

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

Endangered, Threatened and Rare Wildlife Conservation Projects

**Report for Project Year
September 1, 2003 – August 31, 2004**

NJ Department of Environmental Protection

DIVISION OF FISH AND WILDLIFE

ENDANGERED AND NONGAME SPECIES PROGRAM

EXECUTIVE SUMMARY

Project:	Bird Conservation
Federal Aid Project:	T-1-1 (State Wildlife Grants)
Segment dates:	April 1, 2003 to August 31, 2004
Total Project Expenditures:	\$665,667 (\$499,250 Federal, \$166,417 State)

JOB 1: Federal and State Listed Bird Species

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 45 eagle project volunteers. Nests were monitored approximately weekly from January through fledging (usually in July).
- In 2003, 40 eagle pairs were monitored, 35 of those were active (with eggs) and five were territorial (maintained a nest area). In 2004, 48 eagle pairs were monitored, 44 of those pairs were active and four were territorial.
- During the 2003 nesting season 25 nests were successful in producing 41 young, for a productivity rate of 1.17 young per active nest. During the 2004 nesting season thirty-two nests were successful in producing 54 young, for a productivity rate of 1.23 young per active nest. This productivity rate is higher than that required for population maintenance (0.9-1.1 young/active nest), and very close to the past ten year average in New Jersey of 1.25 young/active nest. In the last ten years, an average of 73% of active nests were successful in producing young.
- In each year (2003 and 2004) ten nests failed to produce viable hatchlings, mainly due to contaminants and human disturbance.
- In both years ENSP biologists visited a sample of nests to band young with federal and color leg bands, and take blood samples. In 2003, we sampled 18 eaglets at 11 nests. In 2004, we sampled 30 eaglets at 15 nests. All blood samples were stored for future analyses.
- In 2004 most nests (34, or 71%), were located on private land, as opposed to 29% of nests on public and conservation lands.
- We coordinated the Mid-winter Eagle Survey that took place in January, 2004. A total of 177 bald eagles were counted by volunteers and staff, the second-highest count ever in New Jersey next to 1997's record of 176. Most eagles (125) were observed in southern New Jersey in the Delaware Bay region; northern New Jersey had 52 bald eagles on the Delaware river and on inland reservoirs.

Conclusions:

- The New Jersey bald eagle population has increased each year and continues to maintain above minimum productivity rate. 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 2004 eight new eagle nests were discovered, and based on territorial pairs in 2004, an increase in active nests is expected in 2005.
- Disturbance is a major management issue at many nests, and posting and regular surveillance by staff and nest observers is essential to protecting nests and assuring success.

- Contaminants affect the outcome of at least five nests in the lower Delaware River region at a localized level.
- The majority of nests are located on privately owned land, making landowners essential partners in the maintenance of the eagle population. While many landowners have become staunch advocates for the eagles and work closely with the ENSP staff, others 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. These are conducted largely by a group of trained volunteer nest observers.
- Continue to monitor the New Jersey wintering population through the annual Mid-winter Eagle survey in January.
- 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, 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.

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

OBJECTIVE 1: Assess population status, trends and productivity.

OBJECTIVE 2: Identify and quantify specific threats to populations and productivity.

OBJECTIVE 3: Evaluate and prioritize a range of management approaches for protection and restoration of nesting black skimmers (*Rynchops niger*) and least terns (*Sterna albifrons*) and develop and/or modify existing management plans.

OBJECTIVE 4: Improve reliability and efficiency of surveys.

Key Findings:

- Breeding surveys were conducted at all known nesting sites along the Atlantic Coast from May to August of both 2003 and 2004. Surveys were conducted by NJDFW-ENSP, as well as by other cooperators/landowners, including the National Park Service for the Sandy Hook Unit of Gateway National Recreation Area, USFWS for Holgate at Edwin B. Forsythe NWR, USFWS for U.S. Coast Guard - Loran Support Unit, The Nature Conservancy for the Cape May Migratory Bird Refuge, and Rutgers University for the Barnegat Bay/Little Egg Harbor islands (black skimmers only). Surveys consisted of ground counts conducted largely from the periphery of the colonies during at least 5 census periods throughout the breeding season, and included counting all adults present; sitting adults to estimate nesting pairs; and fledged chicks. Some cooperators walked through colonies to count nests and young instead of conducting periphery counts. In addition to the Atlantic coastal surveys, one-time surveys were conducted along the Raritan Bay and in the New York Harbor area to try to identify new or unknown nesting colonies. Prospective locations were based on historical nesting sites and recent sighting reports. No new active breeding sites were identified, although adult birds were observed at several locations.
- Twenty-seven (27) active least tern breeding colonies were identified in 2003 for a total of 1737 adults, including 981 sitting adults or nests. A significant concentration of birds was present at Hereford Inlet, with two large colonies at North Wildwood and Stone Harbor Point (490 and 255 peak adults, respectively). Productivity was estimated to be low (> 0.0 < 0.5 fledglings per pair). The cause of poor reproductive success varied considerably from site to site, although flooding was the principal factor at many sites. Predation also played a role, and although identifying exact species was difficult in many cases, some documented problems included red fox at Sandy Hook

and cats at Avalon and Townsend's Inlet. Preliminary results for 2004 indicate that the total number of adults present in the state was 1373, a decrease from 2003, and considerably below the 10-year average. Reproductive success was once again low ($> 0.0 < 0.5$ fledglings per pair) in 2004. Flooding continued to be a problem at some sites, although predator threats, which once again varied at different sites, were the main problem.

- Eight (8) active black skimmer breeding colonies were identified in 2003 for a total of 2494 adults, including 793 sitting adults or nests. Nearly half the state's population was present at one breeding site (Stone Harbor Point). Productivity was estimated to be moderate ($\geq 0.5 < 1.00$ fledglings per pair). Flooding was the leading cause of nest failure and brood loss, although predation was a major factor at some sites. Final data are not available for the 2004 breeding season, although preliminary results indicate that the total number of adults was down compared to 2003 and productivity was low ($> 0.0 < 0.5$ fledglings per pair). Stone Harbor Point once again had the largest colony, although flooding and predation (mostly by laughing gulls and feral cats) resulted in extremely low productivity. As a result of severe erosion, no birds were present at Strathmere Natural Area in 2004. This is notable because in recent years this site was often the largest colony in state with anywhere from 695 to 1613 adults present in any given year since 1994 (the year that present survey techniques were instituted). The large numbers of birds absent from this site were not accounted for by increases at any other site.
- Prior to 2003 the number of black skimmers and least terns (total adults and sitting adults) was derived by adding peak counts from each individual colony. This likely inflated the totals, especially in years with high levels of colony turnover (due to failure). Because within-season colony turnover varies from year to year, adding the peak site counts may have contributed to higher variability in annual count estimates, affecting long-term trend analysis. Starting in 2003, nesting season totals were calculated by using the total from the single census period with the greatest number of adults. As expected this method reduced the year-end totals. In 2003 the total number of adult least terns recorded when summing individual site peak counts was 2610, while the highest number of adults present during any single census period was only 1737. Results were similar but not as dramatic for black skimmers, with 2850 adults recorded using site peak counts and 2494 adults during the highest census count.
- The primary management techniques employed to protect nesting colonies on barrier island beaches have been directed at reducing the level and effects of disturbance due human recreational activities. This has included symbolically fencing and posting colonies and regular patrolling. While this approach appears to adequately minimize the human disturbance, colonies experienced poor success due to flooding and predation. Since little can be done to reduce losses to flooding, future management needs increased focus on reducing predation. Predation management approaches need to be explored and applied.
- An investigation of the ability of camera devices and nighttime binoculars to record potential predators at nesting sites, including at night, was begun during this project period. After extensive research with vendors and land managers or biologist using similar devices, a digital camera with infrared capability and a motion detector sensor was purchased with SWG funding. Another standard 35mm camera (already on hand) was modified to reduce the potentially detrimental effect of its flash. Numerous field tests were conducted to determine the best techniques to conceal and place cameras and to gauge the efficacy of the cameras to identify specific predators. The results obtained from either camera were not what were hoped. The infrared camera had very poor picture resolution and it was not always clear what triggered the camera. For the most part, the standard 35mm camera captured clear photographs, including of some predators. However, despite efforts to filter its flash, the flash was still visible and fears remained that it might cause abandonment of a nest or actually attract the attention of predators. Use of nighttime binoculars, purchased with SWG funding, also proved less successful than hoped. The problems were twofold: 1) the lack of range and width of vision made it difficult to locate birds (especially chicks) or predators within a large landscape. 2) the high level of artificial light rendered the binoculars unusable at many sites.

- The location of all colonies identified in 2003 and 2004 were mapped using GPS equipment and entered into Landscape Project and Biotics databases. In addition, all existing nesting records recorded since 1970 were reviewed to assess the continued viability of these data records.

Conclusions:

- The least tern population was sharply lower in 2004 compared to past years. In addition, reproductive success was also very low in 2003 and 2004. Although a variety of factors affected productivity, losses to predation appear to be increasing.
- Although the statewide black skimmer population was down in 2004, years of sharp fluctuations have been common in the past, so it is not clear that this is part of a long-term trend. The significant reduction in the number of active colonies and the concentration of a large percentage of the state's population into two to three of these colonies is a significant concern. This trend increases population vulnerability.
- Population levels continue to be highly variable, especially with regards to least terns, making it difficult to assess long-term population trends. NJDFW believes some of the variability is the result of past collection and reporting methodologies and hopes that recent changes will help alleviate these concerns. At present only two years of data have been obtained using the new approach, so long-term population analysis with updated methodology is not presently possible.
- Limited surveys and review of recent sightings records suggest no large unknown colonies of least terns or black skimmers exist in the Raritan Bay and New York Harbor areas. However, surveys in those areas are logistically difficult and it is premature to conclude that no important nesting colonies are present. Rooftop least tern nesting, common in regions south of NJ may be overlooked in the industrial belt along the Arthur Kill, Newark Bay and Hudson River area.
- Efforts to maximize reproductive success must focus on predation management.
- Better identification of predator species is necessary in order to develop effective site-specific predator management strategies. Continued research of available camera and video observation equipment and techniques is worthwhile, although cost may limit options. Use of night vision equipment appears to be an ineffective means to monitor nesting colonies and especially to identify predator threats.

Recommendations:

- Continue to annually monitor populations and productivity at all known coastal breeding sites using periphery counts conducted at intervals of once every 2-3 weeks.
- Continue to track nesting population trends based on new methodologies.
- Continue efforts to locate "inland" least tern nesting sites (sand mines, gravel pits, industrial sites, etc.) and back-bay black skimmer nesting sites (wrack and sand patch islands) not captured on regular surveys.
- Continue efforts to locate and monitor least tern and black skimmer colonies in the Raritan Bay/New York Harbor area.
- Continue threat assessment with emphasis on effects of predation, in order to develop effective management plans to improve reproductive success.
- Continue to test and evaluate nighttime camera and video devices with the goal of more widespread implementation to better assess specific predator threats. Discontinue any additional purchase of nighttime binoculars as they appear to be ineffective and costly.
- Continue to incorporate data into the Landscape Project and Biotics database.

JOB 1C: Osprey Monitoring and Management Planning

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

Key Findings:

- We conducted ground and aerial surveys of osprey nesting statewide in May and June, 2003. Aerial surveys were conducted by helicopter and covered the Atlantic coastal region from Monmouth County to Cape May County in mid-May and again in mid-June to document egg-stage and nestling-stage activity. Other areas with lower population density were surveyed by ground in June.
- We documented 366 active nests statewide. This is a 7% increase from the 2001 census and a new high population level since DDT-induced declines in the 1950s and 1960s. This level approaches the historic population level estimated at 350-450 pairs prior to 1946.
- Most nests (298, 81%) were in the Atlantic coastal region, 64 nests were in the Delaware Bay region, and four were located inland near the Delaware River.
- Productivity averaged 0.79 young per active nest, and was higher (1.05) in the Delaware Bay region than the Atlantic region (0.74). This is lower than normal productivity for NJ and was likely related to colder and wetter weather conditions in spring 2003 than normal.
- Most nests (74%) were on structures built especially for ospreys. Fourteen percent of nests were on other structures in the coastal area (channel markers, duck blinds and pilings), 9% were on transmission and antenna towers, and 4% were in trees.

Conclusions:

- The population count in 2003 represented a more moderate rate of increase than we had seen during the past ten years. The drop in nest success observed along the Atlantic coast in 1997-1998 may have resulted in fewer maturing adults returning to nest in New Jersey, thus slowing the rate of growth. Other reasons for a slower growth rate could be limitations imposed by insufficient resources, such as fish or nest platforms. It is unlikely that nest structures have been limiting, given that we observed a number of unused platforms in 2003, and we have not seen a rise in ground-nesting that might be expected if such a shortage existed. The decline in certain fish stocks, however, especially the Atlantic Menhaden (*Brevoortia tyrannus*) population (Vaughan and Smith 1998), may be a factor in the slower Osprey population growth along the Atlantic coast.
- In a 1999 study, ENSP biologists recorded 126 identified prey species, most (81%) were fluke or flounder, 9% were menhaden, and $\leq 2\%$ were perch, weakfish, needlefish, and snapper. Menhaden are an important food source for ospreys as the fish migrate north in May. The National Marine Fisheries Service has determined that recruitment of young menhaden in the mid-Atlantic region was below normal in recent years, and this led to a greater proportion of adults harvested, especially coupled with the increasing commercial menhaden harvest (Vaughan 2000).
- 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.
- Human disturbance may pose a threat if it occurs during the most sensitive portions of the nesting season, particularly during egg-laying and incubation.

Recommendations:

- Maintain a schedule of statewide population census every two years (next survey due in 2005) to monitor population changes statewide and regionally.
- Continue to measure productivity of ospreys to monitor regional conditions and changes (e.g., Atlantic vs. Delaware Bay regions, and Atlantic subregional comparisons).
- Continue to collect addled and unhatched eggs for archiving for monitoring contaminant levels regionally and statewide.
- Gather information on fisheries trends (particularly menhaden and flounder species) for potential correlation with osprey population parameters.

JOB 1D: Colonial Waterbirds

OBJECTIVE: To determine statewide distribution and nesting populations for New Jersey's state listed, special concern, and regional priority colonial nesting waterbirds, including long-legged wading birds, gulls, and terns.

Key Findings:

- We conducted an aerial survey of colonial nesting waterbird colonies along the Atlantic coastal marshes from the Cape May Canal to the mouth of the Navesink River on six days from 6/14 to 6/22. The survey was delayed by one week to allow for gulls and terns to renest following flooding by above-normal high tides. The delay in the survey may have influenced survey results, especially for long-legged wading birds, many of which were in a mid-late nestling stage at the time of the survey. The survey included approximately 255 sites previously occupied on surveys conducted since 1985 as well as previously unoccupied sites with suitable habitat. Approximately 185 sites were occupied by at least one nesting bird; 32 by long-legged wading birds and the remaining 153 by gulls and/or terns. Data are currently being entered into an Access database for species-by-species comparisons with previous survey results.
- Habitat at each occupied site was classified during the aerial surveys according to a 2-tiered scheme that classified the site type (e.g., barrier island, marsh island, abandoned dredged material site) and the nesting substrate (e.g., sand or gravel, dense herbaceous vegetation, scrub-shrub). Most gull and tern colonies were on marsh islands in wrack or dense herbaceous vegetation while most long-legged wading bird colonies were on abandoned dredged material sites in scrub shrub and/or dense stands of common reed (*Phragmites* spp.). Analyses will include a more detailed examination of nesting habitat by species.
- To assess the variability and reliability of the aerial survey and to begin an assessment to determine if other survey methods may be preferable with regard to overall efficacy (accuracy, efficiency, disturbance), we conducted repeat surveys and/or double observer surveys, ground counts, flight line surveys and post-season nest counts at selected sites according to the following:
 - During the aerial survey observers recounted 10 colonies (5 long-legged wading bird colonies and 5 gull-tern colonies) that had been counted by the same observers on the previous day.
 - Also during the aerial survey two observers independently counted the number of birds present at 12 sites (4 long-legged wading bird colonies and 8 gull/tern colonies).
 - Periphery ground counts were counted at 2 long-legged wading bird colonies and 3 gull/tern colonies.
 - Flight-line counts were conducted during 3 separate time periods at each of 3 long-wading bird colonies. At each of these sites, we also conducted post-season counts of nests, corrected by a mark-recount index.
- Preliminary informal examination of the data suggests large differences in the number of birds counted by methodology and between simultaneous and consecutive aerial counts. In particular, aerial surveys appear to have markedly undercounted dark long-legged wading birds, especially glossy ibis.
- Based on colony occupancy during the 2004 survey and an evaluation of potential for human disturbance, we are developing a plan that prioritizes sign posting for sites located on lands administered by the Division of Fish and Wildlife and the Division of Parks and Forestry.
- Colony sites are currently being digitized for inclusion in the Landscape Project and the Natural Heritage Program's Biotics database. Existing element occurrence records for previously known sites will be updated and new colonies will be added as new element occurrence records.

Conclusions:

- Large differences in counts obtained by different survey methodologies as well as differences between simultaneous counts conducted by different observers and by the same observer at different time raises significant concerns about accuracy of the aerial survey methodology that has comprised the principal technique for monitoring colonial waterbirds in New Jersey since 1978. Detailed analysis of the data is needed along with continued evaluation of survey techniques.

- Logistical, financial, and practical limitations are likely to decrease the scope of available methods and confound efforts to find a single best survey approach.
- Preliminary examination of habitat data suggests greater use of common reed stands by long-legged wading birds and

Recommendations:

- Continue testing and evaluation of a variety of survey methodologies as well as assessment of variability of aerial survey count data to develop improved survey protocols.
- Consider conducting the aerial survey of long-legged wading birds separate from counts of gulls and terns to account for differences in nesting phenology between these two groups.
- Continue regular (every 2-3 yrs.) surveys of colonial waterbirds.

JOB 1E: Raptors

OBJECTIVE 1: To inventory and monitor state-listed woodland raptor populations and their habitat. To develop forest management practice guidelines 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*). Develop best management practices for natural resource managers and private landowners.

OBJECTIVE 2: To collect baseline data on the populations of species of special concern, specifically American kestrel (*Falco sparverius*) and common barn owl (*Tyto alba*). Develop management guidelines to prevent population declines that would necessitate listing.

Job 1E, Part 1: Woodland Raptors

Key Findings:

- The 2002 Land Use/ Land Cover data will not be available until the summer of 2005, therefore, comparison between raptor presence and habitat analysis of the 1988-89 and 2001-02 data using the most recent Land Use Cover could not be conducted.
 - *Southern New Jersey*
 - Surveys conducted along six survey routes in 2001 found 26 barred owls at 22 of 55 stations, for a 40% barred owl presence rate. This represents a decline from 1988-1989 surveys when we recorded a 53% barred owl presence rate along the same routes. In addition, these routes yielded a 6% Cooper's hawk presence (three Cooper's hawks at three stations of 55 stations surveyed) during the 2001-2002 survey.
 - Among the original six routes surveyed for barred owls, three remained unaltered between the 1988-89 survey and the 2001-02 survey. At one of those constant routes, the response rate remained unchanged from the 1980's to the 2000's at 40%. At the other two, however, the response rates fell from 70% to 40% on one route and 90% to 0% at another.
 - Among the original six routes surveyed for barred owls, three were altered prior to 2001-02 surveys due to development and habitat alteration and where necessary, new survey stations were added. Two of those routes showed increases in barred owl response rates, while the third showed a slight decline.
 - The six original routes were also surveyed for diurnal raptors (Cooper's hawk and red-shouldered hawk) in 2001-2002 as baseline surveys. In addition, ten new routes were surveyed for barred owls and diurnal raptors in 2001-2002 to be used as baseline surveys for future analyses.
 - Woodland raptors were located at 38% of the stations during the 2001-2002 survey (62 stations of 162 surveyed).

- 64 barred owls were identified at 56 of 162 stations surveyed (35%).
 - Nine Cooper's hawks were identified at 8 of 162 stations surveyed (5%).
 - One red-shouldered hawk was identified at 1 of 162 stations surveyed (<1%).
 - Two stations had both barred owl and Cooper's hawk, one station had both barred owl and red-shouldered hawk.
- *Northern New Jersey*
- Along 11 routes surveyed in 1988-89, diurnal raptor surveys conducted in 2001 – 2002 yielded a 25% (29 of 117 stations) diurnal raptor presence (18 red-shouldered hawks at 14 stations, 14 Cooper's hawks at 14 stations, and one northern goshawk at one station with no overlap of species). In addition, barred owl surveys conducted yielded a 47% presence (87-90 barred owls at 52 of 111 stations surveyed).
 - Surveys for diurnal raptors conducted in 1988-1989 yielded a 7% (6 of 91 stations surveyed). Three Cooper's hawks were identified at three stations of 91 stations surveyed and three red-shouldered hawks were identified at three stations of 91 stations surveyed.
 - These surveys indicate an increase in diurnal raptor response rate between the 1980's and the 2000's. However, all 11 original routes were altered (by changing ≥ 1 survey station on each) prior to the 2001-02 survey due to development and habitat alteration.
 - We established 14 new routes and surveyed them in 2001-2002 to develop baseline data for woodland raptors. There, 34% (50 of 146 stations surveyed) yielded a response. Five of the 146 stations overlapped barred owl and diurnal raptor surveys, 15 survey stations were surveyed for either barred owl or diurnal raptors.
 - Fifty barred owls were located at 36 of 136 stations, 14 Cooper's hawks at 14 of 135 stations, 11 red-shouldered hawks at nine of 135 stations, and 0 goshawks.
 - Five stations had both barred owl and red-shouldered hawk; three stations had both barred owl and Cooper's hawk.
 - In total, woodland raptors were located at 41% of the 282 stations surveyed during the 2001–2002 survey.
 - 141 barred owls were identified at 88 of 247 stations surveyed.
 - 28 Cooper's hawks were identified at 28 of 252 stations surveyed.
 - 29 red-shouldered hawks were identified at 23 of 252 stations surveyed.
 - 1 northern goshawk was identified at 1 of 252 stations.
 - Seven stations had both barred owls and Cooper's hawks, 17 stations had both barred owls and red-shouldered hawks.
 - Survey methodologies of other states were not evaluated; instead the focus was directed to 1) repeating previous points and transects in 2003-2004 to document population trend, and 2) adding points within suitable forest and forested wetland habitat patches that would help us evaluate suitable habitat by sampling parts of patches currently valued as barred owl habitat by NJ's Landscape Map of critical wildlife habitat. ENSP is working to develop a model for barred owls that uses these data and recent literature, for application to the Landscape Map and regulatory habitat protection.
 - In southern New Jersey, 58% of the 124 stations surveyed in suitable habitat yielded a positive response for barred owl, tested in 36 valued forest patches.
 - In northern New Jersey, 37% of the stations 116 surveyed in suitable yielded a positive response for barred owl, tested in 24 valued forest patches.

Conclusions:

- Decreases in raptor response were found in nearly all areas, and could be the result of increased forest fragmentation, increased development and disturbance, or simply a decrease in the raptors' responding (weather conditions, lack of territoriality, increased noise pollution). Increases in raptor response, observed in diurnal raptors in northern New Jersey, could be the result of increased

populations, funneling of existing populations into remaining suitable, large forest tracts, or increased territorial response due to shortage of suitable habitat.

- Inclement weather (winds, rain, unseasonably cold temperatures) during the spring of 2003 and 2004 may have negatively affected the results of the barred owl surveys.

Recommendations:

- Analysis of raptor presence to suitable habitat available must be conducted using the NJDEP's 2002 Land Use/ Land Cover, once available, to evaluate population trends and results of presence and absence of raptors.
- Continue to monitor population trends every 3-4 years, using baseline data collected in 2001-2002, as it is a more complete data set.
- Further investigate barred owl presence within suitable habitats throughout NJ to develop a habitat model to be incorporated into NJ's Landscape Map. Survey sites from the 2003-2004 survey that did not yield a positive response should be resurveyed during more optimum weather conditions.
- Expand extensive suitable habitat surveys to diurnal raptors (Cooper's hawk, red-shoulder, and northern goshawk) and incorporate recent literature to develop habitat models for these species to be incorporated into NJ's Landscape Map.

Job 1E, Part 2: American Kestrel

Key Findings:

- In May and June of 2004, a total of 100 routes were surveyed statewide for kestrels. Each route consisted of a continuous 10 km road segment with 11 points spaced 1 km apart. The routes were stratified based on the percentage of open habitat within a 300 m radius buffer applied to each route, and then each of the five stratified categories (15–29%, 30–44%, 45–59%, 60–74%, and 75–89%) was sampled equally, with approximately 20 routes falling in each category. Each route was surveyed twice during the survey period with surveyors stopping for 3 minutes at each designated point.
- Kestrels were observed at 8 of the 1,086 survey points (0.7%) for which data was returned (missing data for 14 points). Seven of the 8 points (87.5%) with kestrels were in areas that fell within the top two stratified categories of kestrel habitat (60-74% and 75-89% open space). One point fell within the third highest category of kestrel habitat (45-59% open space).
- Of the 100 routes that were surveyed, a total of 18 kestrels were seen on 9 routes (9% of the routes). This includes kestrels that were observed between designated survey points along a route and represents the total number of kestrels observed during the first round of surveys.
- Due to the low number of kestrel observations in the original survey, a second round of surveys was conducted in July, 2004. A total of 77 survey points was visited for 10 minutes each. During this second round of surveys, a total of 10 kestrels was recorded at six points (7.8% of the survey points).
 - Thirty-eight of the 77 points had historical kestrel sightings (observation dates of 1994-2003) of which only 3 survey points yielded a kestrel sighting (7.9% of the points).
 - The remaining 39 points were first-round survey points located in highly suitable kestrel habitat (containing >80% open habitat, intersecting grassland patch >20 ha in size, and within ¼ mile of preserved farmland), as determined by an analysis of the habitat within 300 m of known kestrel occurrences. Only 3 of these survey points yielded a kestrel presence (7.7% of the points). One of these observations was also made in the May-June round of surveys.
- In the first round of surveys (3 minute point count), three kestrels were observed at 19 points within highly suitable kestrel habitat (15.8%). In the second round of surveys (10 minute point count), three kestrels were observed at 39 points within highly suitable kestrel habitat (7.7%).

Conclusions:

- The two stratified categories representing the highest percentages of open habitat (60-74% and 75-89%) were selected by 87.5% of the kestrels observed in 2004. These results show that the delineation of the open habitat categories proved to be accurate predictors of suitable kestrel habitat.

- Spending three minutes at a survey point versus ten minutes did not seem to be a limiting factor in detectability. While two kestrels were observed for the first time in the second round of surveys, one kestrel that was observed during the first round was not observed at the same point during the second round.
- The low number of sightings this season at sites that had kestrels in the last ten years suggests a serious decline in the kestrel population.

Recommendations:

- Build a statewide predictive model of kestrel habitat using kestrel occurrences from the 2004 surveys to supplement existing kestrel sightings from 1994 – 2003. Since kestrels seem to display a preference for 60-89% open habitat, percentage of open space will be included as a variable when building the model.
- Conduct kestrel surveys in spring of 2005 only within highly suitable habitat (predicted by the kestrel habitat model) to gather statewide abundance and baseline population data.
- Develop a nest box monitoring program to provide nesting structures for kestrels. Monitor nest boxes on an annual basis by banding young to determine productivity trends and collecting blood samples for contaminant analysis.

Job 1F: Shorebirds - Red Knots in Delaware Bay

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 of coastal habitats, and monitoring abundance and condition of priority shorebird species.

Key Findings:

- Aerial bay-wide surveys showed the number of shorebirds stopping over on Delaware Bay in May 2004 declined for a second year in a row. In 2003, peak count of red knots was 16,255, a 51% decline from 2002 peak count (31,695). In 2004, red knot numbers declined again by 17% to 13,315, 86% below the 95,000 counts recorded in Delaware Bay in the 1980's.
- Shorebird weight gains in 2004 were slightly above the average for the period 1997 to 2003. In 2003, the near complete failure of horseshoe crab spawning meant no surface eggs available to foraging shorebirds until the first week of June. We estimate only 6% (813) of the 13,315 red knots that came to Delaware Bay in 2003 reached threshold departure weight of 185 grams – the minimum necessary to continue migration and arrive in the Arctic in good breeding condition. In 2004, the combination of warm water, calm weather and restriction of all harvest during the spawning period produced good crab spawning activity during May. We estimate that 66% (8,844) of the 13,315 red knots that came to Delaware Bay made threshold departure weight of 185 g.
- Horseshoe crab eggs counts increased slightly in 2004, but egg densities were not significantly greater than those observed in prior years. The key difference between 2003 and 2004 was the timing of spawning events. In 2004, spawning activity was timed perfectly with initial arrival and peak numbers of shorebirds and horseshoe crab eggs were available to foraging shorebirds throughout the stopover period. In 2003, spawning activity did not commence until the first week of June because of bad weather and cold water temperatures, and no eggs were available to foraging shorebirds during May.

Conclusions:

- In 2003 and 2004, we witnessed a shift of migration pattern away from Delaware Bay because of the decline of horseshoe crab egg resources. Horseshoe crab eggs allow weight gains unprecedented in other red knot stopovers worldwide (>8 g/day) while other food resources (mussel spat, small clams) are sporadic and allow only weight maintenance or modest weight gains. Therefore, red knots and

other shorebirds migrating along the Atlantic Flyway are not likely to reach weights necessary for successful reproduction, and population declines are likely to continue.

- While the proportion of red knots reaching threshold departure weight increased in 2004, severe Arctic conditions cause nearly Arctic-wide breeding failure of most species. We believe red knots also suffered near complete breeding failure in 2004.
- The unstable and declining conditions on the Delaware Bay stopover, coupled with unpredictable conditions on Arctic breeding grounds, have removed much of the flexibility this migration/breeding system once had to absorb extreme events such as those witnessed in 2003 (spawning failure) and 2004 (severe Arctic conditions). However, even prior to these extreme events, the decline of the horseshoe crab resource since the early 1990's resulted in reduced weight gains and reduced adult survivorship in red knots (Baker et al. 2004).

Recommendations:

- We must continue to monitor condition of migrating red knots on Delaware Bay including measuring abundance via aerial surveys, surveillance of weight-gains, survival, horseshoe crab egg densities, and shorebird movements relative to foraging/roosting resources.
- Recent horseshoe crab harvest regulations and control of recreational use via beach closures have been appropriate and should be continued well into the future.
- Habitat improvement, particularly bay beaches, should be investigated and incorporated into environmental planning. There may be opportunities to restore beaches to produce better spawning habitat for horseshoe crabs and increase foraging/roosting areas for shorebirds, all of which must be underpinned by the data collected through this project.

JOB 1G: Red-headed Woodpecker

OBJECTIVE: To identify and monitor suitable habitat for the red-headed woodpecker (*Melanerpes erythrocephalus*) and develop planning guidelines for long term conservation.

Key Findings:

- A total of 116 red-headed woodpeckers was detected (109 adults, 2 immatures, 5 juveniles) at 70 locations (N = 311). A call-playback method was used to elicit response from territorial adults, therefore, immature and juvenile detections were necessarily low.
- Eighteen of 21 New Jersey counties were surveyed (excluding Ocean, Gloucester, and Camden).
- A total of 115 individuals (99%) occurred in five counties in southern New Jersey (Atlantic, Burlington, Cape May, Cumberland, Salem); 104 individuals (89%) occurred in only three of these counties (Atlantic, Burlington and Cumberland). One adult was detected in northern New Jersey (Sussex County).
- The forest composition most often used by adults for breeding in southern New Jersey was mixed-oak and oak-pine forest (upland forest). The adult in northern New Jersey was found breeding in a deciduous wooded swamp.
- There was a near-even split between individuals breeding in upland forests (45% of adults) and those utilizing upland forest altered by human activity (forest with interspersed development, forest-field ecotone, cemeteries, and parks; 55% of adults).
- Structural characteristics of southern New Jersey breeding habitats are: mature oak- dominated forest with open or sparse stand density, high overstory, little or no subcanopy, with lowbush blueberry as the major shrub/ground-cover component.
- The great number of birds detected in the south was not due to greater survey effort. The majority of survey points were located in central (n=146) and northern (n=96) New Jersey. Sixty-nine survey points were located in southern New Jersey; red-headed woodpeckers were detected at every location while only one in adult was detected in 242 locations in central and northern NJ.

Conclusions:

- The extremely low number of breeding adults observed in northern and central New Jersey may be due to loss, patchy distribution and/or observer inaccessibility to suitable habitats. Low numbers were also reported by the NJ Audubon Breeding Bird Atlas in the mid-1990's (total of 13 sightings in northern NJ). However, the fact that 242 locations were surveyed using a call playback, to which territorial birds readily responded, leads us to believe the species has declined in northern New Jersey.
- The large number of adults detected in the south is likely attributable to the use of call playback methods and more wide-spread and accessible suitable habitats for this species.

Recommendations:

- Further exploration of survey results is warranted to understand if habitat distribution or outright loss has affected detection of individuals in northern New Jersey.
- Southern New Jersey is a promising region for creation of suitable habitat for red-headed woodpecker because of large expanses of public lands dominated by oak-pine habitat. We will use survey data to develop a model for red-headed woodpecker breeding habitat and best management practices for public and private lands.
- ENSP must develop best management practices for state and private lands to encourage creation of suitable habitat on a rotational scheme.

JOB 2: Species of Special Concern

JOB 2A: Forest Passerines

OBJECTIVE 1: Beginning in 2003, design and experimentally implement techniques for long term monitoring of populations at regional levels in NJ. These techniques should be efficient in terms of cost and time, and should provide measurable results for detection of trends.

Key Findings

- Eleven Wildlife Management Areas (WMAs) were chosen for field studies for forest passerines, no endangered species were found within the WMAs; Buckshutem, Colliers Mills, and Peaslee had threatened species.
 - Species richness and abundance within each WMA were analyzed; Peaslee had the highest diversity of birds (95 species) and averaged 20 species abundance per point. This WMA also had the most homogenous habitat. Colliers Mills averaged 20 species abundance per point, and the second highest diversity (68 species).
 - The survey protocol was evaluated and deemed unsuccessful for NJ's terrain. Fourteen surveyors were recruited to conduct bird surveys, two of them volunteers. All surveyors failed to complete all of the survey blocks assigned to them.
- NJ Audubon literature review identified territory size, area requirements, and habitat preferences of grassland birds that can be used to develop a model to select potential survey sites.
- NJ Audubon recruited, trained, and organized volunteers to conduct migratory shorebirds counts; one count every 10-day period from mid-July until the end of October at specified sites identified based on prior knowledge of their use by the birds. Volunteers recorded the number of individuals of all shorebird species seen, bird ages, if possible, and to provide basic behavioral information (feeding, roosting, flying) and report disturbance types (numbers of joggers, walkers, vehicles, dogs, etc).
 - Volunteer recruitment for the shorebird survey was much more successful than for the songbird project due to site accessibility.
 - Preliminary results yielded a total of 7,266 shorebirds present at Avalon; 381 at Barnegat Lighthouse; 16,233 at Bivalve; 3088 at Cape May Meadows; 2,063 at Holgate; 444 at Sandy Hook; and 12,885 at Two-mile Beach in Cape May. The maximum number seen at each of the above sites were 2284 birds at Avalon; 264 at Barnegat Lighthouse; 4,092 at Bivalve;

1,416 at Cape May Meadows; 2,063 at Holgate; 89 at Sandy Hook; and 6,446 at Two-mile Beach in Cape May.

- NJ Audubon initiated preliminary efforts for developing bird banding on a broad scale (to monitor bird populations) through identifying master banders as potential mentors, discussing potential concerns with the USGS Bird Banding Lab, and initiating contact with potential banders (Citizen Scientists).
- NJ Audubon conducted preliminary work with the NY/NJ Baykeeper and Hackensack Riverkeeper to develop bird survey methodology (opportunistic sampling and on-line reporting) for urban bird surveys.

Conclusions:

- The BTO methodology did not work well for the forest passerine survey likely because the terrain in NJ is unlike England's, which consists of about 55% open fields and agriculture and only about 12% forests, as opposed to 76% forest in our study sites. According to surveyors, there was too much "bushwacking" to complete the surveys in a timely manner.
 - The BTO methodology should not be continued in forest habitat.
- Based on the grassland bird survey locations, methodology and the number of citizen scientists interested in conducting this research, statewide abundance and distribution data can be collected
- Preliminary results suggest that the shorebird survey was successful in terms of recruiting volunteers and collecting data.
- On-line data forms for urban bird surveys were not prepared prior to survey period, therefore, surveys intended for May and June 2004 were not conducted.
 - Volunteers are interested to track abundance and distribution of endangered and threatened species in urban environments. Utilizing Citizen Scientists in urban environments has potential to increase awareness of environmental issues and environmental education of urban citizens
 - There are important areas in urban areas (local parks, small patches of habitat) that have not been systematically surveyed.

Recommendations:

- A stratified approach should be developed while using more accessible points for counting forest passerines.
- Initial grassland bird surveys (field work) should be conducted during the spring 2005 and will most likely include using point counts at randomly located 100 m radius circular plots. A minimum of two visits to each site will be performed, one in May and one in June.
 - Continue to refine methodology based on preliminary survey results of citizen scientists.
 - NJ Audubon should develop a model to select potential survey sites through habitat characteristics and the birds' needs using territory size, area requirements, and habitat type preferences.
- Continue migratory shorebird fall survey in 2005 and possibly include a spring 2005 migration survey.
- Preliminary work must continue to identify and coordinate master banders as mentors and to train citizen scientists interested in the banding projects.
- Urban bird surveys should be conducted in May–June 2005 using opportunistic sampling using on-line reporting.
- The NJ Division of Fish and Wildlife, Endangered and Nongame Species Program and NJ Audubon should continue to provide assistance to urban groups (i.e. Baykeeper and Riverkeeper, and newcomers) in terms of scientific expertise and direction of citizen scientists

JOB 2B: Scrub-shrub/Open Field Passerines

OBJECTIVE 1: To stabilize and reverse the decline in scrub-shrub/open-field nesting birds of special concern, both those that migrate through New Jersey and, in particular, those that breed in NJ. Initial work will focus on golden-winged warbler (*Vermivora chrysoptera*) as a species of state and regional concern. Future work will include: common nighthawk (*Chordeiles minor*), least flycatcher (*Empidonax minimus*), horned lark (*Eremophila alpestris*), and yellow-breasted chat (*Icteria virens*). Goals include: inventorying and monitoring populations, specifically to conduct a monitoring program to track population trends not covered adequately by the Breeding Bird Survey, the identification and preservation of critical habitat, and identification of specific threats at these sites.

Key Findings:

- Biologists conducted daily surveys in three study areas located in Sparta Mountain in 2003 and three study areas located in Sparta Mountain and Weldon Brook Wildlife Management Areas in 2004, only one of the 2003 study areas was repeated in 2004. The goals were to identify all golden-winged warbler territories and individuals, record breeding density, identify nest locations and all nest attempts, and record any indication of competition, hybridization, and possible predators.
- In breeding seasons of 2003 and 2004, 21 individual male golden-winged warblers were identified and 16 of them were color-banded; two individuals were present in both years.
- Seven golden-winged warbler nests were monitored with evidence of 5 additional males confirmed breeding (11 breeding pairs total).
- Approximately 22 golden-winged warbler chicks were fledged in 2003 and 2004. Three (43%) of the seven golden-winged warbler nests fledged 14 chicks in total for a productivity rate of 2.00. One of the seven nests (14%) was abandoned, one (14%) was infertile, and two (29%) were depredated. Of the five additional golden-winged warblers confirmed breeding, only two (40%) showed evidence of fledging. The average clutch size for the seven nests was 4.14.
- We identified two golden-winged/blue-winged warbler hybrids in two territories: one Brewster's female mated with a golden-winged warbler male in 2003, and one Brewster's male was unmated in 2004.
- Overall, territory sizes ranged from 0.17 to 7.84 hectares with the mean territory size of 1.66 (± 0.42) hectares. There was no significant difference in territory size between years or among study sites.
- Golden-winged warbler territories tended to be in wetlands and have slightly more herbaceous (28%) and dead vegetation cover (12%) and greater vegetation height (6.5 m) than areas not occupied by golden-winged warblers.
- Forty-nine different species of birds, including golden-winged warblers, were using the habitat within and around utility rights-of-way on Sparta Mountain and Weldon Brook Wildlife Management Areas, 45 of which used golden-winged warbler territories for breeding or foraging. One species observed is on New Jersey's endangered list (red-shouldered hawk) and two are on the state's threatened list (barred owl, Cooper's hawk). Four species observed, other than golden-winged warblers, are listed as special concern (black-throated green warbler, broad-winged hawk, sharp-shinned hawk, veery), and eighteen species observed are designated as regional priority.
- Nineteen nests of 12 species (other than golden-winged warblers) were located and monitored in 2004. Twenty other individual birds were confirmed breeding on the utility rights-of-way, but no nests were located or monitored.
- Seven (37%) of the 19 nests located and monitored fledged, seven (37%) were depredated, one (5%) abandoned, and four (21%) had unknown results. Of the confirmed breeding sightings without known nests, eight (40%) were carrying nesting material or copulating with unknown results and twelve (60%) were feeding fledglings. Clutch sizes for the 19 nests ranged from one to six with an average of four. The productivity rate for the 13 nests with known clutch sizes and outcomes was 2.00 (26 fledged).
- Only two (9%) of all of the nests, including golden-winged warblers, contained a cowbird egg or chick (prairie warbler and field sparrow), and one (5%) of the 20 confirmed breeding sightings involved a cowbird fledgling (chestnut-sided warbler). There were numerous eastern chipmunks and

white-tailed deer throughout the right-of-way, and one black rat snake was sighted, but there was no evidence of which species depredated nests.

- Approximately nine hectares of right-of-way habitat were cut down during the study in June 2004, which included entire territories of two male golden-winged warblers and territory edges of two other male golden-winged warblers. One territory that was entirely destroyed contained a nest that had been abandoned only three days prior to cutting, and the male golden-winged warbler occupying the other territory destroyed was observed singing during the cutting, but not afterwards. The male golden-winged warblers that occupied the habitat partially destroyed did not appear to be affected.

Conclusions:

- The presence of successful nesting attempts of golden-winged warbler and other scrub-shrub birds on the rights-of-way and the limited number of cowbird parasitism observed suggest that, if managed properly, utility rights-of-way have the potential to be habitat sources and could aid in maintaining the state's golden-winged warbler and scrub-shrub bird populations.

Recommendations:

- Continue to monitor reproductive success and site fidelity of golden-winged warblers and other scrub-shrub birds on utility rights-of-way
- Work with utility companies to implement Best Management Practices (BMP) on rights-of-way for golden-winged warblers, and require BMP implementation as part of the companies' state permits for operation.

JOB 2C: Cliff Swallow

OBJECTIVE: To develop a long-term monitoring strategy for known breeding colonies of cliff swallows (*Petrochelidon pyrrhonota*) throughout the state, and to inventory the state for new or previously unknown colonies.

Key Findings:

- Nest count surveys of cliff swallow colonies were conducted on the bridges over the Delaware River from Trenton, NJ to Phillipsburg, NJ during late June, 2004. All of the bridges were surveyed by boat from the river using a two-person team. The boat operator maintained a position in the river so that the observer could view all potential nesting locations under the bridges. All intact cliff swallow nests were counted at each colony site and were presumed to represent a breeding pair. Nests that were confirmed to be occupied by house sparrows (*Passer domesticus*) were not included in the count. Similar surveys were conducted each year from 1983-87, 1992-94 and in 2003.
- Nineteen bridges were surveyed in 2004 and active cliff swallow colonies were present at eight. A total of 337 nests were counted over a three-day period (June 24, 25 and 28).
- In 2003 the same bridges were surveyed and active colonies were present at six bridges. A total of 330 nests were counted.
- A volunteer survey was conducted in an attempt to locate active colonies and count breeding pairs at inland sites away from the Delaware River. Historical colony sites and suitable habitat were searched throughout northern NJ. Volunteers checked twenty-two sites and active colonies were present at six for a total of 27 pairs. A total of 56 person-hours of volunteer time was contributed to the project.

Conclusions:

- Although the number of active cliff swallow colonies has remained relatively stable, the number of breeding pairs at the Delaware River sites has declined considerably since the last surveys were conducted in the early 1990's. The number of breeding pairs along the Delaware River reached a high of 975 during the 1994 survey. In 2003 and 2004, the number of breeding pairs was 330 and 337, respectively, a decline of roughly 65% from their peak.

- The recent surveys were the first since New Jersey delisted the cliff swallow from threatened to special concern in 1999.

Recommendations:

- Cliff swallow surveys of the Delaware River sites should be repeated every three years to gain a better understanding of long-term population trends.
- Greater effort must be made to assess the inland populations of cliff swallows throughout their range in north Jersey. Inland colony sites appear to be more ephemeral in nature than the river colonies. Volunteers will be solicited for assistance in locating and counting these populations.
- Develop MOU's with the NJ/PA Joint Delaware River Toll Bridge Commission and NJDOT to protect the bridge colonies during bridge maintenance projects. In addition, artificial nest structures should be placed on bridges to encourage nesting after bridge maintenance projects.

JOB 4: Migratory Stopovers

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

OBJECTIVE: The goal of this project is to develop land acquisition and management strategies that help conserve stopover habitats used by songbirds as they travel through New Jersey during north and southbound migrations. A stopover habitat can be defined as "an area with the combination of resources (e.g., food, shelter, water) and environmental conditions (e.g., temperature, precipitation, predators, competitors) that promotes occupancy by individuals of a given species (or population), and allows those individuals to survive" during migration. 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:

- Collected 68 nights of radar data during spring 2003 and 124 nights of data during fall 2003 from Dover Air Force Base, DE (DOX) and Philadelphia, PA (DIX) radar stations to monitor bird migration events in southern and central New Jersey respectively.
- Reviewed data to assess nights when migration events occurred. Only 35-60% of data initially classified as MIG were used in analyses of stopover site use. This is similar to other analyses we have conducted in the mid-Atlantic region.
- ArcView Spatial Analyst© 2.0 was used to build station-specific stopover occupancy models from migration departure data by creating two composite outputs: (1) total bird density during departure across all migration nights for each 1 x 1 km cell (spatial resolution of NEXRAD data) and (2) number of migration nights birds were detected during departure in each 1 x 1 km cell (i.e., frequency of bird occupancy).
- These two outputs were queried to generate stopover occupancy models (SOM). These models were then overlaid onto 2001 National Land Cover Data (NLCD) to begin preliminary investigations of relationships between stopover site occupancy and habitat and landscape features.
- To compare habitat (e.g., forest, agriculture, development) and landscape characteristics (e.g., habitat size, amount of edge, distance to similar habitat) in SOM and NSOM areas, 30 randomly located points were placed within the 80th percentile SOM area, and 30 points in the NSOM area, but within 30 nautical miles (nm, ~55km) of DIX and 45 nm (~73 km) of DOX. These limits were used because these were the spatial extents the 80th percentile SOM for each site.
- To investigate aspects of scale that might influence stopover site use, 1, 3, and 5 km buffers were created around each point to extract data from the NLCD grids and "class metrics" were used to evaluate their land cover and landscape characteristics.

Conclusions:

- Preliminary results suggest that SOM and NSOM areas differ most noticeably with respect to forested wetlands, regardless of season or buffer size we investigated. SOM areas for both sites on average contained significantly more forested wetland habitats than NSOM areas. Additionally, forested wetland patches were generally larger, had greater traversability, and were closer to each other in SOM compared to NSOM areas.
- At the 3 and 5 km buffer size, other factors that appear to contribute to songbird occupancy were related to large upland forest patches and agricultural patches in pasture and hay. In the SOM for DIX, that covers most of the Pinelands, birds appeared to avoid coniferous forest habitats, and moderate and intense development, regardless of season. Avoidance of development was also evident in SOMs for southern New Jersey, although this was not statistically significant.
- Models developed for spring and fall 2003, were spatially congruent with models developed for the same areas using 2002 data. Generally, seasonal models, depending on threshold, showed between 65-80 percent spatial correspondence.

Recommendations:

- Continue to build and refine models exploring all threshold models to establish optimum variables.
- Explore a more detailed and robust relationship of (1) differences in habitat and landscape features between areas described by SOMs and areas outside the models (NSOM), and (2) similarities in spring and fall stopover site occupancy based on the models generated for each season.

JOB 4B: Migratory Raptors (Cape May and Ridge & Valley/Highlands)

OBJECTIVE: To monitor migrating raptor populations and their habitat use during fall migration through NJ, and to develop habitat management guidelines and informational vehicles necessary to sustain the migration.

Key Findings:

- A survey of the Cape May fall raptor migration was designed based on a survey of raptor occurrence in the 40 km length of Cape May peninsula conducted in 2002 that suggested raptors were moving north from the densely developed areas of Cape May in search of habitat. The fall 2003 survey was designed to record abundance and habitat use by migrating raptors in the lower 20 km of the peninsula (following methods in Niles et al. 1996).
- We surveyed 62 randomly-selected points in September-October 2003. Each point was surveyed 14 times, roughly twice per week, resulting in data on 2,344 birds. Observers recorded data on species, behavior, bird altitude, bird distance, flight direction, and habitat characteristics. All data were summarized and prepared for analysis, which is ongoing in cooperation with Rutgers University's Ecology and Evolution program.
- We analyzed habitat availability and trends between 1984 and 2000 using satellite imagery and land use/land cover classifications. Habitat loss has occurred throughout the Cape May peninsula, with the greatest percent loss occurring in the most southern 10 km of the peninsula.
- Preliminary findings have indicated changes in distribution and habitat use by migratory raptors at the Cape May stopover that warrant further investigation.
- We prepared a comprehensive literature review summarizing the importance of habitat at migratory stopovers, which will be used to justify planning recommendations and regulatory protection strategies for the peninsula.

Conclusions:

- This study is not yet complete, but the data suggest a significant loss of available habitat for migratory birds in Cape May peninsula, a nationally important migratory bird stopover site. That habitat loss seems to have prompted a change in distribution of migrating raptors that may have implications for the viability of Cape May as a stopover that supports several raptor populations in the Eastern U. S.

Recommendations:

- Continue this study to complete the analyses of habitat trends in the Cape May stopover and examine correlations in raptor distribution, abundance and habitat use.
- Identify habitats that can be protected and enhanced to meet the stopover needs of migratory bird populations.
- Based on this study's conclusions, make recommendations to land use planning agencies and state regulatory agencies to preserve and enhance habitat.

JOB 5: New Jersey's Important Bird Areas

OBJECTIVE: Important Bird Areas seek to identify and conserve sites critical to migratory, wintering and breeding birds internationally. The program was initiated by Bird Life International, and continued by National Audubon Society. New Jersey Audubon Society has been asked by National Audubon to oversee this innovative project in New Jersey.

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 populations of birds and birding sites in New Jersey, 2) ensure the continued viability of these habitats and ecotourism sites, and 3) to raise public awareness about the value of habitat for birds and other wildlife.

Key findings:

- Worked with the NJ DEP and the USFWS to develop priority species lists and population objectives for New Jersey based on large scale bird conservation plans and used this information to develop criteria for IBBA (Important Bird and Birding Areas) site selection.
- Formed committees composed of experts including ornithologists, state agency personnel, and conservation organizations that will be responsible for reviewing nominated sites and determining their eligibility for IBBA designation.
- Began Collaborating with partner organizations, including NJ DEP, National Audubon Society, the Nature Conservancy, and New Jersey Conservation Foundation, on conservation objectives at potential high-priority IBA sites to facilitate effective regional-scale planning efforts.
- NJAS's IBBA Coordinator gave over thirty public slideshow presentations throughout NJ for conservation groups, birding organizations, and at NJAS nature centers, reaching hundreds of NJ citizens and introducing them to the NJ Important Bird and Birding Areas Program. The objective of these presentations was to recruit volunteers to gather data and nominate potential sites.
- Created a full-color IBBA informational brochure, and distributed over 800 copies to individuals and organizations statewide, asking for public participation in the site nomination/data gathering process.
- Reached thousands of people, asking them to participate in the IBBA Program site nomination process by submitting avian data, through feature articles in local and regional newspapers and magazines highlighting the importance of protecting habitat for birds.
- Identified "model" IBAs and used them to present and promote wildlife conservation and focus planning and conservation efforts, working with ENSP, NJ Audubon, National Audubon chapters and other cooperating groups.

Conclusions:

- Through preliminary workshops, identified over 150 potential sites for IBBA inclusion, with approximately 50 in the northern region, 35 in the central region, and 65 in the southern region of the state. Sites were suggested if it was believed that they had a good chance of meeting at least one of the site-selection criteria.

Recommendations:

- Sites suggested in the preliminary workshops must be documented and nominated using a detailed form in order to be considered by the committee for inclusion in the IBBA Program.
- Continue recruiting volunteers to fill-in site nomination forms and to gather additional data if needed to support nominations.

EXECUTIVE SUMMARY

Project:	Mammal Conservation
Federal Aid Project:	T-1-1 (State Wildlife Grants)
Segment dates:	April 1, 2003 to August 31, 2004
Total Project Expenditures:	\$146,667 (\$110,000 Federal, \$36,667 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.

NEED: All listed species in NJ have special conservation needs due to the unique threats that are impacting their respective populations. These threats include habitat loss or alteration, contaminants, competition, predation and human disturbance. Population monitoring and threat assessments provide the basis for developing conservation strategies and recovery plans for federal and state-listed species.

JOB 1A: Bobcat Conservation

OBJECTIVE: Determine the distribution, size and habitat needs of New Jersey's bobcat population. Map suitable bobcat habitat within the state through the Landscape Project.

Key Findings:

- Bobcat trapping was conducted during February and March of 2004 in selected areas of known bobcat habitat throughout Warren, Sussex and Morris counties in northern New Jersey. The Morris County site included Rockaway River Wildlife Management Area and Picatinny Arsenal. The Sussex County site included Trout Brook Wildlife Management Area and Fairview Lake YMCA Camp. The Warren County site was located northwest of Blairstown where Yards Creek flows into the lower Yards Creek Reservoir.
- A total of 119 trap/nights of effort produced zero captures at the Morris County sites. A total of 38 trap/nights of effort at the Sussex County sites produced zero captures. A total of 22 trap/nights of effort produced two captures at the Warren County site. Although no captures were made at the Sussex and Morris county sites bobcats visited traps at both locations but failed to enter them.
- Trapping was conducted using 19" x 19" x 48" wire mesh live traps baited with beaver meat.
- A male bobcat was captured at the Warren County site on March 5, 2004. The animal weighed 22 lbs. and was anesthetized with 1cc of a 5:1 solution of Ketamine and Xylazine. The drug was administered to the animal while in the trap using a Dan-Inject automatic Jabstick. The animal responded to the drug and was immobilized 19 minutes from the time of injection. Wildlife veterinarian Scott Newman, of The Wildlife Trust, monitored the animal's vital signs during the entire procedure.
- The bobcat was fitted with a 295 gram Televilt GPS-Porsec™ Model 200 store-on-board collar with an internal antenna. The collar is programmed to attempt 2 GPS positions at 05:00 and 22:00 three times per week (Mon., Weds. and Fri.). The collar emits a VHF signal four times each week (Mon., Weds., Thurs. and Fri.) from 10:00 to 14:00 EST. The estimated life of the battery is 418 days (as programmed). The collars have both an activity and mortality sensor and they have an internal drop-off mechanism that is activated by a low battery. Once the collar drops off it continues to emit a double pulse at 48 ppm for 45 days, allowing recovery of the collar.
- A second male bobcat was captured at the same site on March 10, 2004. The animal weighed 30 lbs. The same immobilization procedure was used to affix the GPS-Porsec collar.

- Each cat is located using standard radio telemetry equipment and techniques at least one time per month to keep track of their location and to assure that the collar has not entered the mortality mode or has not dropped off of the animal. The collars are scheduled to drop off on April 26, 2005 and May 1, 2005 respectively.

Conclusions:

- Biologists selected several habitat variables for analysis and compared habitat characteristics of areas where bobcats occurred to randomly selected areas to build a habitat selection model using statistical and GIS analyses.
- The variables that best predicted the presence of bobcats were residential areas (negative relationship) and stony soil (positive relationship).
- The predictive model provides ENSP biologists with an insight into the amount of habitat, distribution of habitat and degree of fragmentation that is characteristic of bobcat habitat in northern NJ.

Recommendations:

- ENSP will continue to trap, collar and track bobcats throughout northern NJ in an effort to further refine the predictive GIS model. The goal is to trap, collar and collect movement and habitat use data from 10-12 bobcats.
- ENSP has developed a standardized sampling regime for conducting scent-post surveys using motion sensitive cameras to record visitation. The sampling regime is based on the Landscape Project mapping and the data collected will be used to test and further refine the predictive model. Data from this survey will provide a better understanding of bobcat distribution within northern NJ.
- The survey method will be tested to determine whether or not individual bobcats can be identified from the photographs. If individuals can be identified from the photos we will use the data to obtain abundance/density indices using mark/recapture techniques.

JOB 1B: Allegheny Woodrat Conservation

OBJECTIVE: Annually monitor New Jersey's last remaining woodrat population and assess the potential exposure risk of the woodrat population to raccoon roundworm (*Baylisascaris procyonis*).

Key Findings:

- Woodrat habitat at the Palisades Interstate Park has been mapped using GIS software and GPS data. Six sampling/monitoring sites have been delineated and have been monitored using varying amounts of sampling effort since 1987. A standardized sampling/monitoring protocol was developed in 1999 and has been employed each year since that date.
- Annual woodrat trapping/monitoring was conducted on October 1st and 2nd, 2003. Forty Tomahawk collapsible live-traps were set for two consecutive nights for a total trapping effort of 80 trap nights.
- A total of 31 individual animals were captured in 2003, the highest number since the standardized sampling/monitoring protocol was instituted in 1999. This represents a capture index of 3.88 individuals/10 trap nights. The capture index has steadily increased from 3.00 in 1999 to 3.88 in 2003.
- The adult:sub-adult ratio was 18:13 and the male:female ratio was 16:15.
- A total of 32 man/hours was spent searching the study sites for raccoon scat to be tested both qualitatively and quantitatively for the presence of *B. procyonis* eggs. However, only two scat samples were found at one sampling/monitoring site. Due to the low sample size, *B. procyonis* testing was not conducted.

Conclusions:

- The Palisades woodrat population appears to be stable or even slightly increasing based on trapping results since 1987.
- Infection by *B. procyonis* does not appear to be a problem at the present time for the Palisades woodrat population. Kidder (1989) indicated that the prevalence of patent infections appears to vary seasonally, with the greatest amount of egg shedding occurring in October, November and December. However, no woodrats displayed any symptoms of infection by *B. procyonis*. These include poor motor coordination, circling and coma. The pathogenicity of the larval migration depends on the number of eggs ingested, site of encystment and strength of the hosts immune response (LoGiudice 2000). Since no symptomatic animals were captured it suggests that infection by *B. procyonis* may not be a significant mortality factor for this population. Woodrat populations exposed to high levels of environmental contamination with *B. procyonis* eggs declined rapidly and persisted for less than 18 months (McGowan 1993).

Recommendations:

- Due to the documented high mortality rates, rapid decline and ultimate extirpation of woodrat populations that are exposed to high levels of environmental contamination with *B. procyonis* eggs, annual sampling/monitoring of the Palisades population should continue using the standardized protocol.
- It is also recommended that the raccoon population be monitored within the woodrat's range within the Palisades. Raccoon scat sampling, both qualitative and quantitative, should continue in an effort to monitor the level of environmental contamination by *B. procyonis* eggs.
- If high levels of environmental contamination from *B. procyonis* eggs is found, then fish meal/polymer baits treated with piperazine (an anthelmintic drug) will be distributed throughout the woodrat sites. The ingestion of piperazine has been shown to effectively reduce the *B. procyonis* burden and completely interrupt egg shedding for nearly three weeks following treatment. Baits would be distributed during October, November and December, which are the months when *B. procyonis* egg loads are greatest.

JOB 1C: Bat Conservation and Management

OBJECTIVE 1: To identify and characterize important summer and winter bat habitats, including those of the federally endangered Indiana bat (*Myotis sodalis*), and determine the distribution of New Jersey's bat populations

Key Findings:

- The volunteer-based "Summer Bat Count" was launched in summer of 2003 to identify locations of summer roosting populations. Sixty bat roosts were reported in 20 counties in various structures including churches, residential attics, eaves, and bat boxes. Twenty-two volunteers submitted data for 22 roost sites in 12 counties with counts ranging from one bat to 1,645 bats.
- Biologists conducted an exploratory survey of Leigh Cave in Hunterdon County to assess use by hibernating bats. A survey in 1993 recorded approximately 20 bats using the cave and a high level of disturbance from recreational caving groups. In March 2004, an unofficial count recorded approximately 300 bats hibernating within the cave passageways.
- Biologists conducted an exploratory survey of Hoit Mine in Warren County to assess use by hibernating bats. Deep water filled most of the internal passageway but all walls and ceiling surfaces were visible from areas of shallower water allowing for the completion of a comprehensive survey. Six little brown bats and one eastern pipistrelle were counted.
- Biologists conducted an internal survey of the Taylor Shaft of the Mount Hope mine in Warren County in the winter of 2004. Indiana bats had been captured at the entrance to the shaft in the mid-1990's but an internal survey had never been attempted. In February, biologists descended 135' into the mine passageways and recorded 13,450 little brown bats and 537 Indiana bats.

- Historical literature, GIS maps, and personal communication were used to prioritize iron mines and caves in New Jersey for suitability as bat hibernacula. Thirty-one iron mines and 4 caves that had potential ground openings were determined high priority for future field survey.

Conclusions:

- Volunteers provided valuable data needed for locating summer bat roost sites. Population estimates at summer roost sites can be documented yearly to help monitor local trends.
- Despite recreational caving use, Leigh Cave is still viable as a site for hibernating bat populations.
- The Taylor Shaft of the Mount Hope mine is the second largest wintering bat site in New Jersey and surpassed Hibernia Mine as the largest Indiana bat hibernaculum in the state.
- It is likely that there are additional bat hibernacula in New Jersey that have not yet been identified or surveyed.

Recommendations:

- Seek closure of Leigh Cave to recreational activities during the winter months to prevent disturbance to hibernating bat populations.
- Continue efforts to install a protective bat gate at the Taylor Shaft of the Mount Hope mine.
- Continue biennial counts of wintering bats at all known hibernacula to compile population and trend data.
- Conduct ground/internal surveys of high priority mines and caves to assess their suitability for wintering bat populations.
- Develop Best Management Practices for protection and management of bat hibernacula.
- Develop information for habitat modeling of essential habitat for both breeding and wintering season bat populations.

EXECUTIVE SUMMARY

Project:	Reptile and Amphibian Conservation
Federal Aid Project:	T-1-1 (State Wildlife Grants)
Segment dates:	April 1, 2003 to August 31, 2004
Total Project Expenditures:	\$376,000 (\$282,000 Federal, \$94,000 State)

JOB 1: Federal and State Listed Reptiles and Amphibians

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

NEED: The majority of New Jersey's listed reptile species have earned their status because of habitat loss (e.g. wood turtle), habitat fragmentation (e.g. northern pine snake), invasive/exotic species (e.g. bog turtle), human persecution (e.g. timber rattlesnake) and illegal collection (e.g. bog turtle). To stem further decline of these species, it is essential that a comprehensive conservation strategy be developed for each species entailing the identification of viable populations, delineating critical habitats, addressing threats through a cooperative effort among Division bureaus and other DEP offices, and establishing a long-term monitoring project for each species.

JOB 1A: Bog Turtles

OBJECTIVE: To preserve and manage populations of the federally threatened and state endangered bog turtle (*Clemmys muhlenbergi*) through establishing cooperative relationships with private landowners, managing and restoring habitats, monitoring long and short-term population trends, coordinating land acquisitions of sites threatened by adjacent land uses, determining the full extent of the species range and distribution through de novo surveys, and encouraging greater surveillance by state and federal law enforcement to help secure populations threatened by collectors.

Key Findings:

- Block and lot information has been determined for over 138 individual private landowners whose property provides suitable habitat for a viable bog turtle population.
- A preliminary database and associated GIS shapefile have been outlined to store private landowner information.
- Two sites were identified late in the season as potential bog turtle habitat in Sussex County. Surveys will be conducted in the spring.
- A total of 12 known sites were visually surveyed opportunistically. Captured turtles were identified and marked, if needed, and locations mapped. Two of these sites, one in Gloucester County and one in Sussex County, are actively livestock managed sites. Turtles were located in low, grazed areas in both sites.
- Through a contract, another 12 sites, with 20+ year old records or unconfirmed sightings, were surveyed. Seven of the 12 sites yielded turtles based on 249 hours of visual and trapping surveys. Most notable were turtles identified in Morris County.
- A total of 5 known sites slated for invasive plant management were trapped. Traps were set equally in both tall, degraded and low, fen vegetation. Out of 20 trapped turtles, two were found in traps set in degraded habitat at the 5 sites.
- Seven turtles were fit with radio transmitters at one pre-restoration deme. Turtles will be tracked for a total of 6 months. Current findings show preference for early successional, low, fen vegetation. There is a general avoidance among tracked turtles of tall, late successional vegetation.

Conclusions:

- A private landowner database for active bog turtle sites will assist in future management through cooperative agreements and assist enforcement with monitoring sensitive sites.
- A potential exists to identify new bog turtle populations.
- Historic and unconfirmed bog turtle sightings need to be evaluated on a periodic basis for data reliability and authenticity.
- Bog turtles show a preference for low, diverse vegetation the majority of the time.

Recommendations:

- Continue to integrate private landowner information into updateable database.
- Continue to explore possibility of identifying new bog turtle habitat for occurrences.
- Expand habitat management practices to sites in danger of becoming degraded outside of those currently being managed through other funding.

JOB 1B: Wood Turtles

OBJECTIVE: To determine statewide wood turtle (*Clemmys 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 habitat protection strategy for viable populations, which entails landscape-level protection of riparian corridors and adjacent upland habitats.

Key Findings:

- As part of water quality/land use study, a total of 283 visual survey hours have been spent at 20 study sites, including two control sites.
- Sixty-three new turtles have been marked in the study so far. Control site turtles consist of 27% of the total.
 - Non-impaired water quality sites yielded 41% of the turtles, moderately impaired 32%, severely impaired 0%.
 - Lightly developed land use sites yielded 54% of the turtles. Developed land use sites yielded 19% of the turtles.
- Non-breeding age turtles (>14 years old) accounted for 11% of marked individuals. No non-breeding age turtles were found in developed land use sites. All but one non-breeding age turtles were found in non-impaired water quality sites.

Conclusions:

- Results, to date, show stronger wood turtle populations prefer non-impaired water quality and lightly developed surrounding land use.
- Diversity in age class structures favors sites that had non-impaired water quality and lightly developed land use.

Recommendations:

- Design a new study, based on the final results of this effort, to determine and identify important habitat preferences at sites with varying water quality and surrounding land use. Combined results of the studies will assist in state regulatory decisions and future habitat management for the species.

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

- Two new dens were located in the fall of 2003 using radio-telemetry.
- No rattlesnakes were captured from the Pinelands region during the 2004 field season that were able to endure surgical implantation of a transmitter.
- Two rattlesnakes were collected, after being struck by cars, and released to veterinarian for medical assistance. Both rattlesnakes survived and were returned to their capture locations.

Highlands region

- Due to proposed legislation that was introduced to protect areas within the Highlands Region, the *Highlands Bill*, timber rattlesnakes within the region became a priority for research to identify critical habitats (dens, gestation areas, basking areas, foraging grounds).
- During the 2003 and 2004 field seasons, twenty timber rattlesnakes, ten new snakes each year, were captured, implanted with transmitters, and tracked using radio-telemetry to locate den locations. In 2003, two of the snakes were killed. Of the remaining eight, four transmitters failed just prior to or after denning, therefore, ENSP was unable to validate the den location through winter surveys and spring emergence. Of the remaining four, two denned at a known den site, one denned within ¼ mile of a suspected den site (enlarging the den area for the ridge), and one denned at a suspected den site, validating the site. As of August 31, 2004, one of the ten snakes implanted earlier in the season was removed from the study (removal of transmitter) due to health concerns. The remaining nine continued to be tracked. ENSP is hopeful, due to capture locations, that new dens will be located.
- An additional eight timber rattlesnakes in 2003 and one timber rattlesnake in 2004 were captured and processed (collection of biological data and DNA blood sample), but were released without transmitters due to physical condition of snake (post-partum, gravid) or time of season (no surgeries conducted after August 15).
- Den locations within the Highlands region have been found on public lands, basking areas and foraging grounds on public and private lands.
- Forty-two volunteers were trained (three retrained) as members of the Endangered and Nongame Species Program's Venomous Snake Response Team within the Highlands Region.
- Six rattlesnakes were found dead on the road in 2004 throughout the Highlands Region, five were collected by the ENSP. All of the specimens will be released to H. Reinert for inclusion in DNA analysis. A seventh snake died at a rehabilitation facility after a citizen attempted to kill it.
- Experienced volunteer conducted educational programs within two communities living in venomous snake areas in an attempt to recruit citizen assistance to help locate/ report rattlesnakes to be included in the study.

Conclusions:

Pinelands region

- The ENSP's Pinelands Rattlesnake Response Team continues to be effective at rapidly responding to rattlesnake reports made by the general public.
- Undocumented rattlesnake dens still exist within the Pinelands Landscape Region.
- Dirt and paved roads in the Pinelands fragment critical timber rattlesnake habitats and pose a major threat to this species.

Highlands region

- Unknown den locations persist throughout the Highlands Region.
- Increasing development and roads continues to impede travel between habitats, isolate populations, and limit habitat use.

Recommendations:

Pinelands region

- Continue to recruit and train volunteers to serve on the Pinelands Rattlesnake Response Team.

- 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.

Highlands region

- Continue to educate and involve NJ citizens in the recruitment of rattlesnakes. Create a sense of ownership and partnership for the rattlesnakes' protection and protection of their habitats.
- Continue radio-telemetric research to identify additional critical habitats. Focus on areas that potentially will identify 1) a link connecting populations throughout the northern edge of the Highlands Region and 2) populations at risk of human encroachment and increased human-rattlesnake interaction.
- Continue to 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.

JOB 1D: Corn Snake and Northern Pine Snake

OBJECTIVE: To conserve populations of state-endangered corn snakes (*Elaphe guttata guttata*) and 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 such as prescribed burns.

Key Findings

- Conducted surveys of state lands where pine snake habitat was believed to exist (based on NJDEP's Landscape Project), but where no pine snakes had been documented or where documented sightings were over 15-years old. Pine snakes or evidence of pine snakes were found on each of the four Wildlife Management Areas surveyed. A total of three pine snake nests and four pine snakes (one adult, three hatchlings) were found on Hammonton Creek WMA. One adult was found at both Union Lake WMA and Manchester WMA. Finally, one pine snake nest was found at Peaslee WMA.
- Established mandatory guidelines for environmental consultant conducting radio-tracking studies of pine snakes in New Jersey. Among other things, these guidelines required consultants to collect detailed habitat data on pine snake locations. This data will be used to update existing pine snake models. Under the permit conditions, consultants are not required to submit this data to the Endangered and Nongame Species Program until January 2005; these data will be evaluated at that time.

Conclusions:

- The NJDEP's Landscape Project correctly identified the presence of pine snake habitat on the four WMAs surveyed during this study.
- Pine snake habitat data collected by consultants will help to refine existing pine snake models and will contribute to our understanding of the habitat requirements of this species.

Recommendations:

- Continue surveying for this species on state-owned lands.
- Refine existing pine snake models to increase their predictive power. Use these models to develop maps that identify important pine snake habitats and can be used to prioritize areas for protection or acquisition.

JOB 2: State-Listed Amphibians

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

JOB 2A: Eastern Tiger Salamander and Southern (Cope's) Gray Treefrog

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

Key Findings

- Conducted surveys of eggs, larvae, and adults tiger salamanders at historic and undocumented sites to establish presence/absence of this species. Most historic sites were found to still contain breeding populations of tiger salamanders. No evidence of tiger salamanders was found at one historic site in Cape May Court House, New Jersey. However, high water levels at this site during our surveys may have reduced our ability to detect salamanders and egg masses.
- The methodology of using standard minnow traps to survey tiger salamander larvae was tested in 2003 and found to be effective for determining the presence of this species in breeding ponds.
- Conducted roadside calling surveys for Southern Gray Treefrogs at 157 sites in Cape May, Atlantic, and Cumberland Counties. Of the 157 sites surveyed, no species of frogs or toads were heard calling from 43 of the sites. Southern Gray Treefrogs were documented at exactly 50% (57 sites) of the remaining survey sites.
- Radio-telemetry data collected from two sites in 2004, showed that Southern Gray Treefrogs can move outside of the protected regulatory upland buffer that is placed on their breeding pools, with some individuals moving over 300 m from these habitats.
- The use of PVC pipes was found to be an effective sampling methodology for Southern Gray Treefrogs, even outside the breeding season.

Conclusions:

- At many historic sites, tiger salamanders appear to be sustaining their populations despite the fact a large percentage of viable tiger salamander ponds occur on private lands in Cape May County, New Jersey.
- The use of minnow traps is an effective method for surveying for tiger salamanders.
- Southern gray treefrogs have a fairly widespread distribution in Cape May County, but have a much more limited distribution on the periphery of their range in Atlantic and Cumberland Counties.
- Existing 150-foot upland buffers that are currently placed breeding habitats of southern gray treefrogs may be inadequate to protect the upland habitat required by this species.

Recommendations:

- Continue to survey for new tiger salamander and southern gray treefrog breeding pools, while working to protect known locations.
- Work with New Jersey's Green Acres Program to purchase properties necessary to protect breeding pools and upland habitats for tiger salamanders and southern gray treefrogs.
- Develop a model for southern gray treefrogs and tiger salamanders that is capable of predicting breeding and critical upland habitats.

JOB 2B: Eastern Mud Salamander

OBJECTIVE: Conduct surveys to verify this species' presence (or absence) in New Jersey.

Key Findings

- Two of the three historic New Jersey locations were surveyed for this species in 2003. No mud salamanders were found during these surveys even though suitable habitat still exists at these sites.

Conclusions:

- Mud salamanders are likely extirpated from, or occur in extremely low numbers at, the two historic sites surveyed in 2003.

Recommendations:

- Conduct intensive surveys for mud salamanders at the third (unsurveyed) historic location for this species.
- Consider removing this species from the Endangered Species List if mud salamander surveys continue to produce negative results.

JOB 3: Special Concern and Priority Reptiles

OBJECTIVE: To conduct research on special concern reptiles that would enable the development of proactive conservation and management plans that secure or improve their status. These species include spotted turtles, eastern box turtles, northern diamondback terrapin, eastern kingsnake, northern copperhead, and the coastal plains milk snake intergrade.

JOB 3A: Queen Snake

OBJECTIVE: Conduct surveys of historic locations to verify this species' presence in New Jersey.

Key Findings:

- Suitable habitats within the historic New Jersey range for this species were surveyed using random searching techniques. No queen snakes were found during these surveys.
- Many of the stream systems and riparian zones within the queen snake's historic New Jersey range are heavily degraded and are no longer suitable for queen snakes.
- Suitable habitats and abundant food resources still exist along some streams on the periphery of this species historic range.

Conclusions:

- Much of the habitat for this species has been lost as a result of development and reductions in water quality.
- It is highly probable that the queen snake has been extirpated from New Jersey.

Recommendations:

- More intensive surveys for this species should be conducted along the periphery of its historic range, where high quality habitats still exist.
- Investigate the possibility of reintroducing this species back into New Jersey.

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

Key Findings:

- In 2003, Herp Atlas volunteers conducted general surveys throughout the state of New Jersey. Volunteers from this project submitted datasheets documenting sightings of over 55,000 reptiles and amphibians, and accounting for 60 different species. Data from 2004 has not yet been compiled.
- Six training sessions were held to educate volunteers and members of the general public on reptile and amphibian identification and conservation.
- In cooperation with USGS, 62 calling amphibian survey routes were established in New Jersey in 2003. Volunteers adopted and surveyed 51 of these routes in 2003 and resurveyed these routes again in 2004. This data was incorporated into a state database as well as into the national North American Amphibian Monitoring Program's database.

Conclusions:

- With the data submitted from our volunteers, ENSP has developed a better understanding of the distribution and abundance of reptile and amphibian species in New Jersey.
- Awareness and sensitivity about reptile and amphibian conservation has been elevated through this project.
- Over the past two years, baseline abundance data has been collected through the calling amphibian surveys conducted by our volunteers. This data will be valuable in identifying trends in populations of calling amphibians along these survey routes.

Recommendations:

- Continue to recruit and train volunteers to participate in the Herp Atlas Project and Calling Amphibian Monitoring Program.
- Focus Herp Atlas volunteers efforts in areas that have not been surveyed.
- Develop a volunteer ranking system that will help identify volunteers with particular expertise and those participating in this project for multiple years.

EXECUTIVE SUMMARY

Project:	Invertebrate Conservation
Federal Aid Project:	T-1-1 (State Wildlife Grants)
Segment dates:	April 1, 2003 to August 31, 2004
Total Project Expenditures:	\$126,666 (\$95,000 Federal, \$31,666 State)

JOB 1: Federal and State Listed Invertebrates

OBJECTIVE: To identify populations and develop strategies to aid in the recovery of listed freshwater mussel species found throughout New Jersey, including the dwarf wedgemussel, brook floater, green floater, yellow lamp mussel, eastern lamp mussel, eastern pond mussel, tidewater mucket, and triangle floater.

JOB 1A: Dwarf Wedgemussel

OBJECTIVE: To conduct searches for dwarf wedgemussels (*Alasmidonta heterodon*) in previously unsurveyed suitable habitats throughout the state and to create a geo-referenced database of extant sites. Also, to protect populations through development of site management plans and to work with the Division of Watershed Management to ensure appropriate stream classifications in dwarf wedgemussel areas.

Objectives:

- To conduct searches for Dwarf wedgemussels (*Alasmidonta heterodon*) in previously unsurveyed suitable habitats throughout the state and to create a geo-referenced database of extant sites. Also, to protect populations through development of site management plans and to work with the Division of Watershed Management to ensure appropriate stream classifications in Dwarf wedgemussel areas.

Key Findings:

- We surveyed 16 stream sites in six counties for Dwarf wedgemussels. Timed searches were conducted in historic locations and/or previously unsurveyed suitable habitats. No Dwarf wedgemussels were found during the survey period.
- We collected water quality and habitat information at each site surveyed. Water quality and habitat parameters measured included temperature, dissolved oxygen, pH, current speed and depth. In addition, we completed EPA Habitat Assessment Field Data Sheets for each survey site, which score individual habitat characteristics (e.g. vegetative protection, bank stability, riparian zone width) on a scale of 0-20. These scores are then added together to provide a total habitat score for a given stream segment.
- Average EPA Habitat Assessment Field Data Sheet scores ranged from 120.0 (Lamington River) to 169.5 (Little Flat Brook), out of a possible 200. Previous ENSP studies have shown that mussels prefer an optimum range of 103-169.5, occurring most frequently at an average score of 131. All sites surveyed scored within the preferred habitat range. An analysis is underway to determine the relationships between freshwater mussel abundance and specific habitat characteristics.
- Species richness was highest in the Stony Brook and Lamington River, with four freshwater mussel species present at each location. These areas have numerous patches of sandy substrate, along with an abundance of the host fish tessellated darter, and may be considered suitable to support Dwarf wedgemussels.
- Freshwater mussels were most abundant at the Pequest River tributary, with a catch per unit effort (CPUE) for all live mussels at 2.90/ minute.
- We documented occurrences of the State Endangered Brook floater at one site (Lamington River), State Threatened Triangle floater at four sites (Musconetcong River – 2 locations, Stony Brook and Pequest River tributary), the State Threatened Eastern pondmussel at one site (Stony Brook), and the

State Special Concern Creeper at two sites (Rockaway River and Stony Brook). All listed and SC species occurrences will be entered into the ENSP's Biotics database.

Conclusions:

- Record precipitation and flooding during the survey period prevented us from conducting searches in 20% of the target areas.
- Streams such as the Paulins Kill (where Dwarf wedgemussels occur) were subjected to extensive scouring over the past two seasons. It is possible that extant Dwarf wedgemussel populations may have sustained negative impacts due to sediment disruption.
- Discovery of Dwarf wedgemussels the Pequest River several years ago underscores the need for more surveys in New Jersey. It is possible that other populations occur in previously unsurveyed streams with suitable habitat and appropriate host fishes present.

Recommendations:

- Continue surveys for Dwarf wedgemussels in suitable, previously unsurveyed habitats to document distribution. Streams with slow to moderate currents, sandy substrate and an abundance of host fishes (e.g. tessellated darter) should continue to be the focus of survey work.
- Monitor extant Dwarf wedgemussels in the Paulins Kill and Pequest River to determine if recent scouring negatively impacted populations.
- Perform quantitative surveys in occupied stream segments to estimate population abundances and determine age classes.
- Develop site management plans for areas where Dwarf wedgemussels occur and request stream classification upgrades to protect water quality.

JOB 1B: Brook Floater

OBJECTIVE: To conduct searches for brook floaters (*Alasmidonta varicosa*) in previously unsurveyed suitable habitats throughout the state and create a geo-referenced database of extant sites. Also, to protect populations through development of site management plans and to work with the Division of Watershed Management to ensure appropriate stream classifications in brook floater areas.

Key Findings:

- We surveyed 16 stream sites in six counties for Brook floaters. Surveys were conducted in historic locations and/or previously unsurveyed suitable habitat. We documented one live Brook floater in the Lamington River.
- We collected water quality and habitat information at each site surveyed. Water quality and habitat parameters measured included temperature, dissolved oxygen, pH, current speed and depth. In addition, we completed EPA Habitat Assessment Field Data Sheets for each survey site, which score individual habitat characteristics (e.g. vegetative protection, bank stability, riparian zone width) on a scale of 0-20. These scores are then added together to provide a total habitat score for a given stream segment.
- Average EPA Habitat Assessment Field Data Sheet scores ranged from 120.0 (Lamington River) to 169.5 (Little Flat Brook), out of a possible 200. Previous ENSP studies have shown that mussels prefer an optimum range of 103-169.5, occurring most frequently at an average score of 131. All sites surveyed scored within the preferred habitat range. An analysis is underway to determine the relationships between freshwater mussel abundance and specific habitat characteristics.
- Species richness was highest in the Stony Brook and Lamington River, with four species at each location. The Stony Brook and Lamington River both provide suitable riffle habitat for Brook floaters.
- Freshwater mussels were most abundant at the Pequest River tributary, with a catch per unit effort (CPUE) for all live mussels at 2.90/ minute.
- We found other listed freshwater mussel species during the survey, including the State Threatened Triangle floater at four sites (Musconetcong River – 2 locations, Stony Brook and Pequest River tributary), the State Threatened Eastern pondmussel at one site (Stony Brook), and the State Special Concern Creeper at two sites (Rockaway River and Stony Brook). All listed and SC species occurrences will be entered into the ENSP's Biotics database.

Conclusions:

- Record precipitation and flooding during the survey period prevented us from conducting searches in 20% of the target areas.
- The Brook floater discovered in the Lamington River during the survey period occurred several miles upstream of a known population. Live Brook floaters may therefore occur in the stream segment between Burnt Mills and Rt. 523 in Bedminster Township.

Recommendations:

- Continue surveys for Brook floaters in suitable, previously unsurveyed habitats to document distribution. Streams with ample riffle habitat should continue to be the focus of survey work.
- Survey the stream segment between Lamington River occurrences for additional individuals.
- Perform quantitative surveys in occupied stream segments to estimate population abundances and determine age classes.
- Develop site management plans for areas where Brook floaters occur and request stream classification upgrades to protect water quality.

JOB 1C: Green Floater

OBJECTIVE: To conduct searches for green floaters (*Lasmigona subviridis*) in previously unsurveyed suitable habitats throughout the state and to create a geo-referenced database of extant sites. Also, protect populations through the development of site management plans and to work with the Division of Watershed Management to ensure appropriate stream classifications in green floater areas.

Key Findings:

- We surveyed 16 stream sites in six counties for Green floaters. Surveys were conducted in historic locations and/or previously unsurveyed suitable habitat. No Green floaters were found during the survey period.
- We collected water quality and habitat information at each site surveyed. Water quality and habitat parameters measured included temperature, dissolved oxygen, pH, current speed and depth. In addition, for each site we completed EPA Habitat Assessment Field Data Sheets for each survey site, which score individual habitat characteristics (e.g. vegetative protection, bank stability, riparian zone width) on a scale of 0-20. These scores are then added together to provide a total habitat score for a given stream segment.
- Average EPA Habitat Assessment Field Data Sheet scores ranged from 120.0 (Lamington River) to 169.5 (Little Flat Brook), out of a possible 200. Previous ENSP studies have shown that mussels prefer an optimum range of 103-169.5, occurring most frequently at an average score of 131. All sites surveyed scored within the preferred habitat range. An analysis is underway to determine the relationships between freshwater mussel abundance and specific habitat characteristics.
- Species richness was highest in the Stony Brook and Lamington River, with four species at each location. These areas have numerous patches of sandy substrate along with calm eddies and are suitable to support Green floaters.
- Freshwater mussels were most abundant at the Pequest River tributary, with a catch per unit effort (CPUE) for all live mussels at 2.90/ minute.
- We documented occurrences of the State Endangered Brook floaters at one site (Lamington River), State Threatened Triangle floater at four sites (Musconetcong River – 2 locations, Stony Brook and Pequest River tributary), the State Threatened Eastern pondmussel at one site (Stony Brook), and the State Special Concern Creeper at two sites (Rockaway River and Stony Brook). All listed and SC species occurrences will be entered into the ENSP's Biotics database.

Conclusions:

- Record precipitation and flooding during the survey period prevented us from conducting searches in 20% of the target areas.

- There is only one current occurrence for the this species in New Jersey. One live Green floater was reported from the Stony Brook, Mercer County in 1996. We have revisited this site numerous times, including once during the survey period, and were unable to relocate the individual.
- Although surveys to locate Green floater populations should continue, it is possible that the species is extirpated in New Jersey.

Recommendations:

- Continue surveys for Green floaters in suitable, previously unsurveyed habitats to document distribution. Streams with calm pools and eddies should continue to be the focus of survey work.
- If found, perform quantitative surveys in occupied stream segments to estimate population abundances and determine age classes.
- If found, develop site management plans for areas where Green floaters occur and request stream classification upgrades to protect water quality.

JOB 1D: Yellow Lampmussel

OBJECTIVE: To conduct searches for yellow lampmussels (*Lampsilis cariosa*) in previously unsurveyed suitable river habitats and to create a geo-referenced database of extant sites. Also, to protect populations through development of site management plans and work with landowners to ensure long-term protection of critical yellow lampmussel areas.

Key Findings:

- We surveyed ten river and stream sites in six counties for Yellow lampmussels. Surveys were conducted in historic locations and/or previously unsurveyed suitable habitats. No Yellow lampmussels were located during the survey period.
- We collected water quality and habitat information at each site surveyed. Water quality and habitat parameters measured included temperature, dissolved oxygen, pH, current speed and depth. In addition, we completed EPA Habitat Assessment Field Data Sheets for each survey site, which score individual habitat characteristics (e.g. vegetative protection, bank stability, riparian zone width) on a scale of 0-20. These scores are then added together to provide a total habitat score for a given stream segment.
- Average EPA Habitat Assessment Field Data Sheet scores ranged from 120.0 (Lamington River) to 167.0 (Musconetcong River), out of a possible 200. Previous ENSP studies have shown that mussels prefer an optimum range of 103-169.5, occurring most frequently at an average score of 131. All sites surveyed scored within the preferred habitat range. An analysis is underway to determine the relationships between freshwater mussel abundance and specific habitat characteristics.
- Species richness was highest in Salem Creek, with five freshwater mussel species present. Also, we documented live Lilliputs (*Toxolasma parvus*) at this location, a species that has never reported from New Jersey.
- Freshwater mussels were most abundant in the Rockaway River, with a catch per unit effort (CPUE) for all live mussels at 2.11/min.
- We documented occurrences of the State Endangered Brook floater at one site (Lamington River), the State Threatened Triangle floater at five sites (Musconetcong River – two locations, Salem Creek – two locations, and Lamington River) and the Creeper, State Special Concern species, at one site (Rockaway River). All listed and SC species occurrences will be entered into the ENSP’s Biotics database.

Conclusions:

- Record precipitation and flooding during the survey period prevented us from conducting searches in almost 40% of the target areas. Flooding in the Delaware River, the only known location for Yellow lampmussels, greatly hampered our ability to conduct searches in historic areas.

Recommendations:

- Continue surveys for Yellow lampmussels in suitable, previously unsurveyed habitats to document distribution. Use SCUBA for surveys in appropriate areas of the Delaware River.

- Perform quantitative surveys in occupied stream segments to estimate population abundances and determine age classes.
- Develop site management plans for areas where Yellow lampmussels occur and request stream classification upgrades to protect water quality.

JOB 1E: Eastern Lampmussel

OBJECTIVE: To conduct searches for eastern lampmussels (*Lampsilis radiata*) in previously unsurveyed suitable habitats and to create a geo-referenced database of extant sites. Also, to protect populations through development of site management plans and work with landowners to ensure long-term protection of critical eastern lampmussel areas.

Key Findings:

- We surveyed twelve stream and wadeable lake sites in six counties for Eastern lampmussels. Surveys were conducted in historic locations and/or previously unsurveyed suitable habitat. Eastern lampmussels (26 live, 104 shells) were documented in Lake Aeroflex, Sussex County.
- We collected water quality and habitat information at each site surveyed. Water quality and habitat parameters measured included temperature, dissolved oxygen, pH, current speed and depth. In addition, we completed EPA Habitat Assessment Field Data Sheets for each survey site, which score individual habitat characteristics (e.g. vegetative protection, bank stability, riparian zone width) on a scale of 0-20. These scores are then added together to provide a total habitat score for a given stream segment.
- Average EPA Habitat Assessment Field Data Sheet scores ranged from 120.0 (Lamington River) to 167.0 (Musconetcong River), out of a possible 200. Previous ENSP studies have shown that mussels prefer an optimum range of 103-169.5, occurring most frequently at an average score of 131. All sites surveyed scored within the preferred habitat range. An analysis is underway to determine the relationships between freshwater mussel abundance and specific habitat characteristics.
- Species richness was highest at Salem Creek, with five freshwater mussel species present. Freshwater mussels were most abundant in the Rockaway River, with a catch per unit effort (CPUE) for all live mussels at 2.10/ minute.
- Other rare species found during the survey period included the State Endangered Brook floater at one site (Lamington River), the State Threatened Triangle floater at five sites (Musconetcong River – two locations, Salem Creek – two locations, and the Lamington River), and the State Special Concern Species Creeper at one site (Rockaway River). All listed and SC species occurrences will be entered into the ENSP's Biotics database.

Conclusions:

- Record precipitation and flooding during the survey period prevented us from conducting searches in 20% of the target areas.
- Although Eastern lampmussels occur in several stream and river habitats within the state, they are also found in lakes and ponds. Surveying these areas adequately requires SCUBA divers. It is possible that Eastern lampmussels are more common than previously thought, since lake habitats have not been the focus of past survey efforts.

Recommendations:

- Continue surveys for Eastern lampmussels in suitable, previously unsurveyed habitats to document distribution. Use SCUBA in Lake Aeroflex and other occupied lake habitats to determine abundance.
- Perform quantitative surveys in occupied stream segments to estimate population abundances and determine age classes.
- Develop site management plans for areas where Eastern lampmussels occur and request stream classification upgrades to protect water quality.

JOB 1F: Eastern Pondmussel

OBJECTIVE: To conduct searches for eastern pondmussels (*Ligumia nasuta*) in previously unsurveyed suitable habitats and to create a geo-referenced database of extant sites. Also, to protect populations through development of site management plans and work with landowners to ensure long-term protection of critical eastern pondmussel areas.

Key Findings:

- We surveyed ten stream sites in three counties for Eastern pondmussels. Surveys were conducted in historic locations and/or previously unsurveyed suitable habitats. We located a live Eastern pondmussel in the Stony Brook, Mercer County, in the same area where a shell had been reported from 1994.
- We collected water quality and habitat information at each site surveyed. Water quality and habitat parameters measured included temperature, dissolved oxygen, pH, current speed and depth. In addition, we completed EPA Habitat Assessment Field Data Sheets for each survey site, which score individual habitat characteristics (e.g. vegetative protection, bank stability, riparian zone width) on a scale of 0-20. These scores are then added together to provide a total habitat score for a given stream segment.
- Average EPA Habitat Assessment Field Data Sheet scores ranged from 112.0 (Chestnut Branch) to 150.7 (Mantua Creek), out of a possible 200. Previous ENSP studies have shown that mussels prefer an optimum range of 103-169.5, occurring most frequently at an average score of 131. All sites surveyed scored within the preferred habitat range. An analysis is underway to determine the relationships between freshwater mussel abundance and specific habitat characteristics.
- Species richness was highest at Mantua Creek, with five freshwater mussel species present. Mantua Creek is a Delaware River tributary with abundance of sandy substrate suitable for Eastern pondmussel occurrences. In addition, freshwater mussel abundance was highest at Mantua Creek, with a catch per unit effort for all live mussels at 3.24/min.
- Other listed species documented during the survey period included the State Threatened Triangle floater at four sites (Mantua Creek, Stony Brook and Salem Creek – two locations). We also documented live Lilliputs (*Toxolasma parvus*), a species that has never reported from New Jersey, in Salem Creek. All listed and SC species occurrences will be entered into the ENSP's Biotics database.

Conclusions:

- Record precipitation and flooding during the survey period prevented us from conducting searches in 25% of the target areas. Flooding in the Delaware River and its tributaries greatly hampered our ability to conduct searches in historic areas.
- Although Eastern pondmussels occur in small-to-mid size streams such as the Stony Brook and Raccoon Creek, there are many locations documented in the Delaware River. SCUBA divers may be necessary to adequately survey for the species.

Recommendations:

- Continue surveys for Eastern pondmussels in suitable, previously unsurveyed habitats to document distribution. Use SCUBA divers in appropriate areas of the Delaware River.
- Perform quantitative surveys in occupied stream segments to estimate population abundances and determine age classes.
- Develop site management plans for areas where Eastern pondmussels occur and request stream classification upgrades to protect water quality.

JOB 1G: Tidewater Mucket

OBJECTIVE: To conduct searches for tidewater muckets (*Leptodea ochracea*) in previously unsurveyed suitable habitats and to create a geo-referenced database of extant sites. Also, to protect populations through development of site management plans and work with landowners to ensure long-term protection of critical tidewater mucket areas.

Key Findings:

- We surveyed six stream sites in three counties for Tidewater mucklets. Surveys were conducted in historic locations and/or previously unsurveyed suitable habitats. No Tidewater mucklets were found during the survey period.
- We collected water quality and habitat information at each site surveyed. Water quality and habitat parameters measured included temperature, dissolved oxygen, pH, current speed and depth. In addition, we completed EPA Habitat Assessment Field Data Sheets for each survey site, which score individual habitat characteristics (e.g. vegetative protection, bank stability, riparian zone width) on a scale of 0-20. These scores are then added together to provide a total habitat score for a given stream segment.
- Average EPA Habitat Assessment Field Data Sheet scores ranged from 112.0 (Chestnut Branch) to 150.7 (Mantua Creek), out of a possible 200. Previous ENSP studies have shown that mussels prefer an optimum range of 103-169.5, occurring most frequently at an average score of 131. All sites surveyed scored within the preferred habitat range. An analysis is underway to determine the relationships between freshwater mussel abundance and specific habitat characteristics.
- Species richness was highest in Mantua and Salem creeks, with five freshwater mussel species present. These creeks are Delaware River tributaries and have suitable substrate for Tidewater Mucket occurrences. In addition, freshwater mussel abundance was highest at Mantua Creek, with a catch per unit effort for all live mussels at 3.24/min.
- We documented occurrences of the State Threatened Triangle floater at three sites (Mantua Creek and Salem Creek – two locations). In addition, we found Creepers, a State Special Concern species, at one site (Mantua Creek). We also documented live Lilliputs (*Toxolasma parvus*), a species that has never reported from New Jersey, in Salem Creek. All listed and SC species occurrences will be entered into the ENSP's Biotics database.

Conclusions:

- Record precipitation and flooding during the survey period prevented us from conducting searches in almost 50% of the target areas. Flooding in the Delaware River and its tributaries greatly hampered our ability to conduct searches in historic areas.
- Recent sightings of the Tidewater Mucket are limited to the Delaware River and tributaries. It is often confused with the Yellow lampmussel and may have been misidentified in the past. SCUBA divers are needed to conduct surveys in deeper sections of the Delaware River.

Recommendations:

- Continue surveys for Tidewater mucklets in suitable, previously unsurveyed habitats to document distribution.
- Perform quantitative surveys in occupied stream segments to estimate population abundances and determine age classes.
- Develop site management plans for areas where Tidewater mucklets occur and request stream classification upgrades to protect water quality.

JOB 1H: Triangle Floater

OBJECTIVE: To conduct searches for triangle floaters (*Alasmidonta undulata*) in previously unsurveyed suitable habitats and to create a geo-referenced database of extant sites. Also, to protect populations through development of site management plans and work with landowners to ensure long-term protection of critical triangle floater areas.

Key Findings:

- We surveyed 24 sites in ten counties for Triangle floaters. Surveys were conducted in historic locations and/or previously unsurveyed suitable habitats. We documented occurrences of Triangle floaters at ten sites (Mantua Creek, Musconetcong River – two locations, Barton Run, Stony Brook – two locations, Salem Creek – two locations, Lamington River, and a Pequest River tributary).
- We collected water quality and habitat information at each site surveyed. Water quality and habitat parameters measured included temperature, dissolved oxygen, pH, current speed and depth. In addition, we completed EPA Habitat Assessment Field Data Sheets for each site, which score individual habitat characteristics (e.g. vegetative protection, bank stability, riparian zone width) on a

scale of 0-20. These scores are then added together to provide a total habitat score for a given stream segment.

- Average EPA Habitat Assessment Field Data Sheet scores ranged from 112.0 (Chestnut Branch) to 169.5 (Little Flat Brook), out of a possible 200. Previous ENSP studies have shown that mussels prefer an optimum range of 103-169.5, occurring most frequently at an average score of 131. All sites surveyed scored within the preferred habitat range. An analysis is underway to determine the relationships between freshwater mussel abundance and specific habitat characteristics.
- Species richness was highest in Salem and Mantua creeks, with five freshwater mussel species present. These creeks have suitable sandy/cobble substrate and are able to support Triangle floater populations.
- Freshwater mussel abundance was highest at Barton Run, with a catch per unit effort for all live mussels at 3.76/min.
- Other rare species documented during the survey period included the State Endangered Brook floater, the State Threatened Eastern pondmussel and the State Special Concern species Creeper. All listed and SC species occurrences will be entered into the ENSP's Biotics database.

Conclusions:

- Triangle floaters were present at ten out of 24 sites that were surveyed. Although widely distributed, they are not abundant in many areas where they occur. A status change to Special Concern may be warranted in the future as more populations are discovered.

Recommendations:

- Continue surveys for Triangle floaters in suitable, previously unsurveyed habitats to document distribution. Since Triangle floaters are generalists, most stream habitats with good water quality should be the focus of survey work.
- Perform quantitative surveys in occupied stream segments to estimate population abundances and determine age classes.
- Develop site management plans for high quality areas where Triangle floaters occur and request stream classification upgrades to protect water quality.
- Continue surveys in Salem Creek to determine distribution of Lilliput population to assess status.

JOB 2: Federal and State-Listed Lepidoptera

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

JOB 2A: Arogos Skipper

OBJECTIVE: Survey suitable habitats for this species. Priority will be given to those sites with suitable habitat that are adjacent to known locations of this species. Once occupied sites are documented, effort will be spent on actively managing these areas to maintain suitable habitats.

Key Findings

- Surveys over the past two years have documented five extant colonies of arogos skippers in the Pinelands landscape region. Two of these colonies were not documented prior to this study, while the other three were historically known.
- Arogos skipper densities were lower at the three historic sites during 2003 and 2004 than during a survey conducted in 1999.

Conclusions:

- Viable metapopulations of arogos skippers do appear to exist in the Pinelands, but population numbers are at critically low numbers and proper management is crucial to their long-term persistence.

Recommendations:

- Continue to monitor known colonies of arogos skippers in the Pinelands.
- Develop a management plan for maintaining the Pine Barrens reedgrass communities needed to support known colonies of arogos skippers. Specifically, woody growth in the habitat of the Penn State Forest colony should be removed, either manually or with the use of fire.
- Surveys for new colonies of this species should be continued.

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:

- Surveys suggest that this species is extirpated from many of its known locations in Southern New Jersey.
- New populations of wild indigo (the larval host plant for frosted elfin) were identified in Southern New Jersey. These populations have never been surveyed for frosted elfins, but may hold undocumented occurrences of this species.

Conclusions:

- Many frosted elfin habitats, even some that occur on state lands, are being improperly managed.
- Because they are often small and isolated, frosted elfin populations in southern New Jersey are extremely vulnerable and easily extirpated if mismanaged.

Recommendations:

- In spring 2005, surveys for Frosted Elfin should be conducted in all areas identified as “Frosted Elfin Habitat”.
- On Wildlife Management Areas, no land management activities should take place in the areas of “Frosted Elfin Habitat” until a detailed management plan for this species is developed by ENSP and the Bureau of Land Management. Furthermore, other hard-impact recreational activities (e.g. enduro races) should no longer be permitted in these areas.
- The Division of Parks and Forestry should be notified about the presence of Frosted Elfin habitat on the utility-line right-of-way in Belleplain State Forest and invited to help generate a management plan for this habitat.
- Where appropriate, the Green Acres Program should attempt to acquire private lands where existing Frosted Elfin habitat is present. On private lands where Green Acre acquisitions are not possible, the Division should work with the land owners to ensure proper management of the habitat.
- Because white-tailed deer can decimate the host plant of the Frosted Elfin, deer harvest limits should be increased in the Deer Management Zones where Frosted Elfin habitat is present. These zones would include DMZ 15, 26, 30, 31, 34, 42, 43, and 45.

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

- Research for this taxon during 2003-2004 largely consisted of conducting preliminary surveys in sites throughout New Jersey. Surveys documented a total of 61 species during the 2004 field season.

Banner Clubtail, a state Threatened (pending) species, was found at one site (Nescochague Creek) and Scarlet Bluet, a Special Concern (pending) species, was also found at one site (W. Br. Wading River). Several priority species tracked by the NJ Natural Heritage Program including but not limited to Arrow Clubtail (2 sites), Mocha Emerald (1 site), American Rubyspot (2 sites) and Sparkling Jewelwing (5 sites) were also found during our surveys.

- In general, the highest odonata diversity was found at sites with the widest variety of microhabitats available. For example, Four Mile Branch, with a total of 19 species present, had the highest species richness and also had many different microhabitat types, including riffles, runs, and well vegetated pools.

Conclusions:

- New Jersey has a rich diversity of odonata.
- Survey sites with the greatest species richness for this group also had the widest variety of microhabitats available.

Recommendations:

- Continue to survey for odonata in sites throughout New Jersey in order to get a better understanding of the general distribution of this group.

EXECUTIVE SUMMARY

Project:	Species Status Review
Federal Aid Project:	T-1-1 (State Wildlife Grants)
Segment dates:	April 1, 2003 to August 31, 2004
Total Project Expenditures:	\$13,333 (\$10,000 Federal, \$3,333 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:

- **FISH:** Nongame fish had not previously been reviewed to determine their status in the state. Division staff selected 55 fish species to be reviewed using the Delphi method. These species included all nongame freshwater species and anadromous species such as shortnose sturgeon and Atlantic sturgeon. Staff selected 14 experts to participate in the review of fish species status. These included representatives from the Division fisheries bureaus, state colleges and universities, DEP's Bureau of Freshwater and Biological Monitoring, NJ Pinelands Commission, Academy of Natural Sciences Philadelphia, US Environmental Protection Agency, DE Division of Fish and Wildlife, and ichthyology consultants. Round 1 was sent via e-mail to all panelists on 17 April 2003 and was completed by 1 August 2003. Round 2 was sent out 12 August 2003 and completed in January. Round 3 was sent out 4 March 2004 and was completed on 16 August 2004. Process will continue to Round 4 after the project period. At the end of the period, consensus on status had been reached on 38 out of 59 species.
- **BIRDS:** Two hundred fifty-four bird species had been reviewed for status in the early 1990s in a thorough approach to that taxon. In July 2004, 95 bird species were selected for review of breeding and non-breeding season status. Staff invited 21 experts to participate in the Delphi process of review, including representatives from the NJ Division of Fish and Wildlife, state colleges and universities, NJ Audubon, NJ Conservation Foundation, ornithology consultants, and unaffiliated experts. All but one of those invited agreed to participate. Unpublished data on species locations and population trends were compiled for the first round. The survey/review form was designed. Materials for the first round will be sent out in the next segment.

Conclusions:

- The Delphi technique is the most objective approach available for determining species status, and should continue to be the method used by the Division.

Recommendations:

- Continue the process of species status review by 1) completing the nongame fish species review, 2) completing the bird status review, and 3) initiating a review of nongame mammal species.
- Compile the results of the Delphi process of review and present them to the Endangered and Nongame Species Advisory Committee for recommendations on new status assignments.
- Proceed with new status assignments through the regulatory process.

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