Species Results

Each taxonomic group has been reviewed by external experts coordinated by the taxonomic group team leader.

MAMMALS

Team Leaders: Bob Allen and Mariana Upmeyer (New Jersey)

Reviewer: John Litvaitis (UNH)

Portfolio results for Mammals: Two mammal species, the Delmarva fox squirrel (Sciurus niger cinereus) and New England cottontail (Sylvilagus transitionalis), were identified as a primary targets (Table 2). One species was identified as a secondary target. Although the fox squirrel is ranked as G5, this subspecies is ranked T3 and is listed as Federally Endangered. There are thought to be about 21 to 80 element occurrences within Virginia and Maryland. There is currently only one population within NAC. This population was reintroduced into Sussex County, Delaware and is considered a "nonessential experimental population" (NatureServe). Thus, the Delmarva fox squirrel's ranking within the North Atlantic Coast ecoregion is XN. We developed no screening criteria and set no goals for this species.

Although the New England cottontail is found at several locations within NAC in Maine, we currently don't have occurrence data that will allow us to develop screening criteria or set goals.

Table 2: Mammal primary target species within the North Atlantic Coast Ecoregion.

Status	Scientific Name	Common Name	GRank	Comments
Peripheral	*Sciurus niger cinereus*	Delmarva Fox Squirrel	G5/T3	Nonessential experimental population in NAC
Peripheral	*Sylvilagus transitionalis*	New England Cottontail	G4	Declining due to loss of early successional habitat and competition with Eastern Cottontail

HERPTILES

Team Leader: Mark Carabetta (Connecticut)

Reviewers: Dawn McKay and Karen Zyko (CT NDDB); Karen Lombard and Alison Bowden (MA TNC); Lloyd Gamble and Paul R. Sievert (UMASS); Bob Allen, Mike Dunphy and Mariana Upmeyer (NJ TNC); Dave Golden (NJ Fish & Wildlife); Nancy Sferra (ME TNC) and Phillip deMaynadier (ME Inland Fisheries & Wildlife); Doug Bechtel (NH TNC); John Kanter, Mike Marchand and Jim Oehler (NH Fish & Game); Pam Hunt (NH Audubon); Julie Lundgren (RI TNC); Marilyn Jordan (NY TNC); Paul Novak (NY Heritage); Susi VonOettingen (USFWS); and the CT DEP Scientific Advisory Committee.

Portfolio Results for Reptiles and Amphibians: A total of three reptile species were selected as primary targets (Table 3). The bog turtle (*Glyptemys muhlenbergii*) is ranked as G3, is declining, and is listed as Federally Threatened. The Blanding's turtle (*Emys blandingii*) is

ranked G4 and is declining. The timber rattlesnake (*Crotalus horridus*) is ranked G4, but has been extirpated from much of the ecoregion. Where it is still found, populations are declining.

Seventeen reptile and amphibian (collectively referred to as herptile) species were selected as secondary targets. For each secondary species, a habitat description was developed, which can be linked to the ecosystem targets in this plan.

Table 3: Herptile primary target species within the North Atlantic Coast Ecoregion.

Status	Scientific Name	Common Name	GRank	Comments
Peripheral	*Glyptemys muhlenbergii*	Bog Turtle	G3	Declining
Peripheral	*Emys blandingii*	Blanding's Turtle	G4	Declining
Peripheral	*Crotalus horridus*	Timber Rattlesnake	G4	Extirpated in much of ecoregion and declining in remainder

Viability Screening

Viability screening was done for primary herptile species only. Initial viability scores of **Y** (viable), **M** (maybe viable), **N** (not viable), and **?** (additional data required) were assigned based on information from Heritage Programs BCD/Biotic databases, interviews with heritage staff and other experts, and landscape context scores generated by TNC. The following criteria were used:

Y = Yes: Element occurrences met the criteria of "viable" by having EO ranks of A or B, as well as multiple (>10) individuals in a population combined with a decent (<50) landscape context score. If an EO is clearly viable based on the number of individuals, less consideration was given to the landscape context score. Likewise, EOs of less than 10 individuals would be considered viable if the landscape context score was very good. Expert input was sometimes used as justification for overriding the viability information in the database.

M = Maybe: Assigned to EOs that had a rounded EO rank of A or B and was right on the threshold of 10 individuals and landscape context score of 50, or had other uncertain information that required review by experts to decide whether the population was viable.

N = No: Did not meet the threshold of 10 individuals or landscape context score of 50. Usually had an EO rank of C, D, E, etc., was noted as Historic or Extirpated in the Heritage information, or landscape context score was >50. Expert input was sometimes used as justification for overriding the viability information in the database.

? = Additional data required: due to an absence of Heritage information, lack of expert input, and/or lack of a landscape context score, no viability score was assigned to this occurrence.

Setting Goals and Results

The bog turtle has a discontinuous, spotty distribution. Its distribution category in the NAC ecoregion is "peripheral or disjunct" because it is more commonly found in the LNE ecoregion.

The distribution of the Blanding's turtle is centered in the Great Lakes region and its distribution category in the NAC ecoregion is "peripheral or disjunct." Because of the designation of both the bog turtle and the Blanding's turtle as "peripheral or disjunct" in the NAC ecoregion, a numeric conservation goal of five occurrences is set for both of these species (Table 4).

For the bog turtle, a total of four viable populations were identified in NAC within two NAC subregions. This total is one short of the numeric goal for this species. It is recommended that more inventory be conducted to locate additional occurrences of viable bog turtle populations. Based on a review of the distribution of all (viable and non-viable) bog turtle occurrences in the records, it was determined that the four viable occurrences meet the distribution goal for this species (Table 4).

For the Blanding's turtle, 15 viable populations were identified in NAC, which surpasses the numeric goal for this species. These 15 viable populations occur within two NAC subregions. Based on a review of the distribution of all Blanding's turtle occurrences, it was determined that the 15 viable occurrences meet the distribution goal for this species (Table 4).

Occurrence data for timber rattlesnake is confidential in most states and was not available for NAC planning purposes. For that reason, no screening criteria or goals were set for this species.

Table 4: Numeric and distribution goals (with percentages) for Blanding's turtle and bog turtle in the NAC Ecoregion. In the first column, the number in parentheses reflects how many viable populations for each species are required to meet the numeric goal. To meet the distribution goal, there must be at least one viable population of each target species in each sub-region where it occurs. Because goals were not set for timber rattlesnake, they are excluded from this table.

Target Distribution in Ecoregion (#)	# of Primary Targets	# of Primary Targets that met numeric Goals (%)	# of Primary Targets that met Distribution Goals (%)
Widespread (5)	0	NA	NA
Limited (10)	0	NA	NA
Restricted (20)	0	NA	NA
Peripheral/Disjunct (5)	2	1 (50)	2 (100)
Total (5)	2	1 (50)	2 (100)

BIRDS

Team Leaders: Bob Allen (New Jersey), Nancy Sferra (Maine)

Reviewers: Nancy Sferra (ME TNC), Lindsay Tudor, Brad Allen, and Tom Hodgman (ME Inland Fisheries and Wildlife), Peter Vickery (Center for Ecol. Res.), Doug Bechtel (NH TNC), Karen Lombard (MA TNC), Tom Maloney (MA TNC), Julie Lungren (RI TNC), Mark Carabetta (CT TNC), Dawn McKay (CT NDDB), Paul Buckley (URI), Marilyn Jordan (NY TNC), Joe Jannsen (NY TNC), Tara Seoane (NY Natural Heritage), Paul Novak (NY Natural Heritage), Mike Scheibel (NY TNC), and Mike Bisignano (NJ TNC).

Portfolio Results For Birds: A total of eight bird species were selected as primary targets (Table 5). Migratory Red Knot (Calidris canutus) is ranked as G5 but is declining rapidly in eastern North America. Piping Plover (Charadrius melodus), ranked G3, is stable or declining depending on location and is Federally Threatened. Least Tern (Sterna albifrons) is ranked G4

and has declined in the eastern United States. Harlequin Duck (Histrionicus histrionicus) is ranked G4; the Atlantic wintering population has declined from about 10,000 individuals to about 1,500, and the species is listed as endangered in Canada (this species should be evaluated in conjunction with efforts in the adjacent Northern Appalachian/Acadian ecoregion). Upland Sandpiper (Bartramia longicauda) is ranked G5, has declined across its range, and has declined dramatically over the past fifty years in the northeastern United States. Roseate Tern (Sterna dougallii) is ranked G4, is stable or declining depending on location, and is listed Federally Endangered. Black Rail (Laterallus jamaicensis) is ranked G4 and is generally thought to be declining, though trend data is lacking. We considered Saltmarsh Sharp-tailed Sparrow (Ammodramus caudacutus) a primary species only north of Boston, where the sparrows are uncommon. We considered Saltmarsh Sharp-tailed Sparrow south of Boston a secondary species because they are common to abundant in their preferred salt marsh habitat. The Saltmarsh Sharp-tailed Sparrow is ranked G4 and is thought to be stable or declining depending on location (though trend data is generally lacking).

A total of 25 bird species were selected as secondary targets. Habitat types mapped as part of this plan were identified for each species.

Table 5: Bird primary target species within the North Atlantic Coast Ecoregion.

Status	**Scientific Name**	**Common Name**	**GRank**	**Comments**
Peripheral	*Calidris canutus*	Red Knot	G5	Migratory population dependent on horseshoe crab eggs
Widespread	*Charadrius melodus*	Piping Plover	G3	Declining due to disturbance of nests, loss of habitat; Federally Threatened
Limited	*Sterna albifrons*	Least Tern	G4	Declining due to predation and disturbance
Limited	*Sterna dougallii*	Roseate Tern	G4	Declining due to habitat loss, competition with gulls; Federally Endangered
Peripheral	*Histrionicus histrionicus*	Harlequin Duck	G4	Wintering population mostly off the coast of Maine
Widespread	*Bartramia longicauda*	Upland Sandpiper	G5	Declining due to loss of nesting habitat
Widespread	*Laterallus jamaicensis*	Black Rail	G4	Declining due to loss of habitat and hydrologic alterations
Limited	*Ammodramus caudacutus*	Saltmarsh Sharp-tailed Sparrow	G4	Populations north of Boston only

Viability Screening

Viability screening was done for primary bird species only. In one case (Black Rail), insufficient information was available to screen occurrences. Initial viability scores of Y (viable), M (may be viable), and N (not viable) were assigned based on information from Heritage programs, state agencies, federal agencies, bird conservation partnerships, nonprofit organizations, and interviews with heritage staff and other experts. The following criteria were used:

Screening Criteria for Piping Plovers

1. **Y** = Yes: Piping Plover pairs were greater than 4 during the most recent year for which we have data OR were greater than 4 at any point during the past 5 years and the population continues to be more than 3 pairs.
2. **M** = Maybe: 3-4 Piping Plover pairs OR were greater than 2 pairs at any point during the past 5 years and the population continues to persist.
3. **N** = No: 2 or fewer pairs in all recorded years.

Screening Criteria for Red Knots

1. **Y** = Yes: Beaches where more than 500 Red Knots have been recorded in one day, Red Knot use has been consistent over the past 10 years, beach is relatively protected from human disturbance.
2. **M** = Maybe: Beaches where more than 500 Red Knots have been recorded in one day, Red Knot use has been inconsistent over the past 10 years, beach may be impacted by human disturbance.
3. **N** = No: Beaches where fewer than 500 Red Knots have been recorded in one day, Red Knot use has been very inconsistent over the past 10 years, beach is heavily impacted by human disturbance.

Screening Criteria for Upland Sandpiper

1. **Y** = Yes: Observation of five or more breeding pairs with occupied nests in appropriate habitat in most years.
2. **M** = Maybe: Observation of one or more breeding pairs with occupied nests in appropriate habitat in more than one year.
3. **N** = No: Observation of one or more breeding pairs with unconfirmed nests in appropriate habitat in one year.

Screening Criteria for Roseate Tern

1. **Y** = Yes: Colonies of greater than 100 pairs.
2. **M** = Maybe: More than 10 pairs and reports are dated (earlier than 1960). Most should not be included because they are no longer viable sites, but this needs to be confirmed.
3. **N** = No: Colonies of fewer than 10 pairs.

Screening Criteria for Least Tern

1. **Y** = Yes: Observation of 50 or more breeding pairs with occupied nests in appropriate habitat in most years.
2. **M** = Maybe: Observation of 15-49 breeding pairs with occupied nests in appropriate habitat in more than one year.
3. **N** = No: Observation of fewer than 15 breeding pairs with unconfirmed nests in appropriate habitat in one year.

Screening Criteria for Harlequin Duck

1. **Y** = Yes: 100+ birds using an area > 1 month yearly
2. **M** = Maybe: 25+ birds using an area > 1 week in most years
3. **N** = No: Fewer than 25 birds using an area > 1 week in most years

Screening Criteria for Saltmarsh Sharp-tailed Sparrow and Black Rail

Saltmarsh Sharp-tailed Sparrows breed in coastal salt marshes and dense, wet meadows throughout the North Atlantic Coast ecoregion. No states currently track these sparrows as element occurrences. Although researchers have conducted several studies on this species, there has been no range-wide survey to determine breeding locations or population size. Such a survey (for Seaside Sparrow as well) has been identified by both the BCR 30 partners and the Mid-Atlantic Partners in Flight plan as a major need and should be considered a high priority project for TNC as well. Currently, within NAC, Saltmarsh Sharp-tailed Sparrows are known to breed from the Delaware Bay to coastal Maine as far north as South Thomaston. The sparrows are common to abundant from Delaware to southern Massachusetts, but become less common north of Boston. We only recorded known locations north of Boston.

Black Rails nest in tidal marshes and freshwater wetlands. The Birds of North America account (Eddleman et al. 1994) shows a range map that includes Delaware and New Jersey as breeding sites and local breeding sites as far north as southern Massachusetts. There are 7 EOs in the spreadsheet - six from Connecticut and one record from New York that shows one calling male that has been present in June over the past 20 years. Other sources report Black Rails in southern New Jersey along the Delaware Bay. However, there are no population estimates and no defensible method for creating a screening criterion for Black Rails. To address this information deficiency, a survey similar to that of the Saltmarsh Sharp-tailed Sparrow should be conducted to determine breeding areas and numbers.

Setting Goals and Results

Goals are summarized in Table 6.

Piping Plover has a widespread distribution. A numeric goal of five viable occurrences is set for the Piping Plover in the NAC ecoregion. Piping Plover meet the numeric and distribution goals of this plan. Well-known breeding areas for Piping Plover are found along the beaches of Long Island, New York and Cape Cod, Massachusetts.

Least Tern has a widespread distribution. A numeric goal of five viable occurrences is set for the Least Tern in the NAC ecoregion. This species meets the numeric and distribution goals of this plan. Similar in distribution to Piping Plovers, well-known breeding areas for Least Tern are found along the beaches of Long Island, New York and Cape Cod, Massachusetts.

Upland Sandpiper has a widespread distribution. A numeric goal of five viable occurrences is set for the Upland Sandpiper in the NAC ecoregion. This species meets the numeric and distribution goals of this plan. Most viable occurrences of Upland Sandpiper in NAC occur on airports or military installations in Massachusetts.

Roseate Tern has a limited distribution. A numeric goal of ten viable occurrences is set for the Roseate Tern in the NAC ecoregion. This species meets numeric and distribution goals of this plan. The largest breeding colonies are on small islands off the coast off Massachusetts and Long Island, New York.

Red Knots are only present as a migrating species in the NAC ecoregion. Up to 80% of the population of subspecies *rufa* utilizes the beaches of the Delaware Bay as a critical stopover habitat during migration every spring. Changes in the number of horseshoe crab eggs available

on these beaches are likely to be the primary cause of the Red Knot's rapid decline. The typical distribution categories for ecoregional targets do not apply well to migrating species. In this case, the stopover site provided at the Delaware Bay is of critical importance to the persistence of *rufa* and all identified stopover beaches within the Delaware Bay need to be protected. In addition, there is a need to reduce disturbance to foraging birds and to increase the number of horseshoe crab eggs available for knot foraging.

Harlequin Duck is a wintering species in the North Atlantic Coast ecoregion. About half of the eastern population of Harlequin Ducks winters along the coast of Maine, especially in Penobscot and Jericho Bays and along the coast of York County. Although the numeric and distribution goals are generally applied to breeding populations, it seems reasonable in this case to apply the same rules to a wintering species. A numeric conservation of five viable occurrences is set for the Harlequin Duck in the NAC ecoregion. Harlequin Duck meet the numeric and distribution goals of this plan.

Black Rail has a widespread distribution. A numeric conservation of five viable occurrences is set for the Black Rail in the NAC ecoregion. It is unknown whether Black Rail meets this criteria.

Saltmarsh Sharp-tailed Sparrow has a limited distribution, occurring only in NAC and south to Virginia. Based on the sparrow's distribution, we would typically set a numeric conservation of ten viable occurrences for the NAC ecoregion. However, since we are considering the sparrow a primary species only north of Boston, it is likely more fitting to set a goal of five viable occurrences. Saltmarsh Sharp-tailed Sparrow probably meet this criteria, but detailed population estimates in salt marshes in northern Massachusetts, New Hampshire, and Maine are not available except at a few well-documented sites.

Table 6: Numeric and distribution goals (with percentages) for bird target groups in NAC Ecoregion. In the first column, the number in parentheses reflects how many viable populations for a given species are required to meet the numeric goal. For example, a restricted species needs at least 20 viable populations in NAC to meet the numeric goal. To meet the distribution goal, there must be at least one viable population of a target species in each sub-region where it occurs.

Bird Primary Target Distribution in Ecoregion (#)	**# of Primary Targets**	**# of Primary Targets that met numeric Goals (%)**	**# of Primary Targets that met Distribution Goals (%)**
Widespread (5)	4	4 (100)	4 (100)
Limited (10)	2	2 (100)	2 (100)
Restricted (20)	0	(N/A)	(N/A)
Peripheral/Disjunct (5)	2	2 (100)	2 (100)
Total	8	8 (100)	8 (100)

TERRESTRIAL INVERTEBRATES

Team leader: Karen Lombard (Massachusetts)

Reviewers: Dale Schweitzer (NatureServe), Paul Novak (NY Natural Heritage), Tim Simmons (MA Heritage), Mike Nelson (MA Heritage), Philip DeMaynadier (ME Inland Fisheries & Wildlife), Marilyn Jordan (NY TNC), Nancy Sferra (ME TNC), Jeff Lougee (NH TNC) and Mark Carabetta (CT TNC).

Portfolio Results for Terrestrial Invertebrates: The initial list of targets was created from combining the portfolio terrestrial invertebrate targets from earlier versions of the Lower New England and North Atlantic Coast Ecoregions plans. This list was then sent to state experts for review. The final list included 28 primary targets and 36 secondary targets for NAC (Table 7). In general, taxonomy confirmations followed NatureServe except in cases where local experts confirmed uncertainties in classification.

Table 7: Numbers of terrestrial Invertebrate targets by species group, and type.

	North Atlantic Coast	
Species Group	**Primary**	**Secondary**
Lepidoptera	23	35
Tiger Beetles	4	1
Burying Beetle	1	-
Totals	28	36

Primary target species (Table 8) occurrences were the focus of the viability screening. Information sources included Heritage occurrence records and expert review. In most cases the data in the occurrence records was sparse, with virtually no information on habitat extent or quality, natural process condition such as fire, or threats such as deer or *Compsilura concinnata*, a parasitic fly introduced as a biocontrol agent on Lepidoptera. We relied heavily on expert review of the occurrences to make the final decision. Eleven species had no occurrences and only six species had more than ten occurrences when Heritage data from all NAC states were combined.

Table 8: Terrestrial primary target species within the North Atlantic Coast Ecoregion.

Status	Scientific Name	Common Name	GRank	Comments
Restricted	*Agrotis buchholtzi*	Buchholz's Dart Moth	G2	NJ pine barrens endemic
Widespread	*Apodrepanulatrix liberia*	A geometer moth	G4	Only in NH in NAC, extirpated or never occurred in other states
Widespread	*Atrytone arogos arogos*	Arogos Skipper	G3G4T1	All but one viable population in NAC
Widespread	*Boloria selene myrina*	Myrina Fritillary	G5T5	Severe decline rangewide
Widespread	*Callophrys irus*	Frosted Elfin	G3	Severe global decline due to deer
Restricted	*Catocala pretiosa pretiosa*	Precious Underwing	G4T2T3	Extirpated in 95% of range
Limited	*Cincindela dorsalis dorsalis*	Northeastern Beach Tiger Beetle	G4T2	Extant only in MA and Chesapeake
Peripheral	*Cincindela lepida*	Little White Tiger Beetle	G4	Declining; perhaps only secure in NJ
Restricted	*Cincindela patruela consentanea*	A Tiger Beetle	G3T2	NAC endemic to NJ pine barrens
Widespread	*Cincindela patruela patruela*	A Tiger Beetle	G3T3	Imperiled in most states
Restricted	*Crambus daeckellus*	Daecke's Pyralid Moth	G1G3	Globally imperiled, restricted to NJ
Limited	*Cyclophora sp. 1*	A Geometrid Moth	G3G4	Limited range in NAC & globally, only in NJ in NAC
Widespread	*Erynnis persius persius*	Persius Dusky Wing	G5T2T3	Globally imperiled and in severe decline
Restricted	*Hemileuca nevadensis subsp.*	Schweitzer's Buckmoth	G5T1 or G5T4	NJ endemic or disjunct; part of undescribed complex
Widespread	*Hesperia attalus slossonae*	Seminole Skipper	G3G4T3	Needs intensive management; only in NJ in NAC
Widespread	*Hesperia leonardis*	Leonard's Skipper	G4	Range probably wider than currently known
Widespread	*Lycaena hyllus*	Bronze Copper	G5	NJ critically imperiled, absent from rest of NAC, loss of early successional habitat
Widespread	*Meropleon cosmion*		G4	Very rare, only in NJ in NAC
Widespread	*Meropleon titan*	A Noctuid Moth	G2G4	Extreme rarity within ecoregion
Limited	*Metarranthis apiciaria*	Barrens Metarranthis Moth	GU	One recent extant EO in NAC and only 1-2 globally
Widespread	*Nicrophorus americanus*	American Burying Beetle	G1	Declining throughout range
Widespread	*Papaipema maritima*	Maritime Sunflower Borer Moth	G3	Only metapopulations are at Cape May and along DE Bay
Restricted	*Papaipema sulphurata*	Decodon Stem Borer Moth	G2	Endemic to SE MA
Widespread	*Parapamea buffaloensis*		G4	Rare, needs deer protection
Widespread	*Ptichodis bistrigata*	A Noctuid Moth	G3	Declining in NAC; disjunct
Restricted	*Richia sp. 2*	A Noctuid Moth	G1Q	Unique endemic ecotype
Peripheral	*Schinia tuberculum*	Golden Aster Flower Moth	G4	Disjunct, local and declining
Limited	*Spartiniphaga carterae*	A Noctuid Moth	G2G3	Two part range; one-half of EOs in NAC

Viability Screening

Screening Criteria

1. **Y** = Yes: Element occurrence met the criteria by having A-C EOrank with a undeveloped block of >100 acres, or with no rank, but good information in EOData (e.g. persistence over time, or food plant present) or general description fields and being less than a 20 year old record.
2. **M** = Maybe: Assigned to EOs that had "limited information" (see below), or A-C rank records in less than 100 acre blocks, D rank records that had good EOdata, or records that were >20 years old, but seemed to have good landscape context.
3. **N** = No: D ranks with no other information, records with no information, records greater than 20 years old with no other information, or marked poor viability or historic.

Additionally, all EOs with an **M** or **N** score were assigned brief comments to guide expert review. These scores were reviewed by experts who in many cases had more information than was in the record and were able to change the scores. Final scores were tallied and used to assess progress toward ecoregional goals. When considering whether the number of EOs met ecoregional goals both EOs M or Y scores were considered towards the goal. In most cases (except for two) the addition of occurrences with M scores did not change whether the species met either distribution or numeric goals for the ecoregion.

Setting Goals and Results

We set numerical conservation goals for the primary target species based on their rarity and distribution as shown in the Table 9. These goals represent a minimum number of populations for successful conservation of a target, and should not, in and of themselves, reflect conservation success. Depending on the species, more populations may be required to ensure target viability over the long term. However, we set these benchmarks in order to set an ecoregional baseline that could be applied evenly across all targets. Local conservation planning and expert review will refine goals based on the unique life-history and habitat requirements of a specific species. In addition, conservation biology literature suggests that five occurrences of a rare species will not ensure its survival long term, but if we can conserve five while we work to determine the real number needed we will be making progress in the right direction.

Table 9: Numeric and distribution goals (with percentages) for terrestrial Invertebrate target groups in NAC Ecoregion. In the first column, the number in parentheses reflects how many viable populations for a given species are required to meet the numeric goal. For example, a restricted species needs at least 20 viable populations in NAC to meet the numeric goal. To meet the distribution goal, there must be at least one viable population of a target species in each sub-region where it occurs.

Terrestrial Invertebrate Distribution in Ecoregion (#)	**# of Primary Targets**	**# of Primary Targets that met numeric Goals (%)**	**# of Primary Targets that met Distribution Goals (%)**
Widespread (5)	15	2 (13)	2 (13)
Limited (10)	4	0 (0)	1 (0)
Restricted (20)	7	1 (14)	2 (29)
Peripheral/Disjunct (5)	2	0 (0)	0 (0)
Total	28	3 (11)	5 (18)

We also tracked how many populations had viable occurrences in each subregion in which they occurred. For example, if the species occurred in only one subregion, the goal was to have at least one viable occurrence there. If the species occurred in all subregions, there should be at least one viable occurrence in all four subregions. These goals reflect our desire to assure that species are viable across their current range.

Of the 28 primary targets, 3 (11%) across all subregions met the minimum number for viability based on numeric goals. Of the targets most concentrated in NAC, none of the four species limited to NAC, and one of the seven (14%) species restricted to NAC met their Numeric Goals.

For distribution goals, 5 (18%) of the Primary Target Species had at least one viable occurrence in every subregion where it occurred. Most of all NAC terrestrial invertebrate Primary Target Species do not have the minimum number recommended of known viable populations in the Ecoregion.

These data reflect a relatively high level of uncertainty for the viability of some populations. This may be due to no data collected on occurrences, inadequate or incomplete information for a given occurrence, uncertainty about the population requirements for long-term persistence of certain species, or other factors. These species and their occurrences would benefit from additional field inventory, better viability assessment criteria, more rigorous monitoring over time, and documentation of species ecological and habitat requirements for long-term conservation.

AQUATIC SPECIES

Team Leader: Alison Bowden (Massachusetts)

Reviewers (TNC): Nancy Sferra, Kathy Jensen (ME TNC); Mark Carabetta (CT TNC); Doug Bechtel (NH TNC), Julie Lundgren (RI TNC); Arlene Olivero, Colin Apse (Eastern Conservation Science); Marilyn Jordan (NY TNC-Long Island); Mark Bryer (Chesapeake Bay); George Schuler, Rebecca Shirer (NY TNC – Eastern NY); Jay Odell (NH TNC); Charles DeCurtis (PA TNC)

Reviewers (Other): Karsten Hartel (Harvard MCZ); Kevin Curry (Bridgewater State College); Phil DeMaynadier (ME Division of Inland Fisheries); Boyd Kynard (Conte Anadromous Fish Laboratory); Brad Chase (MA Division of Marine Fisheries); Fred SaintOurs (entomologist); Jennifer Loose (MA Heritage); Ginger Brown (RI Natural History Survey); Dawn McKay (CT Heritage); Robert Buchsbaum (MA Audubon); Jay Cordeiro (Natureserve); David McLain (UMASS); Ken Sprankle (US FWS); Chris Raithel (RI DEM)

Portfolio Results for Aquatic Invertebrates and Resident Fish (Vertebrates): The initial list of targets was created from combining the portfolio terrestrial invertebrate targets from the Lower New England and North Atlantic Coast Ecoregions; the team leader then added a number of species as candidates. This list of existing targets and proposed candidates was then sent to state experts to review. The final list included 13 primary targets (12 invertebrates and 1 resident fish) (Tables 10 & 11) and 18 secondary targets for NAC. In addition 10 migratory fish species were added as primary targets for the North Atlantic Freshwater Ecoregion, which includes NAC.

Only Primary target species received viability screening. Information sources included Heritage occurrence records and expert review.

Table 10: Aquatic invertebrate primary target species within the North Atlantic Coast Ecoregion.

Status	Scientific Name	Common Name	GRank	Comments
Widespread	*Alasmidonta varicosa*	Brook Floater	G3	Significant declines south, some good populations north, especially in ME
Limited	*Enallagma minisculum*	Little Bluet	G3G4	Relatively common in small, heavily developed range; stable
Limited	*Enallagma pictum*	Scarlet Bluet	G3	Small, heavily developed range, not abundant or widespread
Restricted	*Enallagma recurvatum*	Pine Barrens Bluet	G3	Small, heavily developed range; stable
Peripheral	*Epitheca spinosa*	Robust Baskettail	G4	Southern species at edge of range in NAC; early, short flight season; likely more common
Widespread	*Gomphus apomyius*	Banner Clubtail	G4	Southern species at edge of range in NAC (NJ only)
Widespread	*Leptodea ochracea*	Tidewater Mucket	G3G4	Declining rangewide
Widespread	*Somatochlora georgiana*	Coppery Emerald	G3G4	Local but probably more widespread (difficult to collect); few breeding sites known
Peripheral	*Somatochlora provocans*	Treetop Emerald	G4	Southern species at edge of range in NAC (NJ only); large range, stable but mostly S1-S2
Limited	*Spongilla aspinosa*	Smooth Branched Sponge	G2G3	Acidic ponds; very few eo's
Widespread	*Tachopteryx thoreyi*	Gray Petaltail	G4	Forested seeps; southeastern species with few records in NJ, PA, NY (uncommon and local)
Limited	*Williamsonia lintneri*	Ringed Boghaunter	G3	Sphagnum wetlands in small range; spotty distribution; few sites adequately protected

Table 11: Fish primary target species within the North Atlantic Coast Ecoregion

Status	***Scientific Name***	**Common Name**	**GRank**	**Comments**
Widespread	*Notropis bifrenatus*	Bridle Shiner	G3	Recent severe decline, G5 to G3, unknown cause

Viability Screening

Element Occurrence Rank was generally a poor indicator of viability. For example, there are several A-ranked occurrences for Atlantic sturgeon in rivers where this species has not spawned in at least 100 years. The rank was apparently assigned based on the number of individuals present, but they didn't take into account that these are non-breeding juveniles that will return to their natal rivers when they reach breeding age. If the rank made sense with the information provided in the table or data from other sources, A, B and C ranked EOs were assumed to be viable. E ranks generally were given "maybe" unless other information provided clear guidance on viability. D, H and X ranks were given a "no".

Where available, written descriptions in the Element Occurrence Data or General Description fields were used to assign scores, supported by the Landscape Context Index (good context is LCI<60), census block human population trend, block size, and gap status. Detailed information about buffers, impervious surface percentages, dams, and other attributes of watershed condition were used when the EOData fields were lacking. Scores were not constrained by any specific threshold for any of the criteria; rather a judgment call was made using all available information. For example, an animal dependent on headwater streams is more likely to be impacted by general watershed conditions than say, an amphipod living in an isolated spring in Rock Creek Park. The amphipod in an urban census block may be fine, while a population of brook floaters in a 5,000 acre block in a rural area could be severely impacted by a single road crossing. Actual population information indicating occurrence over multiple years, and/or evidence of reproduction (gravid individuals, juveniles, multiple age classes, etc.), took precedence over the landscape context information in screening, although poor context was noted and was subjected to careful review by the state teams.

Screening Criteria

1. **Y** = Yes: Element occurrence clearly met the criteria of "viability" by having multiple individuals, A/B/C rank that made sense with the EO description, good landscape context, and evidence of reproduction. If a recent recovery plan, status review, or other document that is the product of expert analysis indicated a given population was viable or not, that judgment took precedence and was recorded as the source. See the Atlantic sturgeon example above.
2. **M** = Maybe: Assigned to EOs that had limited or uncertain information that required review by state experts. Ranks of E (extant) with one or few individuals, old records with blank EOdata or Gendesc fields, and occurrences ranked viable in the previous iteration of the plan that have had declines in rank, landscape context, or other issues of concern for viability.
3. **N** = No: Rank of X, D, F, or H indicating evidence of loss of species due to destruction of individuals or habitats, or that the species was out of place, e.g. the only record being one dead individual in clearly unsuitable habitat.

Setting Goals and Results

A subset of viable element occurrences was selected, stratified by subsection. Numerical conservation goals for the primary target species were set based on their rarity and distribution as shown in Table 12. These goals represent a minimum number of populations for successful conservation of a target.

Table 12: Numeric and distribution goals (with percentages) for invertebrate and resident fish target groups in the North Atlantic Coast Ecoregion. In the first column, the number in parentheses reflects how many viable populations for a given species are required to meet the numeric goal. For example, a restricted species needs at least 20 viable populations in NAC to meet the numeric goal. To meet the distribution goal, there must be at least one viable population of a target species in each sub-region where it occurs.

Aquatic Species Distribution in Ecoregion (#)	**# of Primary Targets**	**# of Primary Targets that met numeric Goals (%)**	**# of Primary Targets that met Distribution Goals (%)**
Widespread (5)	5	1 (20)	3(60)
Limited (10)	4	0 (0)	1(25)
Restricted (20)	1	1(100)	1(100)
Peripheral/Disjunct (5)	1	0(0)	0(0)
Total (spp with EOs)	11	2(18)	5(45)

Of the 13 primary targets, 2 (18%) across all subregions met the minimum number for viability based on numeric goals. Two species, robust baskettail and banner clubtail, had no element occurrences. Both species are found on the coastal plain of New Jersey and have a state rank of S1, but are not tracked by the NJ Heritage program. The goal for each of these would be 5 viable occurrences, but no information is available to determine number or viability. As shown in table 12, 11 of the 13 primary targets had element occurrences, with 18% of those meeting numeric goals. The 1 target restricted to NAC, pine barrens bluet, met the numeric goal of 20 occurrences. The other range-limited odonates, two pond damselflies and ringed boghaunter dragonfly, did not. Recent Massachusetts inventory data for scarlet bluet confirmed multiple new sites that were not included here, and it is likely that the numeric goal for that species would now be met. For the widespread species, only tidewater mucket met the numeric goal, with viable sites concentrated in the Cape Cod subregion.

Five (45%) of the Primary Target aquatic invertebrates and resident fish with element occurrences (38% of all primary targets in this category) met the distribution goal of at least one viable population per subregion. The targets that met the goal are bridle shiner, pine barrens bluet, tidewater mucket, coppery emerald, and ringed boghaunter.

It is important to note that targets and results were developed using the best available information. Data for aquatic invertebrates are strongly focused on a few taxa, notably odonates and mussels, which have received a great deal of attention in inventory, are of interest to the public, and are tracked by Heritage programs. The species included here utilize a variety of aquatic habitats, from coastal plain ponds to forest seeps to streams, and it reasonable to consider that successful protection of these species and their habitats will serve as an umbrella for many more species, even some yet undescribed. Aquatic invertebrates, as well as non-game fish like the bridle shiner, are groups that would benefit greatly from additional inventory and monitoring.

Ideally, boundaries for freshwater planning should be based on freshwater ecoregions and ecological drainage units (EDU's) as opposed to the terrestrial ecoregion and subsections. NAC represents a very small portion of the North Atlantic Freshwater Ecoregion, and crosses into the

Chesapeake Freshwater Ecoregion. It is not clear if using the aquatic units would have made a difference in this process in terms of which occurrences were selected for the portfolio or whether goals would be more or less likely to be met. Selection of aquatic versus terrestrial units may have more of an effect on results for river species than on species associated with wet habitats that are more isolated from surface watersheds, such as coastal plain ponds or forest seeps. In this iteration the logistics of data requests, etc. across the much larger scale of the freshwater ecoregion made it impractical to use the freshwater units for most species.

As described below, the analysis for migratory fish was done using the freshwater ecoregion because: a) this was a new process, as opposed to a revision of the earlier plan; b) the data source was not element occurrences and thus the process was not constrained by terms of specific data requests from Heritage programs; and c) we used the NAC revision as an opportunity to develop preliminary data and build a case for planning for long-distance migratory fish in a separate process that integrates freshwater and marine habitat needs.

Portfolio Results for Migratory Fish: Ten species of diadromous fish were selected as primary targets in the NAC aquatic species planning process: alewife, American eel, American shad, Atlantic salmon, Atlantic sturgeon, blueback herring, hickory shad, rainbow smelt, searun trout, and shortnose sturgeon (Table 13). Nine of these species are anadromous, spawning in freshwater but spending most of their lives at sea, and one, the American eel, is catadromous. Eels are born in the Sargasso Sea, migrate into rivers from Canada to the northern tip of South America, and spend 20 years or more in fresh water before returning to the sea to spawn.

This group has one major attribute in common; they share the life history strategy of exploiting both freshwater and saltwater habitats. The distance traveled in order to do this varies widely among the species, from the rainbow smelt that lives its entire life within about a mile of the coast up to the head of tide in rivers, to the Atlantic salmon that travels thousands of miles from the ocean waters off Greenland to headwater streams hundreds of miles inland. The populations of all ten of the species selected as primary targets show evidence of significant decline or, in the case of the sturgeons, are already recognized as globally rare with a rank of G3. Seven of these species also are so wide ranging that protection of the species will require coordinated, targeted efforts across freshwater, marine, and terrestrial realms. There is no habitat we can protect and thus expect to meet all the life history needs of alewife, American eel, American shad, Atlantic salmon, Atlantic sturgeon, blueback herring, or hickory shad. The ten species listed are not the full suite of diadromous fish within this range.

All species were considered, but those that are apparently stable or increasing in number were not selected as targets. Striped bass, sea lamprey, and white perch do not warrant specific conservation attention at this time. They are also likely to benefit from efforts to protect primary target species with similar life histories. Atlantic tomcod were added as secondary conservation targets because there is anecdotal evidence of decline and even disappearance from some rivers in the region, but they are apparently still common in some areas and data are virtually non existent for this small coastal species that is not harvested commercially or recreationally.

Table 13: Migratory fish primary target species within the North Atlantic Coast Ecoregion.

Status	Scientific Name	Common Name	GRank	Comments
Limited	*Acicpenser brevirostrum*	Shortnose Sturgeon	G3	Federally listed; 19 breeding populations limited to Atlantic coast; fisheries closed
Widespread	*Acipenser oxyrhinchus*	Atlantic Sturgeon	G3	ESA candidate, NOAA sp of concern; 14 breeding populations, limited to Atlantic and Gulf coasts; fisheries closed
Limited	*Alosa aestivalis*	Blueback herring	G5	Severe decline rangewide; Historically super-abundant; critical food web role; fishery closed in MA, RI, CT due to low numbers
Limited	*Alosa mediocris*	Hickory shad	G5	Least common of Atlantic coast *Alosa* spp
Limited	*Alosa pseudoharengus*	Alewife	G5	Historically super-abundant; critical food web role; fishery closed in MA, RI, CT due to low numbers
Limited	*Alosa sapidissima*	American shad	G5	Historic low population numbers; ocean fisheries closed
Widespread in freshwater, Restricted marine breeding habitat	*Anguilla rostrata*	American eel	G4	Catadromous; single, panmictic population breeds in Sargasso Sea; range in freshwater contracting southward
Widespread	*Osmerus mordax*	Rainbow Smelt	G5	NOAA sp of concern; range contracting northward
Widespread	*Salmo salar*	Atlantic Salmon	G5/G5T1T2Q	All salmon in U.S. outside of 8 rivers in ME re-introduced (no native or self-sustaining runs in NAC)
Limited	*Salvelinus fontinalis*	Sea run brook trout	G5	Rare anadromous "race" of a common species, range limited from Gulf of St. Lawrence to southern New England

Viability Screening

Conventional screening criteria could not be applied to these species, even though limited occurrence data were available for sturgeons and salmon. Detailed counts of breeding individuals are rarely available, and landscape context information is essentially irrelevant to species that move among realms to complete their life cycles. Presence of individuals, even in large numbers,

is not a reliable indication of reproduction. Atlantic sturgeon are a good example—juveniles travel long distances and are found in many Northeast rivers, but spawning occurs in only three. A number of efforts are underway by partners, including the Atlantic States Marine Fisheries Commission (ASMFC) to assess the status of some of these species that have the least available information.

A data set of occurrences at HUC-8 level was available for 9 of the 10 species. We used the NatureServe table as the base, and updated occurrence data with information on spawning, with the intent of documenting those rivers that currently support self-sustaining populations of target species. An attempt was made to document runs that are regarded as important, but no measure could be applied consistently across the ecoregion. Where no information beyond the NatureServe data was available, the table was not changed. In cases where data clearly indicated absence of a species, that was noted.

Setting Goals and Results

With this information, we can begin to set goals for protection and restoration of these species in our aquatic portfolio by EDU. Initially we intended to compare size of runs across the region, but available data did not support that approach. Information was gathered primarily from state fishery agencies and the US Fish and Wildlife Service, but additional information from other credible sources such as watershed groups was also compiled. The status of each species in each portfolio river was coded to indicate whether spawning occurs (our best available surrogate for viability), if the species is actively being restored (stocked), if juveniles but no adults or fry are present, or if reliable data indicate the species is absent. The full table for all portfolio rivers in the North Atlantic Freshwater Ecoregion (FWE) is shown in Appendix 4.

Although the majority of these fish are G5 and some are still locally common, 40% (alewife, blueback herring, American shad, and rainbow smelt) met the numeric goals and only one, alewife, met the distribution goal (Table 14). All four are severely reduced from historic population sizes. Their ecological role as "forage species" that naturally occur in huge numbers and support higher trophic levels of many taxa is not being fulfilled in most places. Fish migrate in to rivers in spring, when ospreys, eagles, herons, etc are raising young, and young-of-year migrate out in late summer, when birds are preparing for their own migrations. Mammals such as river otters, seals, and black bears also benefit from fish runs.

Table 14: Numeric and distribution goals (with percentages) for migratory fish target groups in the North Atlantic Freshwater Ecoregion. In the first column, the number in parentheses reflects how many viable populations for a given species are required to meet the numeric goal. For example, a restricted species needs at least 20 viable populations to meet the numeric goal. To meet the distribution goal, there must be at least one viable population of a target species in each EDU where it occurs.

Aquatic Species Distribution in Ecoregion (#)	**# of Primary Targets**	**# of Primary Targets that met numeric Goals (%)**	**# of Primary Targets that met Distribution Goals (%)**
Widespread (5)	3	1 (33)	0(0)
Limited (10)	6	3 (50)	1(15)
Restricted (20)	0	0(0)	0(0)
Peripheral/Disjunct (5)	0	0(0)	0(0)
Other (Widespread/Restricted)	1	1 population; viability unknown	1 population; viability unknown
Total	10	4(40)	1(10)

Atlantic and shortnose sturgeon, the only migratory fish species that were targets in the first iteration of NAC, did not meet goals for either number or distribution. Of the 10 targets in this category, the most comprehensive and detailed information was available for these G3 species. All 14 spawning rivers for Atlantic and 19 for shortnose are considered critical to the species' recovery. The largest known populations of shortnose sturgeon are found in this freshwater ecoregion: 38,000 in the Hudson River and 18,000 in the Saint John River. The Hudson River is also important for Atlantic sturgeon, and the Delaware River is thought to have supported the largest population historically, but the species is apparently now more concentrated in the South Atlantic FWE. Actual abundance data are extremely limited.

There are practically no data on hickory shad, but they are likely to have experienced declines similar to American shad. Historically, hickory shad spawned in rivers and tributaries along the Atlantic coast from the Bay of Fundy to Florida, but now they are probably restricted to waters south of New York. Sea run brook trout are a challenging target because there are not always genetic differences among anadromous, resident, and amphidromous forms. Historical accounts suggest that sea run brook trout were common prior to the 1700's, and that they suffered the same fate as other anadromous fish with damming and pollution of rivers. They are now documented in a handful of sites in Massachusetts, Maine, and maritime Canada. Ultimately we may choose to focus on them primarily as an indicator of intact coastal coldwater systems, which were also added as conservation targets in this ecoregional plan revision. More information is needed to support a planning approach for this species.

American eel has one panmictic population across all ecoregions where it occurs, of unknown viability. Almost no data were available for American eel, but they are most likely still present in every river and estuarine system because larvae are planktonic (transported passively). However, their continued widespread distribution is not definitive evidence of viability. Their unusual life history strategy requires a huge number of individuals to sustain the population, but the natural range of variation or number of individuals is unknown. Setting goals for this species is challenging, because its natural status is a single, huge population widely distributed for a long (8-20+ years) growth phase. Any mortality of eels in fresh or estuarine waters is pre-breeding. Goals need to take into account distribution and abundance in freshwater and reproductive success in the marine environment.

The wild Atlantic salmon populations of 8 rivers in Maine were added to the Federal Endangered species list in 2000. The Penobscot River has the largest population, with over 1,000 adults. Native salmon were extirpated from all other U.S. rivers, and despite decades of restoration efforts no runs are self-sustaining yet. A complex and extensive hatchery program provides fish to sustain restoration efforts throughout New England.

Atlantic salmon were extirpated from most of their range in New England soon after the beginning of the industrial revolution by a combination of pollution and loss of access to spawning habitats. Their recovery is in question today due to ongoing pollution problems, especially acid deposition, and changes in their ocean habitats. The remaining species have suffered from multiple interacting threats including loss of access to spawning areas due to dams, destruction or pollution of spawning habitats, exposure to toxic chemicals, and commercial and industrial activities, e.g. dredging, power plant operations, bridge construction and demolition, etc. Overharvest either in directed fisheries or as by-catch has also been a factor for all of these species. In US waters, fishing for Atlantic sturgeon, shortnose sturgeon, and Atlantic salmon is prohibited, and the ocean-intercept fishery for American shad was closed in 2004. New limits are

being considered for American eel, along with an expanded monitoring program. River herring fisheries in freshwater are closed in Massachusetts, Rhode Island, and Connecticut.

Development of a conservation plan for migratory fish that integrates freshwater and marine habitats is a priority strategy for the Eastern US Conservation Region, with implementation scheduled for 2008. Protection and restoration of river continuity is also a priority regional strategy, already underway.

PLANTS

Team Leader: Doug Bechtel (New Hamphsire)

Reviewers: Bill Nichols and Dan Sperduto (NH Heritage); Arthur Haines and Bill Brumback (New England Wildflower Society); Karen Lombard (MA TNC); Bob Allen and Andrea Stevens (NJ TNC) and Mike Van Clef (NJ TNC formerly); Nancy Sferra (ME TNC) and Don Cameron (ME Nature Areas); Marilyn Jordan, Bruce Horwith, Joe Jannsen (NY TNC) and Steve Young (NY Heritage); Ellen Roca (DE TNC) and Bill MacAvoy (DE Heritage); Mark Carabetta (CT TNC); Julie Lundgren (RI TNC).

Methods: The initial list of plant targets was created by combining the portfolio plant targets from the previous ecoregional assessments for North Atlantic Coast and Lower New England Ecoregions. The initial list for review consisted of 164 primarily G1 through G3 plant species which was sent out to state experts for suggestions on additions, subtractions, and comments. Additions consisted of significant disjunct species, populations with unique genetic variation or occurring in a unique ecological context, populations at the far edges of their species range, and ecoregional endemics known to be vulnerable and in decline. Taxonomy and nomenclature were checked for species on the initial list to ensure that all were still valid taxa.

Portfolio Results for Plants: The final list included 65 primary targets, with 98 secondary targets (Table 15). Of the 65 primary targets, four had unresolved occurrence or taxonomic questions, and one originally proposed species (*Rubus orarius*) was not assessed because it is not recognized by NatureServe as a true taxon at this time[1]. For viability, we therefore assessed and report on 64 primary targets. In general, taxonomy followed NatureServe (http://www.natureserve.org/explorer/servlet/NatureServe?init=Species), except in cases where local experts or recent literature and research confirmed uncertainties in classification.

[1] A list of unresolved issues, including species with unresolved taxonomy, late additions to the list, or other issues, is included in Appendix 5.

Table 15. Primary plant target species in the North Atlantic Coast Ecoregion.

Status	Scientific Name	Common Name	GRank	Habitat / Comments
Limited	*AESCHYNOMENE VIRGINICA*	SENSITIVE JOINT-VETCH	G2	Tidal shores, mudflats, marshes
Limited	*AGALINIS ACUTA*	SANDPLAIN GERARDIA	G1	Maritime grasslands
Peripheral	*AGALINIS AURICULATA*	EARLEAF FOXGLOVE	G3	Grasslands and open woods
Peripheral	*AGASTACHE SCROPHULARIIFOLIA*	PURPLE GIANT HYSSOP	G4	Upland woods, floodplain edges. Rare in some portion of range, unranked in others. Sensitive to competition, may not remain at same sites over long-term.
Limited	*AMARANTHUS PUMILUS*	SEABEACH AMARANTH	G2	Sea beaches
Peripheral	*ARABIS PATENS*	SPREADING ROCKCRESS	G3	Moist rocky woods
Limited	*ASTER DEPAUPERATUS*	SERPENTINE ASTER	G2	Serpentine outcrops and barrens, synonym is *Symphiotrichum depauperatum*
Limited	*BIDENS BIDENTOIDES*	MARYLAND BUR-MARIGOLD	G3	Freshwater intertidal marsh, tidal stream edges, estuarine shores
Limited	*BIDENS EATONII*	EATON'S BEGGAR-TICKS	G3	Estuaries
Limited	*CARDAMINE LONGII*	LONG'S BITTER-CRESS	G3	River and stream edges, estuaries, freshwater intertidal marsh
Peripheral	*CAREX MITCHELLIANA*	MITCHELL'S SEDGE	G3	Freshwater wet meadows. Often near salt marshes, low wet woods, shaded edges
Limited	*CAREX POLYMORPHA*	VARIABLE SEDGE	G3	Nutrient poor sandplains, disturbed openings, dry forests, thin woods, dry, open woods, acid soils
Widespread	*CHENOPODIUM FOGGII*	FOGG'S GOOSEFOOT	G3Q	
Peripheral	*CIRSIUM VIRGINIANUM*	VIRGINIA THISTLE	G3	Peatlands, bogs, wet pinelands
Limited	*COREOPSIS ROSEA*	ROSE COREOPSIS	G3	Coastal plain pond, wet, sandy, acidic soil, shallow water
Widespread	*CYPRIPEDIUM ARIETINUM*	RAM'S-HEAD LADY'S-SLIPPER	G3	Mesic forests, forested swamps, cedar swamps
Widespread	*ECHINODORUS TENELLUS*	AMERICAN DWARF BURHEAD	G2	Mud, wet sand, shallow water, with seasonal water fluctuations
Limited	*ELEOCHARIS AESTUUM*	TIDAL SPIKERUSH	G2	Freshwater tidal marsh
Restricted	*ELEOCHARIS DIANDRA*	WRIGHT'S SPIKE-RUSH	G2	Shores of large lakes and streams, fresh or tidal / brackish
Widespread	*ELEOCHARIS FALLAX*	CREEPING SPIKERUSH	G2	Coastal fresh and brackish wetlands
Limited	*ERIOCAULON PARKERI*	PARKER'S PIPEWORT	G2	Found where accretion and erosion are in balance
Restricted	*EUPATORIUM LEUCOLEPIS VAR NOVAE-ANGLIAE*	WHITE BRACTED-BONESET	G3	Coastal plain pondshores
Limited	*EUPATORIUM RESINOSUM*	PINE BARRENS BONESET	G3	Low ground of open bogs, swamps
Peripheral	*EUPHORBIA PURPUREA*	GLADE SPURGE	G3	Dry or moist woods, low moist ground of rich woods
Peripheral	*GENTIANA AUTUMNALIS*	PINE BARREN GENTIAN	G3	Wet, open, sandy pinelands edges
Widespread	*HASTEOLA SUAVEOLENS*	SWEET-SCENTED INDIAN-PLANTAIN	G3	High energy riverbanks, moist low ground. Synonyms are *Cacalia* s. and *Synosma* s.

Restricted	*HELIANTHEMUM DUMOSUM*	BUSHY ROCKROSE	G1	Maritime grassland
Limited	*HELONIAS BULLATA*	SWAMP-PINK	G4	Swamps, bogs
Widespread	*HYPERICUM ADPRESSUM*	CREEPING ST. JOHN'S-WORT	G3	Marshes, coastal plain fresh-water pond-shores, and wet meadows
Widespread	*ISOTRIA MEDEOLOIDES*	SMALL WHORLED POGONIA	G3	Secondary forest, fragipan soils, mesic dry oak forests, population center in NH
Limited	*JUNCUS CAESARIENSIS*	NEW JERSEY RUSH	G3	Sandy, wet pineland bogs
?	*JUNCUS SUBNODULOSUS*	BARNSTABLE BOG RUSH	G3	Salt marsh
Limited	*LIATRIS SCARIOSA VAR NOVAE-ANGLIAE*	NORTHERN BLAZING-STAR		Calcareous rocky summit, nutrient poor sandy soils, sandplains, disturbed openings, maritime grasslands.
Peripheral	*LIPARIS LILIIFOLIA*	LARGE TWAYBLADE	G3	Rich mesic woods
Peripheral	*LOBELIA BOYKINII*	BOYKIN'S LOBELIA	G3	Wet ground, shallow water of ponds
Limited	*MALAXIS BAYARDII*	BAYARD'S MALAXIS	G3	Dry open woods, sandy and shale barrens
Restricted	*MIMULUS RINGENS VAR COLPOPHILUS*	ESTUARY MONKEYFLOWER	G3	Estuary tidal mud flats.
Peripheral	*MUHLENBERGIA TORREYANA*	TORREY'S DROPSEED	G3	Wet, open soil of sandy pinelands
Limited	*NAJAS GUADALUPENSIS SSP MUENSCHERI*	HUDSON RIVER WATER NYMPH	G2	Freshwater tidal mudflats
Restricted	*NARTHECIUM AMERICANUM*	BOG ASPHODEL	G2	Wet, open soil of sandy pinelands
Limited	*PANICUM HIRSTII*	HIRST BROTHERS' PANIC GRASS	G5	Water of ponds
Peripheral	*PHACELIA COVILLEI*	BLUE SCORPION-WEED	G5	Moist alluvial woods, floodplains and adjacent forests on Potomac. Synonym is *P. ranunculacea* (Gleason & Cronquist), recognized by Kartesz at species level due to recent chromosome counts, other features
Widespread	*POA PALUDIGENA*	BOG BLUEGRASS	G5	Bogs and wet woods
Limited	*POLEMONIUM VANBRUNTIAE*	JACOB'S LADDER	G2	Beaver pond wet meadows and shallow emergent marsh; circumneutral seeps, occasionally along roadside wetlands
Limited	*POLYGONUM GLAUCUM*	SEA-BEACH KNOTWEED	G2	Sandy coastal beach and dune, dry, open beach sand, saline edges
Widespread	*POTAMOGETON HILLII*	HILL'S PONDWEED	G2	Calcareous ponds and ditches
Limited	*POTAMOGETON OGDENII*	OGDEN'S PONDWEED	G2	Calcareous ponds and ditches
Limited	*PYCNANTHEMUM CLINOPODIOIDES*	BASIL MOUNTAIN-MINT	G3	Rocky summit grassland and Appalachian oak-hickory forest on traprock, traprock communities and woodlands.
Peripheral	*PYCNANTHEMUM SETOSUM*	AWNED MOUNTAIN-MINT	G2	Dry or moist, open sandy ground

Widespread	*PYCNANTHEMUM TORREI*	TORREY'S MOUNTAIN MINT	G2	Rocky summit grassland and Appalachian oak-hickory forest on traprock, traprock communities and woodlands, nutrient rich dry forests, thin woods
Peripheral	*RHEXIA ARISTOSA*	AWNED MEADOWBEAUTY	G1	Wet, sandy, acid ground of pinelands
Restricted	*RHYNCHOSPORA KNIESKERNII*	KNIESKERN'S BEAKED-RUSH	G1	Wet soil of pineland bogs
Limited	*RHYNCHOSPORA PALLIDA*	PALE BEAKRUSH	G3	Wet soil of pineland bogs
Disjunct	*SABATIA KENNEDYANA*	PLYMOUTH GENTIAN	G3	Coastal plain ponds
Restricted	*SAGITTARIA TERES*	SLENDER ARROWHEAD	G3	Coastal plain pond, submersed or on sandy wet shores, sandy soil in shallow acidic water. In Long Island Pine Barrens only 1 A occurrence in Lake Panamoka, highly developed & disturbed
Limited	*SCHIZAEA PUSILLA*	CURLY-GRASS FERN	G3G4	Bog / interdunal swale, white cedar bog edges. Pine barrens NJ, only one location on Long Island
Peripheral	*SCHWALBEA AMERICANA*	CHAFFSEED	G2	Moist/dry sandy pine-oak woods
Widespread	*SCIRPUS ANCISTROCHAETUS*	NORTHEASTERN BULRUSH	G3	Open wet meadows
Limited	*SCIRPUS LONGII*	LONG'S BULRUSH	G3	Nutrient poor bogs, fens, seeps, fresh water of swamps, marshes
Limited	*SCLEROLEPIS UNIFLORA*	ONE-FLOWER SCLEROLEPIS	G4	Nutrient poor pondshores, still, shallow water - coastal plain
Limited	*SUAEDA ROLANDII*	SEA-BLIGHT	G1G2Q	Estuarine subtidal (& intertidal?) saline/brackish. Probably an allotetraploid species of hybrid origin from crossing of *S. calceoliformis* and *S. maritima*. Reproductively isolated from "parent" species. Living material maintained at Brooklyn Botanic Garden. (G. Moore)
Peripheral	*UVULARIA PUBERULA VAR. NITIDA*	MOUNTAIN BELLWORT	G3G4	Red maple-black gum swamps
Peripheral	*VALERIANA PAUCIFLORA*	VALERIAN	G3G4	Moist rich woods
Peripheral	*VITIS RUPESTRIS*	ROCK GRAPE	G3G4	Dry hills, rocky talus, hybridizes with other grapes in Potomac - genetic dilution a threat(?)

Viability Screening

Primary Target species were the focus of viability screening. We assigned initial viability scores of **Y** (viable), **M** (maybe viable), and **N** (not viable) based on information from Heritage Programs BCD/Biotic databases. Heritage information that had most utility for decisions on viability included population size, EORank, descriptive information in EODATA and GENDESC, and other modeled characteristics. Although EORANK was useful, it was highly inconsistent across species, states, and years, while the number of individuals (generally in SIZE) was most useful when combined with descriptive information.

1. **Y** = Yes: Element occurrence clearly met the criteria of "viability" by having multiple individuals, usually >100 individuals unless there was clear guidance (EOSpecs) that recommended other specific criteria. "100 individuals" is an arbitrary threshold that we chose to help get started, but was informed by the fact that many of the EOSpecs written for species assigns 100 individuals as a B/C threshold for EORank. The threshold may not work for all species, depending on the spatial distribution of a particular EO; certain species-specific characteristics; the history of a particular population; the trend (increasing or declining) in population numbers over time; etc. Number of individuals at a site was the priority scoring criteria because it seemed to drive the EORanks in most states, and was the most efficient way to establish a preliminary score for review. **M** = Maybe: Assigned to EOs where Heritage Database information was insufficient to assign a **Y** score, but had a rounded EORank of A or B; was right on the threshold of 100 individuals; or had other uncertain information that required review by state experts to decide.
2. **N** = No: Did not meet the threshold of 100 individuals; was an EO from the state Heritage Programs with no information to support a decision; there was insufficient descriptive information with an EORank of C, D, E, etc.; or was noted as Historic or Extirpated in the Heritage information.

Additionally, all EOs with a **M** or **N** score were assigned brief comments to guide expert review. We reviewed and assigned viability scores to a total of 1,256 Primary Target EOs, 120 of which occur in LNE. The Viability Scores were reviewed by state experts, with particular emphasis on the **N** and **M** scores to ensure we were not discounting viable populations of globally rare targets. Final scores were tallied and used to assess progress toward ecoregional goals (see below). All occurrences receiving a **Y** or **M** score were counted as "viable" against ecoregional goals (see below).

Setting Goals and Results

We set numerical conservation goals for the primary target species based on their rarity and distribution as shown in the Table 16. These goals represent a minimum number of populations for successful conservation of a target, and should not, in and of themselves, reflect conservation success. Depending on the species, more populations may be required to ensure target viability over the long term. However, we set these benchmarks in order to set an ecoregional baseline that could be applied evenly across all targets. Local conservation planning and expert review will refine goals based on the unique life-history and habitat requirements of a specific species. In addition, conservation biology literature suggests that five occurrences of a rare species will not ensure its survival long term, but if we can conserve five while we work to determine the real number needed we will be making progress in the right direction.

We also tracked how many populations had viable occurrences in each subregion in which they occurred. For example, if the species occurred in only one subregion, the goal was to have at least one viable occurrence there. If the species occurred in all subregions, there should be at least one viable occurrence in all four subregions. These goals reflect our desire to assure that species are viable across their current range.

Table 16: Numeric and distribution goals (with percentages) for plant target groups in the North Atlantic Coast Ecoregion. In the first column, the number in parentheses reflects how many viable populations for a given species are required to meet the numeric goal. For example, a restricted species needs at least 20 viable populations in NAC to meet the numeric goal. To meet the distribution goal, there must be at least one viable population of a target species in each sub-region where it occurs.

Plant Distribution in Ecoregion (#)	# of Primary Targets	# of Primary Targets that met numeric Goals (%)	# of Primary Targets that met Distribution Goals (%)
Widespread (5)	11	1(9)	3 (5)
Limited (10)	27	10 (37)	11 (17)
Restricted (20)	7	4 (57)	4 (6)
Peripheral/Disjunct (5)	18	4 (22)	6 (9)
Total	64	19 (30)	24 (38)

Of the 64 primary targets, 19 (30%) across all subsections met the minimum number for viability based on numeric goals. Of the targets most concentrated in NAC, only 10 of the 27 (37%) of "limited" species and four of the seven (57%) "restricted" species met their numeric goals. For distribution goals, 24 (38%) primary target species had at least one viable occurrence in every subregion where it occurred. In other words, almost two thirds of all NAC primary target species do not have viable populations in the Ecoregion.

Because species occurrences receiving a "Maybe" score for viability were counted as contributing to numeric goals, we reviewed how many primary targets met goals due to the contribution of Maybe's. We asked the following questions regarding "Maybe" viability scores (Table 17):

1. Which species had more "Maybe" than "Yes" scores?
2. Of these, how many did not meet the numeric goals?
3. How many species meeting numeric goals relied on the contribution of "Maybe's"?

Table 17. The relative contribution of "maybe" scores for population viability in achieving numeric goals.

Primary Target Species	Numeric Goal	# YES	# MAYBE	# TOTAL Viable	Notes
Bidens bidentoides	10	2	5	7	1,2
Carex mitchelliana	5	3	2	5	3
Eupatorium resinosum	10	7	14	21	1,3
Gentiana autumnalis	5	1	11	12	1,3
Juncus caesariensis	10	4	24	28	1,3
Rhynchospera knieskernii	20	7	14	21	1,3
R. pallida	10	4	6	10	1,3
Schizaea pusilla	10	1	8	9	1,2
Scirpus longii	10	9	6	15	3

1 = Majority of occurrences are Maybe's
2 = Did not meet Numeric Viability Goal
3 = Maybe's required to meet Numeric Viability Goal

These data reflect a relatively high level of uncertainty for the viability of some populations. This may be due to inadequate or incomplete information for a given occurrence, uncertainty about the population requirements for long-term persistence of certain species, or other factors. These species and their occurrences would benefit from additional field inventory, more rigorous monitoring over time, and documentation of species ecological and habitat requirements for long-term conservation.

Summary of Portfolio Results for Species

The NAC ecoregional planning team addressed terrestrial and freshwater avian, mammal, fish, herptiles and macro-invertebrate targets. A total of 81 primary targets were identified, including:

- 60 G1-G3 species (G3/G4 included)
- 0 taxa for which global ranks have not been assigned
- 2 globally rare subspecies or subpopulations
- G4 and G5 species of selected taxonomic groups either endemic to the ecoregion or restricted to a portion of it or with disjunct populations in NAC.

There were 3093 primary species target EOs assessed, including 1312 plant EOs (42 spp) and 1781 animal EOs (39 spp). In addition, the team selected 2204 secondary species target EOs (88 spp) which should be addressed through site conservation planning.

Viability was difficult to assess because EO ranks had been assigned for very few animal occurrences in the ecoregion and we were not able to get up-to-date EO information for all states. In general, occurrences were discarded if the date last seen was more than 20 years ago and if the location information was too general.