate IBA protection.
- Maps of IBAs located in the William Penn Foundation's Environmental and Communities grant region were provided to the Penn Foundation to be used to identify future focal areas for the Foundation.
- Maps of the Indian Trail Swamp IBA were distributed to the Middle Township Planning Board and the public to prevent inappropriate development.
- Maps of the Palmyra Cove IBA were distributed to conservation organizations, NJ Department of Environmental Protection and the public to prevent inappropriate development of the site.

- Initial development of the Adopt-an-IBA Program, a volunteer/intern program that engages the community in restoration and monitoring, has included the identification of communities interested in conservation at their local IBA(s), coordination of community restoration events and IBA monitoring by trained citizen scientists. The Adopt-an-IBA Program has encouraged community volunteers to participate in conservation and has increased awareness about the importance of wildlife habitat.
  - Community members local to the Mercer Sod Farm IBA coordinated a trash clean-up day and plan to participate in trail maintenance at the IBA. Two volunteers (citizen scientists) also conducted avian surveys to collect baseline data.
  - The local community of the Jenny Jump State Forest IBA implemented several restoration projects in the IBA including a wetland restoration. IBBA staff also provided informational presentations to the community to increase awareness about the importance of the IBA and conservation of important habitat.
  - An IBA restoration event and clean-up day was held in the Mannington Meadows IBA. Over 35 participants planted trees and cleaned trash around the shoreline of the Mannington Meadow.
- Initial conservation plans developed for two priority IBAs, the Mannington Meadows and the Southern Pinelands, have been finalized and are being implemented. Within these IBAs, IBBA staff continue to coordinate informational workshops for landowners, work with landowners to implement habitat restoration projects and collaborate with partner organizations. Using a prioritization model based on species, habitat and threats at IBAs, additional priority IBAs, including the Cohansey River Corridor, have been targeted for conservation.
  - A total of seven workshops were held in priority IBAs. Workshops focused on local IBA conservation issues and identifying opportunities for habitat restoration. Two workshops were held in the Mannington Meadows IBA, four in the Pinelands IBA macrosite, and one in the Cohansey River Corridor IBA.
  - IBBA staff continued to assist private landowners in implementing 600 acres of existing habitat restoration projects. In addition, IBBA staff identified 312 new acres of private land for restoration planning and are currently either beginning implementation or identifying funding sources for implementation. Plans include 226 acres targeted for riparian restoration or enhancement, 329 acres targeted for grassland management or restoration, 17 acres of wetland restoration, and 340 acres of forest management.
- The IBBA Program continues to develop and foster many partnerships within priority IBAs on conservation objectives at priority IBAs to facilitate effective regional-scale planning efforts.
  - The Mannington Meadows IBA Conservation Plan identifies farmland preservation as a high priority for protecting this IBA. To that end, NJAS developed a partnership with Delaware & Raritan Greenway land trust to make Mannington Township a project area for this land trust. Thus

far, D&R Greenway has identified over 2,500 acres of private land for farmland preservation funding.
  - In the Cohansey River Corridor IBA, we have developed a partnership with the American Littoral Society (ALS) to focus on the Cohansey River Watershed. We are currently expanding the Cohansey River Corridor IBA Conservation Plan to include land use guidelines and descriptions of tools developed by the ALS. In addition, IBBA staff regularly provide ALS staff with information about species, habitat needs, and priority places for protection.
  - We have also developed partnerships with local community groups such as Mannington Preservation Citizens' Committee, Cohansey Area River Protection, and the Salem County Watershed Task Force to provide valuable information about species, habitat needs, and priority places for protection that will guide these groups as they work within their communities.

Conclusions:

- Completion of the IBA inventory and online database has facilitated the dissemination of information about NJ's most important bird habitats. This comprehensive resource provides the community, conservation partners, planners and other stakeholders with a valuable tool to develop and implement successful conservation planning.
- The preliminary and finalized GIS layers of IBA boundaries provides IBA boundaries and maps to guide conservation planning by IBBA Program staff, local and regional planners and partners within priority IBAs.
- Using the IBBA Program model, NJAS will continue to protect rare species through a landscape-based approach; target habitat enhancement opportunities for present and future action; assist with implementation of NJ's WAP; promote "hands-on" educational activities and volunteer stewardship opportunities; and encourage ecotourism in the state.
- The Adopt-an-IBA Program promotes community involvement in site identification, monitoring and stewardship at IBAs and promotes awareness of conservation and the importance of wildlife habitat.
- The response of the local community, state and local governments and partner conservation organizations to conservation efforts at priority IBAs has been well received and warrants continued implementation.
- NJAS has made significant progress towards achieving the goals of the IBBA Program. With 122 important bird areas and an effective conservation model developed and successfully implemented at several priority IBAs, it is imperative that investment into the IBBA Program continue to ensure the conservation of NJ's important bird habitats.

Recommendations:

- In order to maintain an accurate, comprehensive inventory of important bird areas in NJ, it is essential to continue to receive new IBA nominations and additional site information to update existing IBAs.
- The NJ IBA database currently hosted by National Audubon should be updated regularly with new site data to provide accurate information to the public.
- The process of integrating bird observations reported at IBAs into the ENSP's Biotics Database should be streamlined and implemented to inform future versions/releases of the Landscape Project.
- Delineated IBA boundaries should be updated using Landscape Project Version 2.1 data and submitted to ENSP by February 2008 for incorporation as a stand alone GIS layer into iMap and Version 2.1 and Version 3.0 of the Landscape Project. Following this release, an additional GIS layer of IBAs that includes species data will be submitted for inclusion in the next version of the Landscape Project. The GIS layer of IBA boundaries should be regularly updated as new information becomes available.
- Implementation of the Mannington Meadows Conservation Plan (prepared by IBBA Program Staff) should continue to ensure successful restoration of important habitats.
- IBBA Program Staff should develop/ continue to develop conservation plans for the Cohansey River Corridor IBA and other priority IBAs to ensure successful restoration of important habitats.
- Additional priority IBAs should be identified and targeted for conservation.

- Community involvement in the protection and restoration of IBAs should be encouraged through participation in the Adopt-an-IBA Program.
- Development of a monitoring program for evaluation of restoration activities at IBAs should continue and be implemented at additional priority IBAs.
- Partnerships with local governments, citizens groups, and professional planning organizations should continue to be generated/fostered to facilitate the identification and protection of important bird habitat within communities.

EXECUTIVE SUMMARY

Project:	**Mammal Conservation**
Federal Aid Project:	T-1-4 (State Wildlife Grants)
Segment dates:	September 1, 2006 to August 31, 2007
Total Project Expenditures:	$140,670 ($105,503 Federal, $35,168 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

OBJECTIVE: Determine the distribution, size 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:

- A scent dog-handler team surveyed areas with known bobcat locations in northern New Jersey between January and May 2007 in an effort to identify and build a database of unique individuals for bobcat sex ratio and minimum population size estimates. A 5 km grid was generated and the bobcat sightings locations were overlaid on top; we ran a single transect within a grid cell containing a known bobcat location to help more evenly distribute the sampling effort. Approximately 50 transects between 0.6 and 9.1 km were run over the study period. The scent dog ("Bear") alerted to 120 scat piles, of which 35 (29%) were confirmed to be bobcat based on DNA analysis. 24 of 57 (42%) of grid cells surveyed were positive for bobcat scat (Figure 1). 15 of 147 (10%) individual scats Bear alerted to did not contain adequate DNA to determine species identification. In total, we collected and recorded the location of 49 individual bobcat scats.
- The remaining bobcat tissue samples from New Jersey (N = 4), New York (N = 16) and Pennsylvania (N = 12) were collected and sent to a lab for DNA analysis to help understand the genetic structure of the New Jersey population that will inform the development and implementation of a recovery plan for the state. All tissue samples were taken from dead specimens that we have collected over the years, using a small piece of tissue from the tongue.
- Twenty seven bobcat records were added to the Biotics database.
- The predictive habitat model was tested with approximately 50 new bobcat sightings that have been received since the model was built. Approximately 75% of the sightings fell within predicted suitable habitat. Also, approximately 98% of locations from 4 collared bobcats fell within predicted suitable habitat.
- Bobcat trapping was conducted from February 13, 2007 through February 28, 2007 in an attempt to capture the female bobcat that was originally captured and collared on February 24, 2005. This animal was tracked continuously from the date of capture until July 31, 2006 when the signal could no longer be located. It was determined that this collar had also failed to perform as specified by the manufacturer. Therefore, we have conclusive evidence that three of the four Televilt GPS Posrec collars failed to perform. Three of the four collars have been recovered to date. On February 28, 2007 the female bobcat was successfully trapped and the collar was recovered from the animal. The cat was held overnight and released at the capture site on March 1, 2007.
- Fortunately, all of the data recorded by, and stored on, the collar GPS units were recovered. Kernel home ranges (50% and 95% probabilities) were calculated for each bobcat using Animal Movement,

an ArcView program extension that requires the simultaneous use of Spatial Analyst (Hooge and Eichenlaub 1997). Kernel home ranges were calculated using an ad hoc calculation of a smoothing parameter. The 95% and 50% probability kernel home ranges for two bobcats with complete (year-round) GPS collar data are in Table 1. The GPS unit on a second male bobcat (originally trapped on March 11, 2005) malfunctioned and collected data from March 11, 2005 through July 25, 2005. It resumed data collection on August 15, 2005 and continued until October 17, 2005 when it stopped collecting data. As a result, no home range could be calculated on this incomplete data set. This male bobcat moved more than 25 miles (straight-line distance) from its capture location.

Bobcat	95% Probability kernel home range	50% Probability kernel home range
Male (3/5/04)	50.3 km^2	9.6 km^2
Female (2/24/05)	22.6 km^2	2.8 km^2

Table 1. Results of home range analysis from 2 GPS-transmittered bobcats.

- A training seminar was conducted on February 11, 2006 to instruct volunteers on the proper identification of bobcat tracks. Twenty-three volunteers participated in the four-hour training seminar. Sean Grace, a trained expert trapper, conducted the seminar. Although the training was held late in the winter and snowfall amounts were below normal last winter, three volunteers conducted track surveys following a snowfall that occurred in late February and submitted three new bobcat locations. Volunteers were required to submit good quality photographs with all data so that ENSP biologists could verify proper track identification prior to adding any data to the Biotics database.
- No scent station surveys using motion-sensitive cameras were conducted during the project period. This technique will be re-evaluated during the 2007-08 project year using a select group of skilled volunteers and experienced trappers. Poor success during past surveys has prompted this evaluation.
- Biologists attended a two-day training course on the chemical immobilization of wildlife. The training is part of the preparation for participation in the bobcat response team. The bobcat response team will assist trappers that inadvertently trap bobcats while legally pursuing game species. This is a voluntary service being provided to any trapper that seeks assistance in releasing a trapped bobcat.

Conclusions:

- The relatively low accuracy rate of the scent-detection dog was the result of inadvertent training on coyote scat over the course of the survey period; from mid-February until the end of the survey period, the dog was alerting to both bobcat and coyote scat (Figure 2). We worked closely with the DNA lab after the first few survey days to evaluate the detection dog's accuracy and when the results were close to 100% these quality control checks stopped. The dog-handler team has been working with the original trainers of the detection dog to train him off coyote scat in preparation for the upcoming field season. The individual identification of the confirmed bobcat scats has not yet been completed by the lab.
- The DNA lab is analyzing the full set of tissue samples from New Jersey (n=18), New York (n=45), Pennsylvania (n=12), and Maine (n=25) for the regional genetic variability study. The goal was to obtain 25 samples each from northern and southern New York, eastern and western Pennsylvania, northern New Jersey, and northwestern Maine. The goal was not met in most states due to lower than expected harvest, or lack of bobcat carcasses opportunistically found/reported (in the case of NJ).
- The predictive habitat model is performing well based on testing with independent data.
- The poor performance of the store-on-board GPS collars is cause for concern and as a result we are investigating the use of different GPS collars or possibly satellite collars for next season.

Recommendations:

- Continue to survey for scat using the dog-handler team in northern New Jersey. Work with a statistician from Rutgers University to run simulations to determine if DNA results from scats samples collected during winter 2008 can be added to those from 2007 to estimate a minimum population size and sex ratio, or if just one survey season's data can be used for the estimate due to excessive population modeling violations. The results of the simulations will determine how the survey is conducted.
- Continue to work with the detection dog trainers to get the detection dog's accuracy as close to 100% on bobcat scat as possible prior to the beginning of the 2008 survey period. Work with the lab to get a quicker turn-around of the species identification results periodically over the entire survey period as a quality control check.
- Work with the U.S. Forest Service Rocky Mountain Research Station (MT) lab as they perform the mitochondrial DNA sequencing and analysis for the regional genetic variability study. Work with surrounding states in 2008 to collect more tissue samples if needed.
- Continue to add new bobcat sightings to the Biotics database, including results from the scat survey and the locations of the tissue samples acquired in New Jersey.
- Continue to trap and monitor bobcat movements and habitat use using remote sensing equipment (GPS/satellite collars). Focus future trapping in areas of north Jersey identified by the predictive model as having suitable habitat but where we lack bobcat locations and habitat use data.
- A follow-up training session on bobcat track identification should be conducted periodically to serve as a refresher course for those previously trained, and training for newly recruited volunteers.
- Conduct a re-evaluation of the scent post/motion-sensitive camera survey using a longer sampling period, more experienced volunteers and different scent lures to determine the efficacy of the technique in surveying for bobcats.

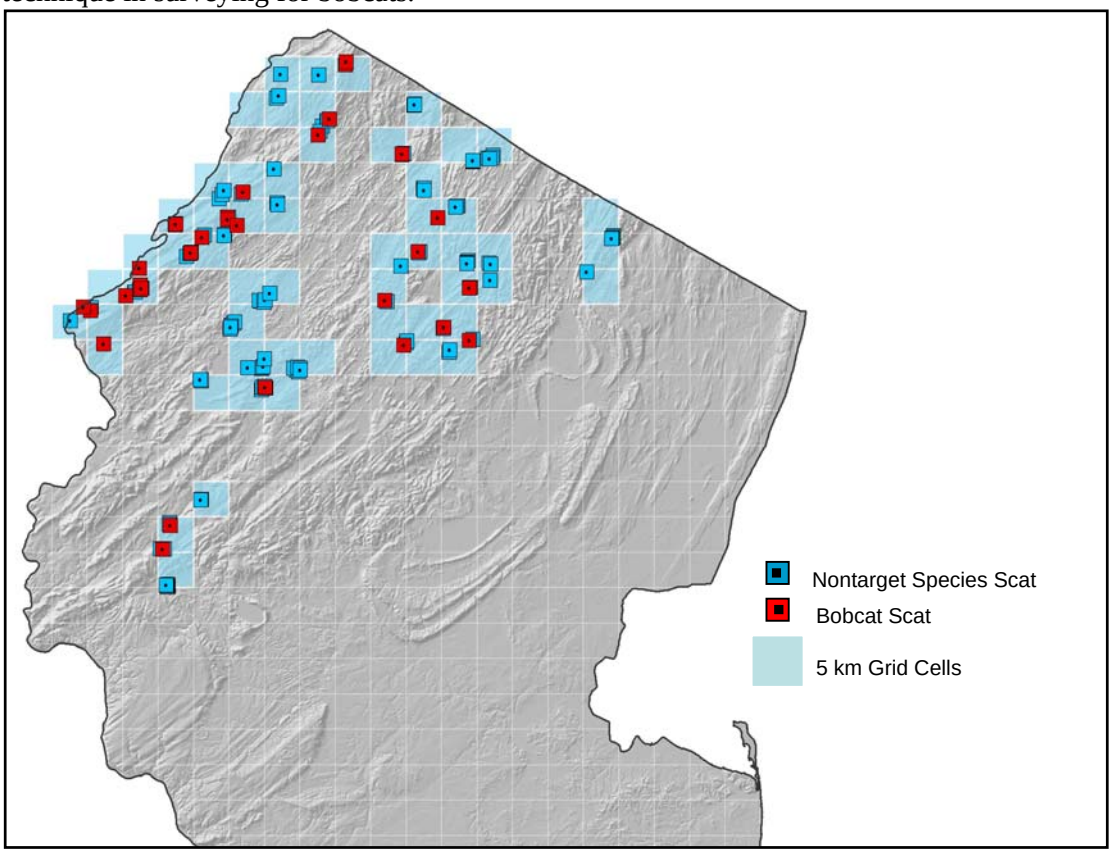


Figure 1. Scats collected using a dog-handler team in northern NJ, January-May, 2007.

JOB 1C: Allegheny Woodrat Conservation

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 5-6 October 2006. 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.
- Thirty-six traps were set for two consecutive days for a total of 72 trap-nights of sampling effort.
- A total of 25 woodrats were captured for a capture index (# of individuals trapped/10 trap-nights) of 3.47.
- Captured animals consisted of five adult males, seven adult females, four sub-adult males and 9 sub-adult females.
- Two adult females were recaptures from the fall of 2004. Three adult males and four adult females were recaptures from the fall of 2005. One adult female was a recapture from both 2004 and 2005.
- 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 any signs of infection by *B. procyonis*. All animals were ear-tagged with a unique identification number and released at the site of capture.
- A total of 54 man-hours of search effort were conducted at the trapping sites for raccoon scats and latrines. Only five raccoon scats were located during the search efforts.

Conclusions:

- A linear regression analysis was performed on the data (year and capture index) collected between 1987 and 2006. Only data from years where 60 or more trap nights of effort were expended were included in the regression analysis. The r^2 value for the regression is 0.8220 indicating that the equation represents a good description of the relation between the year and capture index. The t statistic is >7 and the P value is <0.0001. These results suggest that the Allegheny woodrat population at the Palisades may be increasing.
- Eight individuals were captured from previous years (2004 and 2005) suggesting that adult animals within the population are surviving for several years and not succumbing to *B. procyonis* infection.
- None of the captured animals exhibited any symptoms of infection by *B. procyonis*.
- The paucity of raccoon scats/latrines located in the vicinity of the woodrat habitat suggests that the raccoon population is low or that there is a spatial separation in habitat use between the two species.

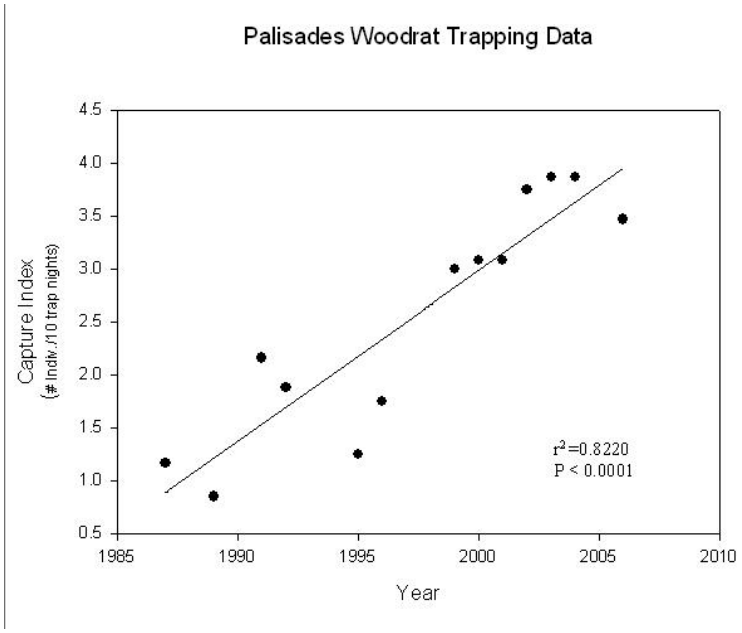


Figure 1. Linear Regression of Year on Capture Index for Allegheny woodrat.

Recommendations:

- Research (LoGuidice 2000 and 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.
- In the event that an increase in the raccoon population (an abundance of scat and latrine sites) occurs at the woodrat site, it is recommended that fishmeal/polymer baits, treated with the anthelminthic drug piperazine, be distributed 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).

Job 2: Bat Conservation and Management

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:

- The volunteer based "Summer Bat Count" program was continued during the project period, however data has not yet been submitted.
- No large summer bat colonies were identified in locations that were conducive to sampling using harp traps or mist nets.

- ENSP biologists provided technical assistance to dozens of private individuals and land managers regarding the proper eviction and bat-proofing of bat-occupied dwellings; and technical assistance in providing/ creating alternative roost sites where large colonies were evicted.
- NJ participated in a genetic study of winter populations of Indiana bats by Western Michigan University in an effort to identify possible management units and provide a context for management efforts. Results from that study identified four main population groups (Midwest, Appalachian and two Northeastern), and NJ's bats are most similar genetically to bats found in two caves and one mine in NY (Northeast 1). Results suggest colonization of the NJ hibernacula by a small number of bats and that there is limited female dispersal between all NY and NJ sites (Vonhof 2007).
- A winter population count was conducted at the Hibernia Mine on 9 February 2007. A total of 27,594 bats of four different species were tallied, including 23,317 *Myotis lucifugus*, 1 *M. septentrionalis*, 122 *M. sodalis* and 154 *Pipistrellus subflavus*. The total number of bats counted in this survey declined from the last survey (2005) by more than 6,000 bats. Some of this difference may be attributed to different personnel conducting the counts. The number of Indiana bats remained nearly the same as in the previous count.
- 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 documented flooded shafts, open fissures, shallow workings with too much airflow, or no remaining evidence of previous mine activity. A total of 20 additional mines were located and assessed for suitability as bat hibernacula. Of these, three mines appeared to have the potential to support wintering bat populations. Additional assessment is needed to determine whether the mines can be safely entered to conduct surveys. To date, a total of 111 mines have been field checked for bat suitability.
- Fall sampling at the Mt. Hope Mine was conducted on 23 September 2006. A total of 196 bats of four species were captured. Two male Indiana bats were captured and fitted with a unique metal coded band on the right wing and red plastic bands on the left wing. Other species captured included 156 male *M. lucifugus*, 32 female *M. lucifugus*, 3 *M. septentrionalis* and 1 *Pipistrellus subflavus*.
- No new data loggers were installed because no significant new bat hibernacula were discovered.
- ENSP biologists worked with experts to evaluate an appropriate technique to stabilize the Mt. Hope West mineshaft opening. The result was a design to install a culvert and concrete pad that will provide a level and stable base for the construction of a bat gazebo. The gazebo will be completed in the spring of 2008 after spring emergence from the mine. In addition, a large subsidence opened directly adjacent to the Mt. Hope West mineshaft. As a result, experts were consulted to determine an appropriate means of securing the subsidence without threatening the suitability of the hibernacula. Under separate funding, temporary fences were erected around both the subsidence and the mine opening to prevent access.
- NJ hosted the Northeast Bat Working Group (NEBWG) meeting in January 2007. All member states were represented at the meeting. NJ developed and maintains a bat banding database for use by all researchers conducting banding in the Northeast in an effort to coordinate northeastern bat data.

Conclusions:

- Volunteers participating in the 2007 Summer Bat Count have not submitted their data forms as of the end of the project period. Results of the summer bat count will be reported in the 2007-2008 project report.
- The total number of bats counted in the 2007 Hibernia Mine winter survey declined from the last survey (2005) by nearly 18 percent. The lower count may be a result of different personnel conducting the counts or bats using other parts of the mine that cannot be accessed for survey. The number of Indiana bats remained nearly the same as in the previous count.
- Results from the Western Michigan University study identified four main population groups (Midwest, Appalachian and two Northeastern), and that NJ's bats are most similar genetically to bats

found in NY (Northeast 1). These results suggest colonization of the NJ hibernacula by a small number of bats and limited female dispersal between NY and NJ sites.

Recommendations:

- Continue field surveys of abandoned mines and caves in northern New Jersey to assess their suitability for wintering bat populations.
- Repair or replace the bat conservation gate at Hibernia Mine, as previous breaches have rendered the gate ineffective at preventing unauthorized access to the mine, and continue to monitor the population for trends and to evaluate the effectiveness of the gate.
- Conduct a winter survey of the Hibernia Mine in 2008 in an effort to determine if lower tallies from the 2007 survey were due to counter variations or an actual decline in the number of wintering bats using the main tunnel.
- Identify and conduct trapping/sampling at a minimum of 6 summer roost locations in an effort to determine bat distribution within the state. ENSP biologists will review the feasibility of contracting this work with an experienced person/ team to ensure surveys are completed at the proper times and locations.
- Continue the volunteer summer bat counts and expand participation in the project in an effort to locate large summer bat colonies for sampling.
- Due to a recent staff resignation, the database manager for the NEBWG must be replaced. A notice will be sent out to the NEBWG to request a volunteer to assume management of the organization's database.

Literature Cited

Vonhof, Maarten J. 2007. Genetic analysis of Indiana bats (*Myotis sodalis*) from Hibernia and Mt. Hope West mines. Unpublished report to the New Jersey Division of Fish and Wildlife. 9pp.

JOB 3: Pinniped Research and Conservation

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 biologists participated in several meetings with the Ocean County Mosquito Commission (Commission) to solicit their assistance with documenting seal occurrences via routine helicopter flights and other methods. Since the events on September 11, 2001, they are unable to allow non-employees access to aircraft for insurance reasons. Commission staff agreed to report incidental seal sightings to ENSP during routine flights over Barnegat Bay and Great Bay.
- Between November 2006, and May 2007, Commission pilots completed 25 routine flights, approximately once every two weeks, between Barnegat March, Clam Island and Sedge Island. In addition, four flights in the Great Bay/Holgate area were completed in April. These flights were routine in nature and pilots did not deviate from their usual flight path to complete surveys.
- Commission staff reported an incidental sighting of a dead Harp Seal on 3 May 2007. Mosquito Commission biologists photographed the seal for identification purposes; ENSP biologists confirmed the identification. The seal occurrence was entered into the Biotics database.
- Biologists from the NJ Division of Fish and Wildlife, Bureau of Wildlife Management were asked to report any seal occurrences during their annual mid-winter waterfowl aerial surveys. These surveys

were conducted coast wide from 31 December 2006, through 11 January 2007. No incidental seal sightings were reported during the survey effort.

- In addition to incidental aerial survey sightings, ENSP biologists performed site visits at two of the three major pinniped haul out areas in the state (Monmouth and Ocean counties) and identified potential threats. ENSP biologists was assisted by a park ranger from the NJ Division of Parks and Forestry, who provided information on specific seal haul out sites inside the bay (on exposed sandbars at low tide) and on the rocks south of the adjacent inlet.
- Staff from contractor Conserve Wildlife Foundation of NJ created a marine version of the ENSP's Rare Species Sighting Form for use in reporting pinnipeds and other marine species. The form was distributed to a representative of the Cape May Whale Watcher, who agreed to partner with ENSP and provide sightings information on marine species.
- We reviewed scientific literature regarding home range, foraging range, and habitat preferences in order to formulate species occurrence areas (SOA's) and chose appropriate land use/ land cover types from the NJ Department of Environmental Protection's 2002 Level III Land Use/ Land Cover classification system to be applied in future versions of the ENSP's Landscape Project.
- At the request of the DEP's Division of Science, Research and Technology (DSRT), ENSP biologists are currently serving as members of the NJ Wind Power Initiative Technical Review Committee. As part of the committee, we will have input/oversight on the 2008-09 effort to survey for marine mammals (including pinnipeds), sea turtles, and birds by boat and aircraft in potential wind farm areas. Pinniped surveys off the coast are due to begin by GMI, Inc., Texas-based consulting firm, in January 2009. All pinniped sightings gleaned from the survey will be incorporated into the ENSP's Biotics database. We assisted DSRT staff in completing a NMFS permit application to conduct marine mammal surveys.

Conclusions:

- Incidental aerial survey sightings yielded only one new pinniped record for inclusion in the ENSP's Biotics database.
- Boat surveys focusing on known haul out locations may be more effective in terms of counting individuals and determining species.
- Although foraging trips from haul out sites where the individual returns to the same haul out have been documented as being as great as 60 km for harbor seals and 145 km for grey seals (Thompson 1996), shorter distances are most often documented, with 10 km being the lower limit of the average foraging range (Gjertz 2001; Tollit 1998; Waring 2006). Thus, the more conservative figure of 10 km was chosen as a more practical manner of representing the seals' foraging species occurrence area, until such time when more data become available.
- The following Landuse/Landcover categories may be valued for seal (Gray, Harbor and Harp) haul out sites in future versions of the Landscape Project: 1419 – bridge over water; 5410 tidal rivers, inland bays and other tidal waters; 5430 – Atlantic Ocean; 6111 – saline marsh; 7100 – beaches; 7420; altered lands.

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 will be positioned on Division owned property and will be 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. If feasible, partner with GMI, Inc. to perform aerial surveys outside and north of the wind power project area.
- Apply SOA's and LU/LC types to seal occurrences (Gray, Harbor and Harp) for use in future versions of the Landscape Project.

- Continue to solicit pinniped sightings information from whale watch groups, fishermen, environmental organizations, etc.
- 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 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.

EXECUTIVE SUMMARY

Project:	**Reptile and Amphibian Conservation**
Federal Aid Project:	T-1-4 (State Wildlife Grants)
Segment dates:	September 1, 2006 to August 31, 2007
Total Project Expenditures:	$182,000 ($136,500 Federal, $45,500 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

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

Key Findings:

- A total of 17 bog turtle sites were evaluated between May and July, 2007. These sites were chosen because they had not been visited to assess habitat suitability or turtle presence in a minimum of 7 years. Sites were evaluated for habitat suitability (i.e., woody vegetative growth, invasive species, and hydrology). Six of the 17 sites evaluated were unlikely to have suitable habitat remaining to support a viable population of bog turtles, although some turtles may still persist in the less than optimal conditions. Some form of woody vegetation or invasive species management is needed at all 17 sites. Bog turtles were discovered during habitat evaluations at 2 of the sites.
- A total of 9 sites where habitat management has occurred within the last 3 years were surveyed visually for turtles. The goal was to determine if turtles could be found utilizing portions of the site previously managed for woody vegetative or invasive species where they had not been observed prior. Four of the 9 sites had previously been surveyed for this purpose and had confirmed that turtles were occupying portions of the site after management treatments had been applied. Turtles were found utilizing managed habitat at 7 of the 9 sites. Typically, management included reducing the density of Phragmites and/or cattail.
- Information from habitat reviews was integrated into USFWS 5-year review for the species.
- Dr. Ed Green from Rutgers University was contracted to assist in developing a population estimate mark-recapture study this winter.
- No genetic samples were collected this season because no turtles were found outside of areas where samples had previously been collected. No future samples will be collected as the DNA project has ended.
- ENSP coordinated with state and federal law enforcement on at least 2 occasions regarding bog turtle. Both investigations are currently ongoing.
- ENSP biologists conducted necessary habitat management for bog turtles on state lands during the fall of 2006.
- ENSP coordinated with 6 Citizen Scientists to assist in presence/absence surveys and monitoring at 8 sites in Northern New Jersey. This group includes 2 citizens and 4 environmental consultants that are all highly trusted.

Conclusions:

- Successful management has opened up new habitat at bog turtle sites that tend to be colonized within 1–3 years when adjacent to currently occupied habitat.

- Bog turtles may still be present at a large number of sites not visited in many years. Efforts to resurvey these sites to update the occurrence data are needed.
- The majority of occupied bog turtle habitat demands restoration both for vegetation and hydrology in order to continue to support viable populations.
- Cooperation with private landowners is crucial to the success of NJ bog turtle populations. The strongest documented populations exist on private lands.

Recommendations:
- Initiate survey efforts of known habitats that have not been visited in at least 5 years.
- Continue to evaluate known sites with limited occurrence data for habitat suitability and new occurrences.
- Restore potential habitat for vegetation and hydrology in an effort to make suitable habitat for colonization. Monitor success of restoration efforts.
- Continue to monitor known populations for population trend development and analysis of current habitat management strategies.
- Survey suitable habitats for currently unknown populations.
- Continue to rely on state and federal law enforcement agents to investigate poaching in NJ

JOB 1B: Wood Turtles

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:
- A total of 6 wood turtles (4 females, 2 males) were radio tracked at 2 sites within the Highlands Region.
  - One turtle's transmitter fell off, and one turtle was in rehabilitation for the majority of the active season, so complete data sets exist for 4 of the 6 turtles tracked.
- "Deciduous Wooded Wetlands, Deciduous Forest with 10-50% Crown Closure," and "Deciduous Forest with >50% Crown Closure" were the most preferred habitat types based on the NJ Department of Environmental Protection's 2002 Level III Land Use/Land Cover data layer.
- The average home range size for 4 turtles (3 females, 1 male) across all sites was 9.25 ha (range = 1.19 ha – 20.09 ha) using the minimum convex polygon model.
  Movements:
  - The farthest straight line distance a turtle traveled from a stream across the study sites was 146 meters, by an adult female turtle.
  - The farthest straight line distance a turtle traveled up and down a major stream corridor was 1078 meters, by an adult male turtle.
  - Males remained closer to the streams season-long compared to females. This is consistent with existing data.
- Nesting areas were found for 1 of the females in the study.
- Seven volunteers were enlisted to monitor wood turtle nest pits for the 2008 season.
- ENSP coordinated with the Bureau of Lands Management to manage a known nest site at 1 site this year.

Conclusions:
- Habitat selections made by ENSP biologists to value critical habitat for wood turtles is generally supported through the results of this radiotelemetry study.

- Wood turtle habitat use and movements in New Jersey are comparable to data in other states within the species range.
- Nest predation is an issue at both of the study sites. Additionally, at least 3 of the turtles moved outside their normal ranges to nest in yards, although suitable nesting habitat appeared to exist in more natural settings.
- Coordination with state and federal law enforcement for bog and wood turtles took place in the 2005-2006 reporting period and was unnecessary to meet again this reporting period. Officers received all pertinent information at the previous meeting.

Recommendations:
- Additional telemetry is not necessary in the Highlands region at this time, although habitat may differ for the species outside of the region so supplemental populations should be researched.
- Using information on habitat use, management opportunities may be initiated based on in-state research.
- Work to combat nest predation through predator-exclusion fencing at known nesting areas.
- Educate private landowners who have wood turtles nesting on their properties.

JOB 1C: Timber Rattlesnakes

OBJECTIVE: To conserve NJ's timber rattlesnake *(Crotalus horridus horridus)* populations through a coordinated approach of population and habitat monitoring, threat assessment, habitat protection and acquisition, management, research, education and environmental review.

Key Findings:
Pinelands region
- In fall 2006, a telemetered (external transmitter) post-partum female (Snake 1) was tracked 2 miles from her gestation site to her den (discovered in 2005) by the ENSP's research partner, the NJ Conservation Foundation (NJCF).
  - 1 neonate was observed trailing her; uncertain if the neonate was one of her young.
  - Researchers noted that in 2005, a non-gravid, non-post-partum female (Snake 2) had traveled from an area in close proximity to Snake 1's gestation area and returned to the same den traveling a more direct route between sites through wetlands and streams. In contrast, Snake 1, post-partum, traveled a longer distance through uplands, circumventing wet habitats.
- November, 16, 2006, an adult male rattlesnake was captured at a known den and fitted with an external transmitter for recapture in spring 2007 for surgical implantation of transmitter.
  - External transmitter remains underground, suspected to have fallen off during hibernation as Pinelands rattlesnakes tend to sit in water.
- One female rattlesnake was outfitted with an external transmitter during the mid-summer 2007, and was tracked by ENSP's research partner, the NJ Conservation Foundation (NJCF) staff.
  - Snake was removed from a boy's camp facility during its shed cycle.
  - ENSP and NJCF staff created suitable habitat approximately 100m from the capture location for snake's release and conducted a brief training for staff members and guests at the facility.
  - Tracked snake for approximately 1½ weeks when it made small movements around area, finally settling into man-made habitat to shed; NJCF continued to track her occasionally (approximately every 10 days).
- ENSP biologists responded to eight timber rattlesnake calls and acted on one of these calls by going to the property of the caller and removing a snake.

Highlands region

- Using the den model ENSP developed in the spring of 2005, ENSP volunteers and staff surveyed for rattlesnake presence at potential dens during the emergence period.
  - One timber rattlesnake was observed deep within crevice; area suspected to be den or transient/ staging area.
  - Approximately 9.5 kilometers of ridgeline and four areas of isolated outcrops/ mountains were surveyed. Volunteers attempted to survey during optimal weather conditions, however, unseasonably low day and night temperatures made it difficult to schedule survey periods that fit the volunteers' work schedules and snake emergence.
    - Two known dens were visited during emergence, once each, with no observations of timber rattlesnakes. One black racer was observed basking a few feet from the den crevice at one site.
  - The den model has not been revised due to a lack of confirmed locations within and outside of the areas identified by the den probability mapped.
- During the September 1, 2006 – August 31, 2007, field seasons, no snakes were captured in targeted areas, therefore, ENSP did not use radio-telemetry to track timber rattlesnakes to locate new dens, gather critical habitat data, nor identify home range territories.
- A partnership with a non-government researcher (K. Michell and staff) along the NJ-NY border has continued.
  - One mature male rattlesnake was captured and transmittered in NJ in late September 2006 and was tracked to a NY den. We requested this rattlesnake continue to be tracked to determine if southern NY is part of his typical home range. Due to time constraints, the male was tracked sporadically and therefore, we were unable to fully evaluate his home range.
  - One gravid female continued to be tracked upon ENSP's request in an attempt to locate the gestation area. This female's transmitter failed in early August; we were unable to locate her gestation area. Of note, she was last observed in late July with the male that bred her in 2006 in the interior forest, dense canopy and understory, no rock outcrops in close proximity.
- One female rattlesnake was fatally wounded in a landowner's attempt to kill her. This matter is currently being investigated by the Bureau of Law Enforcement.
- Currently, no strategy has been developed to recruit law enforcement to monitor den locations for illegal collection. Spring 2006, ENSP biologists identified key locations for the DFW Bureau of Law Enforcement (BLE), but due to limited staff, the BLE continued to be unable to monitor these areas. ENSP staff continued to consider the potential positive and negative effects of releasing den location data to those outside the ENSP and the BLE.
- Volunteers were trained/ retrained as members of the Endangered and Nongame Species Program's Venomous Snake Response Team within the Highlands. There were 23 new volunteers and 15 returning volunteers.
- One experienced volunteer conducted educational programs at two state parks regarding living in venomous snake areas in an attempt to educate citizens about rattlesnake behavior and to recruit citizen assistance to help locate/ report rattlesnakes to be included in the study and the ENSP Biotic's database.
- Venomous Snake Response Team reported responding to nineteen complaints on private lands during the 2007 field season, fourteen of which were confirmed to be timber rattlesnakes. Three of the reported incidents occurred in the Ringwood area, three in West Milford, and three on and adjacent to the Wawayanda Mountain range. (Staff responded to an additional two complaints in the northern region.)
  - Of the 67 members of the northern Venomous Snake Response Team, twenty-eight submitted official timesheets reporting their 2007 response time; fifteen volunteers' time was extracted from response team training sign-in sheets.

- Using micro-habitat data collected (2003-2005) and known snake territories (2003-2005), ENSP identified random habitat points to be surveyed to analyze habitat use characteristics. Random point locations were selected in 2006 using a 95% CI, using ESRI's ArcView 3.2 © software's Animal Movement Extension. The remaining 240 sites of the total 312 were surveyed during the 2007 field season (post leaf-out, pre-leaf drop); fulfilling a random set of habitat points at 10% AE.
- Habitat at locations where study snakes (study 2003-2005) were observed was reanalyzed using NJ DEP, 2002 Level III Land Use/ Land Cover (LULC02) and Kruskal-Wallis analyses.
  - Female study snakes were removed from habitat analysis due to these factors:
    - There were very few females existing in the study; one female was gravid and two were post-partum.
    - Females generally have a smaller territory, and gravid females use significantly different habitat which could bias the analysis to determine critical summer habitats.
  - Non-study snakes identified as females were also removed from the habitat analysis, a detail overlooked prior to the 2006 analysis. Male non-study snakes and snakes of undetermined sex remained in analysis.
  - Analysis of timber rattlesnake habitat use, <u>including both den and foraging habitats</u>, showed:
    - No significant difference between Highlands Region male study snakes' locations (n=658) and non-study snakes' (sex undetermined; known females excluded from analysis) locations (n=43) in 1995, (χ^2=3.20, P=.07), nor in 2002, (χ^2=3.11, P=.07).
    - No significant difference between Highlands Region's male study snakes' locations (n=658) and Kittatinny Ridge male study snakes' locations, one season (n=307) in 1995, (χ^2=1.75, P=.18), nor in 2002, (χ^2=0.06, P=.79).
    - Habitat preferences of Highlands Region's male study snakes:
      - Most frequently used habitat: 76.6% of observations were within the LULC02 identified as # 4120 (deciduous forest with >50% crown closure).
        - 2006 analysis using 1995 imagery and DEP 1995 Land Use/ Land Cover data showed 81% of the observations were made within habitat identified as #4120 (deciduous forest with >50% crown closure).
        - 2007 analysis using NJ DEP's 2002 reinterpreted 1995 Land Use/ Land Cover showed that 77.9% of the observations were made within habitat identified as #4120 (deciduous forest with >50% crown closure).
      - Second most used habitat(s): 7.45% of the observations were within LULC02 identified as # 4110 (deciduous forest with 10-50% crown closure).
        - 2006 analysis using 1995 imagery and DEP 1995 Land Use/ Land Cover data showed 5.1% of the observations were made within habitat identified as #4110 (deciduous forest with 10-50% crown closure).
        - 2007 analysis using NJ DEP's 2002 reinterpreted 1995 Land Use/ Land Cover showed that 5.62% of the observations were made equally within habitat identified as #4110 (deciduous forest with 10-50% crown closure) and #6210 (deciduous wooded wetlands).
  - Analysis of timber rattlesnake habitat use, <u>excluding den habitats</u> showed:
    - Slight significant difference between Highlands Region's study snakes' (males) locations (n=625) and non-study snakes' (sex undetermined; known females and observations at dens excluded from analysis) locations (n=43) in 1995, (χ^2=4.55, P=.032), and in 2002, (χ^2=4.31, P=.037).
      - Non-study snakes were observed in three Land Use/ Land Cover classes (#1463, upland rights-of-way undeveloped; #4110, deciduous forest with 10-50% crown closure; #4120, deciduous forest with >50% crown closure), while study snakes (due to the nature of this project) were observed/ recorded within seventeen habitat classes.

- Further analysis excluding all observations other than those within the three habitat classes recorded for non-study snakes whereby study snakes's observations (n=532) and non-study snakes' observations (n-43) revealed no significant difference in habitat selection (χ^2= 0.99, P= .319).
    - No significant difference between Highlands Region's male study snakes' locations (n=625) and Kittatinny Ridge male study snakes' locations, one season (n=294) in 1995, (χ^2=2.52, P=.11), nor in 2002, (χ^2=2.16, P=.64).
    - Habitats most commonly used by the Highlands Region's male study snakes' during their summer foraging range consisted of:
        - 78.08% of observations were within the LULC02 identified as #4120 (deciduous forest with >50% crown closure).
        - 6.24% of the observations were within LULC02 identified as #6210 (deciduous wooded wetlands).
- Further analysis of habitat used relative to habitat available is pending entry of the latest field sampling completed in September, 2007.

Conclusions:

Pinelands region

- There is preliminary (limited) evidence that postpartum females alter their travel corridor to benefit scent-trailing young.
- Undocumented rattlesnake dens and range still exist within the Pinelands Landscape Region and the use of radio-telemetry is the most efficient means of locating them.
- Dirt and paved roads in the Pinelands fragment critical timber rattlesnake habitats and pose a major threat to this species.

Highlands region

- The ENSP's northern region's Venomous Snake Response Team continues to be effective at rapidly responding to rattlesnake reports made by the general public.
- Additional surveys are 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.
- Increasing development and roads continues to impede travel between habitats, isolate populations, and limit habitat use.
- It has become increasingly difficult to obtain completed timesheets from volunteers.
- The unexpected difference in habitat use between Highlands Region's male study and non-study snakes is suspected to be the result of observers spending more time within particular habitats tracking study snakes and therefore, having a greater potential of observing non-study snakes. Telemetered snakes were observed in numerous habitat types, but five habitats had only one observation each, two habitats had two observations each, suggesting non-study snakes may have been in these areas as well, but were not found due to the limited time spent searching the area.
- It remains to analyze the habitat data to evaluate the relationship between habitats snakes used and available habitat.

Recommendations:

Pinelands region

- Continue to recruit and train volunteers to serve on the Pinelands Venomous Snake Response Team to remove snakes from human-inhabited areas for the safety of the snakes and NJ citizens.

- Conduct research focused on assessing the overall effects of roads on timber rattlesnakes in the Pinelands. Identify stretches of roads where high mortality of this species occurs and develop a strategy for reducing snake mortality in these areas.
- Continue the ongoing effort to identify new den locations by radio-tracking rattlesnakes and working with non-government agencies to collect and share data of rattlesnake occurrences.

Highlands region
- Continue radio-telemetric research to identify additional critical habitats in areas where data gaps exist. Focus on areas that potentially will identify 1) a link 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.
- Conduct analysis of used versus available habitat for future development of a critical habitat model for integration into NJ's Landscape Project map.
- Review available data of macrohabitat features (e.g., streams, water bodies, roads, elevation, slope) for a correlation between the feature and the snakes' foraging areas/ home 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.
    - Consider coordinating team leaders for areas responsible for the collection of completed timesheets mid-September and mid-November of each year.
- Recruit dedicated volunteers to conduct den model validation searches. Isolate volunteers to thoroughly survey smaller, more localized areas regularly rather than surveying larger areas sporadically.
- Continue to develop educational methods to involve NJ citizens in the recruitment of rattlesnakes. Create a sense of ownership and partnership for the rattlesnakes' protection and protection of their habitats.

JOB 1D: Northern Pine Snake

OBJECTIVE: To conserve populations of state-threatened Northern pine snakes *(Pituophis melanoleucus melanoleucus)* by identifying critical habitats, monitoring trends in populations, productivity and habitat, evaluating meta-population and genetic diversity issues, and implementing innovative habitat management practices.

Key Findings:
- In cooperation with the New Jersey Pinelands Commission and a private consultant, the Endangered and Nongame Species Program undertook an extensive pine snake radio-tracking study to evaluate habitat use, home range size, and den/nesting site fidelity. Radio tracking for this study began in October 2006 and is ongoing. A total of 35 adult pine snakes are being radio tracked as part of this study and snake locations are being determined (via radio tracking) every other day throughout the active season.
- Habitat characteristics such as percent cover, soil type, distance to nearest tree, and vegetative community composition have been recorded at each snake location throughout the 2007 field season. This information will be used to test, and inform, ENSP's existing pine snake habitat model.
- ENSP biologists evaluated all existing pine snake sightings contained within the Biotics database to establish, and rank, Element Occurrences (referred to as "EOs" in Biotics) for the Pinelands Region.

Establishing EOs involved grouping pine snake sightings into "subpopulations". These EOs (or subpopulations) are considered to be breeding subsets of the entire New Jersey pine snake population. EOs were then assigned ranks to indicate the estimated long-term viability. This process resulted in a total of 26 pine snake EOs.

- Between October 2006, and September 2007, 124 new pine snake records were reviewed by ENSP biologists and entered into ENSP's rare species tracking database (Biotics).
- In 2007, ENSP began researching and planning for ways to reduced pine snake mortality along roadways. This resulted in the planning of a 3-mile "ecopassage" along the Garden State Parkway. The Garden State Parkway is the main north-south corridor that runs along eastern New Jersey and currently bisects existing pine snake populations. The proposed ecopassage will consist of 13 wildlife underpasses and 3 miles of barriers to prevent animals from entering the roadway. The location of the ecopassage was selected based on information pertaining to pine snake locations in an effort to reconnect pine snake populations that are currently being isolated by this roadway.
- Targeted pine snake surveys on state lands were not carried out during 2007. However, pine snake sightings that were made as part of general herptile surveys (i.e., Herp Atlas Project) were reported on state-owned property. Furthermore, much of the pine snake radio telemetry that was performed this year was carried out on Stafford Forge Wildlife Management Area (property managed by NJ Division of Fish and Wildlife).
- ENSP biologists reviewed over 22 development applications and evaluated the proposed activities for possible impacts to northern pine snakes. For the majority of these applications ENSP staff was able to work out agreements with the applicants so that impacts to pine snake habitat were either avoided or mitigated. In one case, however, a Wal-Mart development application was denied based on the fact that it would have an irreversible adverse impact on pine snakes and their habitat. NJ DEP's denial of this application is being challenged by the applicant and will likely go to court within the next 6 months.

Conclusions:

- Extensive research is underway to examine the typical home range size and habitat use of the northern pine snake. This research will be a crucial component in the testing and updating of ENSP's existing pine snake models.
- Using sightings data from the ENSP's Biotics database the entire New Jersey pine snake population has been divided into Element Occurrence groups (i.e. breeding subpopulations) and viability estimates have been assigned to each of these groups.
- 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.
- ENSP has recognized that roads are a major contributor to T&E species mortality and serve to isolate breeding populations of small and slow-moving animals. Plans to retrofit certain roadways with wildlife passageways have been initiated and will be implemented in next few years

Recommendations:

- Summarize findings from pine snake radio-tracking study and test existing pine snake habitat models.
- Develop strategies to increase the long-term viability of pine snake EOs that have been ranked with low viability.
- Continue to pursue strategies that will reduce the impacts of roads on pine snake populations in the state.

1E: Northern Copperhead

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:

- Northern copperhead location data was compiled, figure 1.
  - ENSP compiled identified copperhead locations from ENSP's Biotics database (observations input as of February 2007), rejecting observations believed to be in inappropriate territory. The resultant map identified nine locations; shown as solid dark blue rectangles on the map, Figure 1.
  - An additional seven sites/ areas (shown as blue dotted rectangles, figure 1) were identified through confirmed observations by ENSP biologists and reported for inclusion in the Biotics database including 1 den and 1 area where we identified a shed site and a gestation site.
  - ENSP attempted to contact individuals including hobbyists, professors of herpetology, and wildlife professionals for additional location data, but only one professional was able to provide information on eleven historic locations (based on observations made in the late 1970's - early 1980's) (figure 1, red rectangles). Due to the period these observations were made and the location of many of them falling within areas that have undergone development, six, possibly seven, of these sites will need to be confirmed for continued copperhead presence.
    - Volunteers were not solicited to search potential den locations as information on historic observations were not compiled until after emergence.
- Members of the Venomous Snake Response team reported no confirmed observations of copperheads, although volunteers responded to 2 potential copperhead occurrences with no observations made.
- One local farmer was consulted and reported locations where copperheads have been found on their property in the past; no observations were reported in 2007, no GPS locations were recorded.
- ENSP proposed a habitat restoration/ copperhead movement monitoring project to one municipality where copperheads are currently seeking more suitable habitat in the open areas of private lands surrounding public lands. The project would have provided the township with a passive recreational area while opening up habitat along the mountain in hope of enticing snakes, especially gravid females, to remain on the mountain rather than moving out onto private lands. There was minimal cost to the town through a requirement for police to patrol the area for illegal off-road vehicles, but the township was not interested since the project was based on a venomous snake species.
- No public call for observations was made due 1) the public's dislike for snakes, venomous or non-venomous, 2) the difficulty in validating the public's observations as many citizens commonly misidentify eastern milk snakes and northern water snakes for copperheads.

Conclusions:

- Northern copperhead observations are lacking:
  - There appear to be few northern copperhead observations outside of large tracts of public lands, such as the Kittatinny Ridge.
  - Alternate sources for observations are difficult to obtain whether due to our contacts being unaware of copperhead presence or that they do not wish to share location data.

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.

- Reach out to landowners/ organizations that are land stewards where copperheads exist to recruit assistance in locating critical sites (dens, gestation areas, shed sites) and for potential research projects (e.g., habitat restoration, habitat study through telemetry).

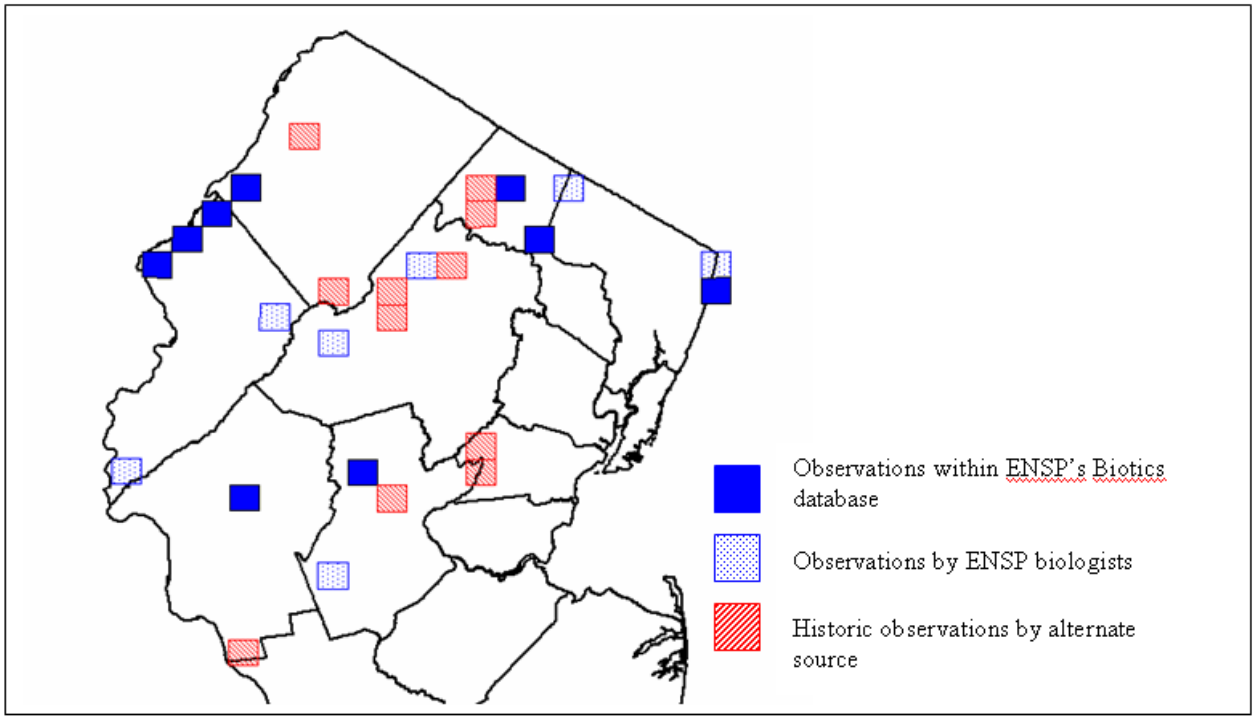


Figure 1: Distribution map of northern copperheads throughout the northern range of New Jersey.

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 2B: Long-Tailed Salamanders

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

Key Findings:

- Long-tail salamanders are known to currently occupy Sussex, Warren, Hunterdon, and Union Counties. Historic records indicate the species once occurred in Somerset, Morris, and Mercer counties, as well.

- A total of 43 long-tail salamander sites were visually surveyed from September 2006 through August 2007. The 43 sites are locales where the species had been previously documented and where the location data was considered accurate within 20 meters.
- Long-tails were documented at 14 of the 43 sites (32.5%), and precisely mapped.
  - All sites previously had records dated 1970 to current.
  - The average amount of time needed to find a long-tail during a single visit was 15.14 minutes.
  - Location of the 14 positive sites included Hunterdon (6), Sussex (5) and Warren (3) counties.
- Twenty-nine of the 43 sites (67.5%) surveyed did not yield long-tail salamander observations.
- An additional 5 incidental occurrences (Sussex – 2, Warren – 1, Hunterdon – 1, Union – 1) were also mapped precisely.
- Habitats (NJ Department of Environmental Protection's 2002 Level III Land Use/Land Cover types) in which long-tail salamanders were most frequently encountered included "Deciduous Wooded Wetlands" and "Deciduous Forests with >50% Crown Closure."
- Lack of staff time did not allow ENSP to monitor population dynamics at reference sites.
- Staff conducted preliminary exploratory analyses to evaluate variables to include in model building. We decided to delay further analyses and model building until the survey of all historical locations was complete and the final dataset was available in order to work with as large a sample size for the model building as possible.
- The survey of all historical locations has now been completed in 2007, and we will work with that dataset to build a predictive habitat model to help guide survey efforts in 2008.

Conclusions:
- Although long-tails were not observed at a large percentage of sites, incidental sightings by the public and ENSP biologists lead us to believe that additional locales will be discovered after the development of a predictive model.
- In this season, long-tails were usually discovered in under 20 minutes of survey effort, where they did occur.
- Some recent findings suggest that small populations of this species may occur in residential sections of Hunterdon County due to the historic nature of the homes that tend to provide suitable overwintering habitat.

Recommendations:
- Using this base layer of current, accurate sightings a predictive model can be created to guide future surveys. Since only known sites were surveyed, a potential exists that many other locales for the species are not yet recorded.
- The long-tail salamander is a relatively unknown state-threatened species and may be under-reported to ENSP through Sighting Report Forms. Articles in non-profit newsletters or an online ENSP article may better publicize this species as important to document.
- Continue to analyze and evaluate models that value habitat for the species as additional sightings are made and new land use/land cover data becomes available.

2C: Amphibian Crossing

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:

- Volunteers manned three survey sites where amphibian crossings occur; data collection was limited as the migration *en masse* occurred during a previous morning of optimal conditions from approximately 3:00am through 6:30am, when volunteers were unavailable to survey.
  - "Rescue only" sites:
    - Independence Township, Warren County: March 15, 2007, 8:20pm – 10:20pm
      - Volunteers transported 29 amphibians across the road including 25 spotted salamanders, one wood frog, and 3 northern spring peepers.
      - Nine cars passed through the corridor during the 2-hour survey period.
      - Weather conditions consisted of sleet, temperature range 3.8–4.5ºC (38-40ºF).
    - Montville Township, Morris County: March 15, 2007, 8:00pm – 10:00pm
      - Volunteers observed no amphibians crossing the road; this site has been informally observed over the past four years and has shown a steady decrease in amphibian presence.
      - One hundred seventy-two cars passed through the corridor during the 2-hour survey period.
      - Weather conditions consisted of a steady drizzle, temperature range 5.0–6.1ºC (41-43ºF).
  - "Survival" site:
    - Hardwick Township, Warren County: March 15, 2007, 8:25pm –10:25pm
      - Volunteers observed 17 amphibians attempting to cross the road.
        - Five survived including 3 spotted salamanders and 2 Jefferson salamanders.
        - Twelve were run over by passing cars including 8 spotted salamanders, 1 northern spring peeper, and 3 red-spotted newts (71% of the amphibians crossing were killed).
      - Thirty cars passed through the corridor during the 2-hour survey period.
      - Weather conditions began with sleet and light snow, but stopped by 9:25pm, temperature range 3.2–5.7ºC (38–42ºF).
- Volunteers informally manned a fourth survey site under the leadership of NJ Audubon Society targeting the same wetland complex as the Montville site, but on a less traveled, unpaved road. Surveyors counted amphibians crossing along a 1000m stretch of unpaved road in an effort to pinpoint the corridor. Results of this site have not been submitted.
- Volunteers were assigned survey areas for potential crossings based on ENSP's vernal pool coverage, aerial photographs, and topography. Survey of thirty-seven potential crossings ranging from 0.18 – 3.8 km lengths at 30 minute intervals during potential emergence nights when weather conditions were appropriate resulted in amphibians being observed crossing at nineteen sites. No significant crossings were observed.
  - As expected, drive-around surveys adjacent to Wallkill National Wildlife Refuge resulted in amphibian observations at six out of six survey areas; no significant crossings observed.
- 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. This failure to confirm locations is often a result of amphibians moving *en masse* during inconvenient hours (e.g., 3:00am–6:30am in 2007 when weather conditions were optimal) for volunteers to survey.
- No grants have been sought for any permanent management strategy (e.g., culverts, raised roads) due to a lack of supportive evidence.
- No temporary road closures were sought for spring 2007 in hope of gathering additional data to support more permanent management strategies.
- Five organizations formally joined the partnership 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. In addition, Byram Twp. Environmental Commission contacted the ENSP for inclusion in the partnership, but due to the late timeframe, Byram could not be formally trained. As such, they were provided maps of potential areas to survey, but no data was submitted.

Conclusions:

- Data collection has been complicated and limited (2003-2007) due to mass migrations occurring at "inconvenient" hours for volunteers to survey. However, our limited data suggest road traffic may cause significant mortality during amphibian mass migration events that may lead to localized population declines.
- "Drive-around" surveys were a successful means of gathering general information about potential crossings and required minimal volunteer management.

Recommendations:

- In anticipation that optimal weather conditions and therefore, crossings, may continue to occur at inconvenient hours for survey, partners should attempt to work with municipalities and counties to permit temporary road closures at identified crossings by sharing collected data thus far and applicable information from literature reviews.
- Partners (ENSP, Conserve Wildlife Foundation of NJ, and NJ Audubon Society) should continue to collect survey data at manned crossing to gather supportive evidence for the need of management and to recruit, train, and manage volunteers to continue to conduct "drive-around" surveys in search of additional crossings.
- Volunteers conducting "drive-around" surveys adjacent to Wallkill National Wildlife Refuge should refine their search to target significant crossings.
- Continue to expand the partnership with conservation organizations and land trusts, environmental commissions, and county park systems/ commissions.

JOB 4: NJ Herp Atlas Project

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. A web-base method of data collection and distribution will be used for conservation, planning, and education purposes.

Key Findings:

- The New Jersey Herp Atlas Project was initiated in 1995, which makes 2007 the 12th year of this long-term project. Completing a final and comprehensive report of the findings of this project was always one of the anticipated products of this work. This season it was decided that this report would take the form of a revised version of the "Field Guide to Reptiles and Amphibians of New Jersey". Planning for this publication/report began in 2006/2007 and, using data from the Herp Atlas Project, 73 revised distribution maps were created. Over 50 new photographs of reptiles and amphibians were submitted by Herp Atlas volunteers and will be used to update the "plates" within the existing field guide. Once the Herp Atlas data from the 2007 field season is compiled, work on the comprehensive data summary from the past 12 years of this project will begin and will be included in the revised field guide.
- In 2006 and 2007, Herp Atlas volunteers conducted general surveys throughout the state. While data from 2007 have not yet been compiled, in 2006 volunteers from this project submitted datasheets documenting sightings of 11,442 reptiles and amphibians, comprising 54 different species. The species reported fell into the following species groups: 15 snake species, 13 frogs and toads, 12 salamanders, 11 turtles, and 2 lizards.
- Over the 2006/2007 project year, Herp Atlas volunteers submitted 5 endangered species sightings (all rattlesnakes), 16 sightings of threatened species (including long-tailed salamander, northern pine snake, Pine Barrens treefrog, and wood turtle), and 100 special concern species sightings (including:

carpenter frog, eastern box turtle, Fowler's toad, marbled salamander, northern diamondback terrapin, northern spring salamander, spotted turtle).

- As part of this project in the past year, we documented the presence of breeding populations of two previously undocumented species in New Jersey. The first is the northern leopard frog (*Rana pipiens*) and the second is the Italian wall lizard (*Podarcis sicula*). The northern leopard frog was first reported to ENSP by a Herp Atlas volunteer in 2006. In spring 2007, ENSP biologists confirmed its presence in the Great Swamp National Wildlife Refuge. Reports of Italian wall lizards were made to ENSP by a Herp Atlas volunteer in late summer 2007. ENSP biologists confirmed the presence of this species in Mt. Laurel, NJ in 2007. As a non-native species, it will not be added to the state's official list of nongame species.
- In cooperation with USGS, 62 calling amphibian survey routes were established in New Jersey in 2003. In 2007, volunteers surveyed a total of 26 of these routes. Many of the routes were surveyed multiple times resulting in a total of 61 surveys as part of this project. These data were incorporated into a state database as well as into the national North American Amphibian Monitoring Program's database.
- A grand total of 452 volunteer hours were logged for this project over the past year. These are broken down as follows: Herp Atlas volunteers reported a total of 331 hours and Calling Amphibian Monitoring Program volunteers reported 122 hours of volunteer time.

Conclusions:

- After 12 years of data collection, the Herp Atlas Project can be brought to a close. Completion of this project will entail completing a comprehensive report of the findings.
- The presence of two new species (one reptile and one amphibian) was documented in New Jersey as part of this project.
- The number of routes surveyed as part of the CAMP dropped in 2007.

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 2008.
- Begin completion of the Herp Atlas project by contacting volunteers and completing a final report for the project. The final report should take the form of a revised version of the Field Guide to Reptiles and Amphibians of New Jersey.
- Conduct surveys that will help establish extent of the distribution of northern leopard frogs and Italian wall lizards in New Jersey.

EXECUTIVE SUMMARY

Project:	**Invertebrate Conservation**
Federal Aid Project:	T-1-4 (State Wildlife Grants)
Segment dates:	September 1, 2006 to August 31, 2007
Total Project Expenditures:	$43,000 ($32,250 Federal, $10,750 State)

JOB 1: State Listed Mollusks

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:

- ENSP biologists and Conserve Wildlife Foundation of NJ contractor, Allen Barlow, surveyed 14 stream sites in six counties for listed freshwater mussels during the survey period. Timed searches for mussels were conducted at historic locations and/or previously unsurveyed suitable habitats.
- ENSP biologists and contractor performed habitat assessments and/or preliminary searches at six additional sites to determine if larger surveys were warranted.
- EPA Habitat Assessment Field Data Sheet scores ranged from 116 (Muddy Run, Salem County) to 167 (Pequest 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.
- ENSP biologists and contractor found the Federal/State Endangered Dwarf wedgemussel at two new locations along the Pequest River, Warren County. Two fresh Dwarf wedgemussels shells were found in the vicinity of Cemetery Road, Great Meadows, whereas one live individual and one shell of the species were located in the vicinity of Long Bridge Road, Allamuchy Township. Other rare species found at the Great Meadows site include Triangle floater (Threatened, five shells) and Creeper (Special Concern, three shells). Triangle floaters (2 shells) were also present at the Allamuchy site.
- In addition to the above-mentioned species, we collected a fresh shell of a possible Green floater (E) at the Great Meadows site. The Green floater hasn't been reported in New Jersey since 1996. The shell was shown to USGS freshwater mussel biologist Rita Villella for species confirmation. In her opinion, it can be labeled "possible green floater", with all the same characteristics as a green floater, though lacking one piece of the shell. She also stated that it could be no other species reported in NJ but the green floater. Pequest River at Great Meadows is one of only a few historic locations reported for the Green floater.
- Two live Eastern pondmussels (state threatened species) and one shell were found at a new location in the Stony Brook, Lawrence Township, Mercer County. A live Creeper and shell of the species were also discovered at the site.
- Numerous Eastern pondmussels were observed in the Maurice River below Willow Grove Lake, Salem County as part of a known population. We monitored the population throughout the summer (six trips total), and spent one day transporting individuals of the species (along with other species) to a different section of the river. The mussels were moved due to severely low flow/low water conditions resulting from the emergency draining of Willow Grove Lake. At the time we moved the mussels to deeper water, we measured dissolved oxygen at the substrate level to be 1 mg/L. Eighteen Eastern pondmussels were moved to safety, along with six Paper pondshell, six Eastern floater, and 36 Eastern elliptio.

- ENSP biologists and contractor trained five volunteers to identify and survey freshwater mussels as part of the freshwater mussel atlas effort. The volunteers are covering parts of Burlington, Mercer and Salem counties. Layout of the freshwater mussel guide has now been completed. 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.
- ENSP biologists (with advice from contractor, Allen Barlow) recommended eight stream segments to the Division of Water Quality for Category One antidegradation status based on presence of listed freshwater mussels. Category One is the highest level of stream protection, essentially allowing no measurable change in water quality due to surface water discharge and also providing a riparian buffer for legally designated C1 waterways.

Conclusions:
- The new Dwarf wedgemussel sightings in the Pequest River expand the lower population boundary by approximately ten miles.
- 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 Stony Brook, despite fluctuating flow and water quality issues, serves as critical habitat for a variety of listed and rare freshwater mussels.
- Despite previous concerns of state extirpation, the Green floater most likely still occurs in the Pequest River in the vicinity of Great Meadows.

Recommendations:
- Continue surveys for listed species in previously unsurveyed habitats to document distribution.
- Focus survey efforts in the Pequest River to determine Dwarf wedgemussel population boundaries and size.
- Continue to monitor the Eastern pondmussel population and habitat conditions below Willow Grove Lake.
- Perform a species status assessment using the Delphi method (see Species Status Review project in T-4) for all native freshwater mussels within the next year.
- Continue work on mussel atlas and solicit assistance from additional Wildlife Conservation Corp volunteers; train volunteers to identify and survey for mussels; assign specific areas for survey work where data are lacking; print mussel field guide and distribute to volunteers.

JOB 2: Federal and State-Listed Lepidoptera

OBJECTIVE: To identify, survey, protect, and manage for listed Lepidoptera populations and habitats in New Jersey. Listed species include arogos skipper, Mitchell's saytr, bronze copper, Appalachian grizzled skipper, checkered white, silver-bordered fritillary, and frosted elfin. For the 2006 field season, surveys will focus on identifying new colonies of arogos skipper, and frosted elfin.

JOB 2B: Frosted Elfin

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

Key Findings:

- We visited 10 out of the 13 documented frosted elfin sites in the state at least twice between May and June 2007. Six out of the 10 sites surveyed were positive for frosted elfin, with a total of 47 individuals of this species observed during the survey period.
- Numbers of individuals dropped significantly from last year at Beaver Swamp North and Beaver Swamp South despite the fact that host plant densities increased at both sites. These two sites had a total of 181 individuals observed in 2006, but only 14 observed in 2007. These sites both fall along a utility right-of-way that was mowed in winter 2006 under the direction of ENSP. The mowing activity reduced the density of woody vegetation along the right-of-way, which increased the abundance and density of wild indigo (the host plant for this species), but may have also contributed to the decrease in frosted elfin numbers. ENSP plans to conduct more extensive surveys at these two sites in 2008 to determine if frosted elfin numbers rebound in 2008.
- Vegetation and soil surveys were carried out at 6 frosted elfin sites in 2007. Soils at each of the sites were relatively infertile, exhibiting low pH values ranging from 4.0 to 5.0 and trace/low nutrient levels (N, P, and K). The vegetation composition for each of the sites was similar, averaging 65% herbaceous and 35% woody composition.

Conclusions:
- Frosted elfin continue to persist at many of the historic sites in the state despite minimal habitat management.
- Efforts to management habitats for this species have lead to an increase in Baptisia abundance and density, but a decrease in forest elfin abundance.
- Existing frosted elfin sites are characterized by low soil pH and nutrient levels and are dominated by herbaceous plants.

Recommendations:
- Conduct intensive surveys of the two sites that were mowed in winter 2006 to estimate frosted elfin numbers in 2008.
- Work with utility companies to determine best management practices on rights-of-way where frosted elfin habitat is present.
- Move forward with habitat enhancement/creation activities in areas where soil characteristics are suitable for the planting of wild indigo.

JOB 3: Rare Odonata Conservation

OBJECTIVE: To evaluate the status of rare Odonata species in New Jersey and proceed with the state listing process for those species that warrant the status of threatened or endangered. Routine surveys for rare Odonata species will be an important component of the long-term protection of rare Odonata in New Jersey. This project will also investigate the role of hydrological and water quality issues that may affect habitat suitability and population trends. Management will involve integrating habitat needs into forestry, farming and other land use practices, combined with habitat restoration and protection of concentration areas.

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 located individuals of the species. It is feared that the Gray Petaltail is now extirpated in the state.
- A reintroduction of the Gray Petaltail was undertaken during May 2007. The site chosen for the reintroduction is a large woodland seepage in Trout Brook WMA, Sussex County, NJ. This 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 petaltail colonization throughout a large area of contiguous, protected habitat and 3) there are other suitable petaltail habitats nearby, thus there is potential for additional colonies to be established.

- A total of 31 larvae were carefully collected at a large seepage complex in State College, PA for transport to NJ. The larvae were successfully transplanted into the seepage at the site.
- The site was visited through mid-July on a weekly basis to search for adult Gray Petaltails. During the course of these visits, a total of eleven adults was observed, though the maximum number seen during any visit was two. Individuals were marked to establish an estimate of the total number of individuals observed. Based on markings, seven discreet individuals were recorded.
- Although no breeding behavior was observed, it should be noted that the Gray Petaltail is secretive and such behavior is rarely observed.

Conclusions:

- Although the Gray Petaltail may have been extirpated in the state, we have identified several protected northern sites with spring fed seepage habitat suitable for reintroduction.
- Monitoring of the Quick Pond reintroduction site indicates successful transformation of transplanted larvae into adult dragonflies.
- It remains undetermined if a breeding colony of Gray Petaltail now exists at the Quick Pond reintroduction site.

Recommendations:

- Monitor reintroduction site during May-July 2008 and a subsequent three years 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.
- Continue to identify suitable habitat elsewhere and conduct surveys for the presence or absence of this species.

EXECUTIVE SUMMARY

Project:	**Species Status Review**
Federal Aid Project:	T-1-4 (State Wildlife Grants)
Segment dates:	September 1, 2006 to August 31, 2007
Total Project Expenditures:	$24,000 ($18,000 Federal, $6,000 State)

JOB 1: Species Status Review and Listing

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

Key Findings:
BIRDS:

- In the previous segment, the Endangered and Nongame Species Advisory Committee recommended species status changes be made in the state regulations. In the current segment, staff prepared drafts of the regulatory changes to be made to the NJ Endangered and Nongame Species Conservation Act, and to create the regulatory definition of "special concern." Several drafts were prepared but not finalized during the segment, but we expect the revised regulations will be finalized and submitted for publication early in the 2007-2008 segment.

MARINE MAMMALS:

- The status review of 36 species in this group was initiated. We selected 13 reviewers to participate in the Delphi process for marine mammals. 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.
- During Round One, 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 four pinnipeds, 11 dolphins, one porpoise, and 20 whales. 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 secure website.
- During round one, consensus was achieved on nine out of 36 species as follows: Endangered – Northern right whale; Stable – Gray seal; Undetermined – Striped dolphin; Not Applicable – Killer Whale, Melon-headed Whale, Pantropical dolphin, Clymene dolphin, Spinner dolphin and West Indian Manatee. Additional rounds of review will continue in the next segment, and the review should be completed in mid-2008.

MARINE FISH:

- ENSP biologists completed the review of 59 marine fish, with the assistance of the Bureaus of Freshwater Fisheries and Marine Fisheries. While most of the status review was conducted under NMFS Section Six job, the final summary and reporting to the Endangered and Nongame Species

Advisory Committee was conducted under this project. The review resulted in resolution of status for 40 species, of which one, Atlantic sturgeon, was recommended for endangered status.

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:

- Continue the process of species status review by 1) completing the marine mammal species review, 2) initiating a review of nongame mammal species, and 3) initiate a new status review of reptiles and amphibians based on the recommended five-year review period.
- Compile the results of the Delphi process of review and present them to the Endangered and Nongame Species Advisory Committee (and Marine Fisheries Council, as appropriate) for recommendations on new status assignments.
- Proceed with new status assignments through the regulatory (rulemaking) process.

EXECUTIVE SUMMARY

Project:	**The Landscape Project & Natural Heritage Program Database**
Federal Aid Project:	T-1-4 (State Wildlife Grants)
Segment dates:	September 1, 2006 to August 31, 2007
Total Project Expenditures:	$449,300 ($336,975 Federal, $112,325 State)

JOB 1: Critical Habitat Mapping

OBJECTIVE: Design, refine and make available critical habitat designations using the most current data on rare species populations and land cover types.

Key Findings:

- ENSP incorporated approximately 5,000 new or updated Species Occurrence Areas (SOA) for use in Landscape mapping.
- Staff created and documented a new SOA approach to defining suitable habitat parameters.
- Staff updated Version 3.0 of Landscape Project within the Highlands Region of New Jersey. This version incorporates a more species-specific habitat approach using NJ Department of Environmental Protection's 2002 Level III Land Use/Land Cover (LU/LC) habitat typing. This methodology was developed, documented, and applied to the Highlands region first, with plans to extend it statewide. This dataset is scheduled to be released November 2007.
- Staff created an update to Version 2.0 using new SOA files and updated LU/LC 2002 base data. The Version 2.0 report included a refined and documented peer review process.
- Staff created Critical Wildlife Habitat mapping within the Coastal Areas Facilities Review Act (CAFRA) zone, as documentation of present habitat that is afforded extra protection under CAFRA regulations.
- ENSP did not complete an aquatic component to the Landscape Project map due to time constraints. Staff determined it was more critical to update Version 2.0 with the NJ DEP's 2002 Level III LU/LC. As no new products were created, it was unnecessary to convene the peer review panel.
- Land Use/Land Cover in the CAFRA zone was compared between 1995 and 2002; the following summarizes the results.

Type LU/LC	1995 LU/LC acreage	2002 LU/LC acreage	Change acreage
Agriculture	31,524	33,452	-1,927
Barren Land	12,823	12,356	+ 467
Forest	92,466	100,364	-7,898
Urban	165,160	153,634	+ 11,526
Water	671,291	671,158	+ 133
Wetlands	284,768	287,069	- 2,301
Totals	1,258,033	1,258,033	

- The CAFRA zone comprises 1,258,033 acres; ENSP has designated 188,017 acres as Critical Wildlife Habitat. This mapping is being reviewed and may be modified before final release.

Conclusions:

- While updating Version 3.0 of Landscape Project within the Highlands Region, it was decided that implementing Version 3.0 methodology statewide would take longer than expected, so ENSP created an update to Version 2.0. This update to Version 2.0 includes new sightings information through the use of the updated SOA file, and a new base layer, the NJ DEP 2002 Level III LU/LC.
- Version 3.0 mapping methodology, according to biologists' review, more accurately represents species habitat needs than previous versions of the Landscape Project.

Recommendations:

- Create one more update using Version 3 methodologies in the Highlands area, and Version 2 methodologies in the remainder of the state, applied to the 2002 base layer and an updated SOA file. Release this update in May of 2008.
- By November 2008, release statewide a version of the Landscape Project that incorporates Version 3 methodologies, addressing all state listed species for which we have occurrence data.
- Continue the peer review process on new methodologies.
- Develop a release plan for the Landscape Project products and, to the extent possible, minimize delays in product updates.

JOB 2: Landscape Project Stepped-Down Planning

OBJECTIVE: Build knowledge of critical habitat locations to guide land management, habitat conservation and acquisition, and land planning at all levels of government and non-government organizations.

Key Findings:

- Provided 25 training/guidance sessions attended by approximately 350 people.
  - Provided guidance to representatives of municipal agencies including environmental commissions and planning boards; county agencies including Camden, Cumberland, Gloucester, Mercer, Middlesex, Monmouth and Salem; state organizations including NJDEP's Land Use Regulation, Dam Safety, and the Office of Environmental Review; NGOs and private consulting firms as well as the general public. Also provided instruction on the creation and use of the Landscape Project through Rutgers University's continuing education course.
- Partnered with the Association of New Jersey Environmental Commissions (ANJEC) to provide customized training for municipal environmental commissions.
  - Provided guidance to representatives of over 40 municipalities including Monroe Twp., Mannington Twp., Upper Deerfield Twp., Stone Harbor Twp., Hopewell Twp., Fairfield Twp., Vineland Twp., East Greenwich Twp., Medford Twp., Great Egg Harbor Twp., Middle Twp., Avalon Boro., Alloway Twp., Mansfield Twp., Vernon Twp., Watchung Twp., Tewksbury Twp., Clinton Twp., Hardwich Twp., East Amwell Twp., Hampton Twp., Roxbury Twp., Millstone Twp., Woodbridge Twp., Hightstown Boro., Howell Twp., Spring Lake Heights Boro., Southampton Twp., Millville Twp., Haddon Twp., Chatham Twp. and Readington Twp.
- Developed preliminary supplemental material for a new version of the Landscape Project developed in the Highlands Region including a report detailing the new methodology and updated training materials for outreach and guidance.
- Continued to provide support to the Division of Natural and Historic Resources' *Standard Operating Procedure* for screening actions to determine if they will have an adverse impact on threatened and endangered species habitat.

Conclusions:

- Training users is essential to the success of the Landscape Project. Creating and distributing the product (or making the product available) does not encourage use/ proper use of this critical tool; the Landscape Project has greater impact when creation and distribution are done in conjunction with training to ensure its correct use and interpretation.
- Partnering with ANJEC and other agencies to target and organize potential end-users is an effective way to administer the training program.

- Through the Natural and Historic Resources' (NHR) internal project review process, Department-owned lands are being screened at a more restrictive level than required by current regulations.

Recommendations:
- Continue to offer training and guidance sessions to:
  - Tailor training's to particular users' needs.
  - Develop partnerships with known user groups.
- Continue to provide guidance to state, federal, and municipal agencies and conservation groups.
- Continue to provide assistance to the NHR in support of the screening tool.
- Continue to provide training and guidance to the Department's environmental review groups.

JOB 3: Wildlife Action Plan Stepped-Down Planning
OBJECTIVE: To coordinate the implementation of the NJ Wildlife Action Plan (Plan) through outreach to NJ's stakeholders, land and wildlife stewards, and citizens.

Key findings:
- ENSP (in partnership with the Conserve Wildlife Foundation of NJ and Environmental Law Institute) held four regional landscape stakeholders' meetings to develop a list of priority conservation actions for four of the five regions and to refine/revise them to include measurable outcomes and stakeholders' comments and recommendations.
  - Meetings were convened and co-hosted as follows:
    - Piedmont Plains Regional Landscape meeting was held September 7, 2006, co-hosted with: D&R Greenway Land Trust.
    - Skylands Regional Landscape meeting was held January 10, 2007.
    - Atlantic Coastal Regional Landscape meeting was held March 29, 2007, co-hosted with: Richard Stockton College of New Jersey.
    - Pinelands Regional Landscape meeting was held June 13, 2007, co-hosted with: Richard Stockton College of New Jersey.
- Participants discussed the conservation goals and actions outlined within the region of focus, shared comments and recommendations, and finally conducted a prioritization exercise to select those actions deemed most important for resource allocation in the 3-5 year planning time frame.
  - Piedmont Plains Regional Landscape Meeting:
    - Fifty-three participants were invited from various agencies and organizations (both traditional and non-traditional partners); 15 attended.
    - Participants reviewed 128 specific and broad-based* conservation actions; selecting 57 priority actions.
    - Summary report of meeting was distributed to participants.
    - Internal follow-up meeting was held to discuss the comments and recommendations and revisions were incorporated into the Plan throughout all regions, as appropriate, per the discussion from this meeting.
  - Skylands Regional Landscape Meeting:
    - Forty-two participants were invited from various agencies and organizations (both traditional and non-traditional partners); 34 attended.
    - Participants reviewed 104 specific and broad-based* conservation actions; selecting 50 priority actions.
    - Summary report of meeting was distributed to participants.
    - Internal follow-up meeting was held to discuss the comments and recommendations and revisions were made to the Plan per the discussion from this meeting and a revised version

(February 16, 2007) of NJ's Wildlife Action Plan was posted on the Division of Fish and Wildlife's Web Site (http://www.njfishandwildlife.com/ensp/waphome.htm).

- Atlantic Coastal Regional Landscape Meeting:
  - One hundred two participants were invited from various agencies and organizations (both traditional and non-traditional partners); 41 attended.
  - Participants reviewed 100 specific and broad-based* conservation actions; selecting 52 priority actions.
  - Summary report of meeting is in preparation.
  - Internal follow-up meeting was held to discuss the comments and recommendations; revisions to the Plan are in progress.
    - The "ocean" conservation zone will be extracted from this region's portion of the Plan and a 6th "region" will be created. Results from this meeting regarding marine species/ habitats and results from the NJ Marine Mammal and Sea Turtle Conservation Workshop (April 2006) will be compiled to create this section.
- Pinelands Regional Landscape Meeting:
  - One hundred three participants were invited from various agencies and organizations (both traditional and non-traditional partners); 36 attended.
  - Participants reviewed 80 specific and broad-based* conservation actions; selecting 40 priority actions.
  - Summary report of meeting is in preparation.
  - Internal follow-up meeting was held to discuss the comments and recommendations; revisions to the Plan are in progress.
- Delaware Bay Regional Landscape Meeting:
  - ENSP staff prepared and distributed working documents for stakeholders' to review in preparation for the stakeholders' meeting to be held in September, 2007.

**For the purpose of the prioritization exercise, conservation goals and conservation actions that were similar between conservation zones (sub-regional levels) were consolidated into one conservation goal or action. Such an action selected as a priority during the meeting would then affect all similar or related actions within the relevant conservation zones, making all of them priority actions.*

- Urban-focused Landscape Meeting:
  - ENSP and the Conserve Wildlife Foundation of NJ co-hosted one informal urban-focused landscape meeting (September 5, 2006) with a sub-set of stakeholders to discuss the value of urban landscapes and surrounding areas to NJ's wildlife and the issues to consider within urban areas.
  - Information was shared with the Division of Fish and Wildlife's Bureau Chiefs in hope of generating additional insight/ comments.
  - ENSP staff prepared and distributed working documents for stakeholders' to review in preparation for a second informal stakeholders' meeting (with a subset of stakeholders) to be held in September, 2007.

- The Wildlife Action Plan booklet highlighting the state-level priority goals and strategies was completed, printed, and has been distributed at the regional stakeholders' meetings, various conferences attended by ENSP biologists, and upon request.
  - Finalization of the book occurred in December 2006, three months after expected due to a number of revisions (completed by ENSP staff and other NJ Department of Environmental Protection's staff members) and the unexpected delays by the printing contractor.
- ENSP Wildlife Action Plan Coordinator presented NJ's Wildlife Action Plan as a tool in land use planning at the following conferences/meetings:
  - Regional Planning Comes of Age, New Brunswick, NJ; September, 2006.

- American Planning Association's 99th National Planning Conference, Philadelphia, PA; April 16, 2007.
- Somerset County Planning Board sponsored seminars, Somerset, NJ; April 25, 2007; co-presented with ENSP Piedmont Plains Landscape regional biologist.

- Revisions to the Plan were not completed after the Atlantic Coastal and Pinelands Regional Landscape Meetings.
  - Internal meetings to discuss the comments and recommendations of the meetings and finalize the language were not held immediately following the Atlantic Coastal nor the Pinelands Regional meetings due to time constraints and other commitments of ENSP biologists necessary to attend the internal meeting.
  - The delay in holding internal meetings led to delays in the incorporation of revisions to the Plan as the Atlantic Coastal internal meeting extended into the period of preparation for the Pinelands Regional meeting and the Pinelands internal meeting extended into the period of preparation for the Delaware Bay Regional meeting.
- ENSP staff began compiling priority and non-priority state-level goals and actions for internal review and research planning discussion.
- ENSP staff began compiling priority and non-priority state-level goals and actions for internal review and research planning discussion. Discussion will be to layout the future work of the ENSP for the next 3-5 years.
- ENSP staff continues to assist interested parties in using the Plan to seek grants, understand conservation objectives, and encourage partnerships when requested. Due to time constraints, the Wildlife Action Plan coordinator has not actively begun coordinating partnerships for implementation.

Conclusions:

- ENSP's intention to develop regionally-based information pamphlets highlighting regional priority conservation goals and actions was not feasible on the timeline set forth.
  - Revisions were necessary to all landscape regions after each regionally-based stakeholders' meeting in an effort to further refine and develop the Plan. As such, staff determined it would be most efficient to complete all regional meetings, and incorporate the revisions to the Plan prior to preparing the regional pamphlets to prevent misinformation, inaccurate objectives/ actions when cross-referencing the Plan to the pamphlets.
  - Regional meetings were not completed until September 12, 2007.
- Revisions to the Plan are in progress.
- Obtaining an Assistant Wildlife Action Plan Coordinator would help streamline the process of making revisions to the Plan and jumpstart coordination of implementation with potential partners.
- NJ's citizens and organizations (local government agencies, sportsmen groups, watershed associations, etcetera) have not been well informed of the Plan's existence and purpose.

Recommendations:

- ENSP must work with the Conserve Wildlife Foundation of NJ to co-host three regionally-based (north, south, central) open house sessions to inform and engage the public about the Wildlife Action Plan as a tool for wildlife conservation and local, regional, and state planning efforts.
- ENSP to complete revisions to the Plan, post the most up-to-date version on the DFW website, and notify the USFWS of revisions.
- Develop and distribute region-based Wildlife Action Plan pamphlets.
  - Regional ENSP biologists to meet with the Wildlife Action Plan coordinator to identify the most critical priority conservation goals and actions for their assigned regions to be highlighted in the region-based pamphlets.
  - Staff to work with the coordinator to revise the language for the general public.

- Continue to pursue completion of ENSP's 5-year implementation plan as outlined in the 2005-2006 project proposal (SWG proposal 2005).
- ENSP must work with partners in conservation to publicize the Plan's existence, purpose, and benefits, and encourage partnerships in land management and research at all levels.

JOB 4: Biotics Database

OBJECTIVE: Update and maintain the most current data on rare species populations.

Key Findings:
- Biotics staff received approximately 1,919 rare animal records from the public (n = 730) and from ENSP biologists (n = 1,076) (n = 113 were not assigned a source). Approximately 2,112 records were reviewed by biologists, and approximately 1,986 rare animal records were entered into Biotics. The spatial and/or tabular data of 6,300 records were modified in Biotics. There remains a backlog of approximately 1,100 endangered and threatened species records that were reviewed and accepted by biologists and await entry into Biotics.
- Biotics staff focused on getting records of several key species updated in Biotics, for which several years of backlog had built up and in most cases Biotics wasn't serving as the source of data for those species records used in the Landscape Project mapping. The species completed so far include bog turtle, osprey, peregrine falcon, northern pine snake, and several special concern species. Mapping methodology prescribed by NatureServe has been implemented for those same species.
- Citrix, a means of accessing the Biotics database remotely through the internet, was established and is being tested before adding more users.
- A Biotics data entry user's manual is being finalized, which will ensure standardized entry of data. Staff created and released Species Occurrence Area Version 3 (SOA_3) and Source Features Version 3 files using a new automated approach. SOA_1 was released in July 2006, SOA_2 was never released, and this is the first time Source Features have been created and released.
- All SOAs now have documented buffer size justifications associated with them.
- Initiated discussions with Rutgers University, DEP's Office of Information Resources Management and the Bureau of GIS to build a web-based mapping and data submittal application for rare animal occurrences. A contract with Rutgers University to develop and host an electronic submittal application was delayed after review by DEP's Office of Information Resource Management (OIRM). Legal concerns may require the online application be run in-house, which is preferred for integrating the application and data with other DEP programs and avoids security issues. However, the application is not yet out of development and the electronic submittal application would not be up and running until at least 2009. We are currently re-evaluating our options.
- Developed a data license agreement that can serve as a template for other agencies with whom we may share Biotics data in the future.
- Staff had preliminary discussions with New York and Pennsylvania regarding a data exchanging arrangement for rare animal data within a certain distance of our borders.

Conclusions:
- ENSP is receiving and biologists are reviewing nearly as many rare animal records as Biotics staff are entering into Biotics. There still remains a backlog of records to enter.
- Biotics staff have spent much time modifying records already in Biotics to populate fields that were either new as a result to the conversion to Biotics or were not populated when new records were entered as a way to expedite entry of the backlog. That process is now complete for all records used in the Landscape Project mapping.

- Biotics staff have brought several species up to date in Biotics so that the database can serve as the sole source of data for those species.
- Citrix allows more individuals to access and enter data into Biotics and the user's manual will assure standardized entry of data by multiple individuals.
- SOA_3 and Source Features Version 3 files are made up mostly of data from Biotics, but a few extraneous data sources outside of Biotics were still used.
- A newly developed license agreement template is enabling us to move forward with data sharing and data exchange agreements with other agencies.

Recommendations:

- Finish species-focused projects so that all endangered and threatened species data are up-to-date in Biotics and Biotics is the sole source of data constituting the SOA and Source Feature files in the future.
- Find documentation and update Biotics with all animal records being pulled from extraneous sources for SOA_3 so that Biotics is the sole source of data for released products.
- Allow a small number of staff in field offices to enter data into Biotics via Citrix to help with the backlog.
- Develop a protocol for quality controlling all records entered into Biotics.
- Standardize review decisions by biologists in terms of feature label/species combinations to include in Biotics and in Landscape.
- Establish deadlines to ensure an update of the SOA and Source Feature files are ready for release every 6 months.
- Continue discussions with DEP OIRM and Rutgers University to solidify a plan to get an electronic data submittal up and running as quickly as possible. The application will streamline the data submittal, review, and entry process and thus enable Biotics staff to enter and update many more records in Biotics than is currently possible.
- Proceed with data license agreements with other agencies, include the surrounding states so that those cross the border records can be used in future updates of the Landscape Project mapping.

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