Chapter 4: Conservation Actions for Connecticut's Twelve Key Habitats and GCN Species

This Chapter presents information on conservation actions needed to address the threats to GCN species and their key habitats. It also provides more detail on the 12 habitats initially described in Chapter 2 and summarizes the best available information on the locations and conditions of these twelve key habitats. For each of the key habitats, GCN species are listed as Most Important, Very Important, or Important. Threats, conservation actions (CAs), and research/survey/monitoring needs (R) are identified for each habitat. This Chapter addresses elements 2, 3, and 4.

Development of Conservation Actions

Conservation actions and research/survey/monitoring needs were developed based upon the review of over 100 existing conservation and management plans (see Appendices 1a, 1d, and 1e) and from information provided by DEP staff, the Endangered Species Scientific Advisory Committee (ESSAC), and various stakeholders during the CWCS input process.

Next, DEP BNR staff consolidated the identified conservation actions by taxon and habitat through an iterative ranking process. A database was created to store all existing information on GCN species status, threats, and actions. Species habitat associations, assigned by BNR staff and ESSAC, were used to sort species into the 12 key habitats. Additional, iterative analysis and prioritization continued at the Program, Division, Bureau, Department, and external stakeholder levels until actions for each habitat were believed to capture the priority conservation needs for the next decade.

To facilitate implementation of identified strategies and tasks, conservation actions were organized into hierarchical levels: statewide and taxon-specific actions (including policy-based actions and information needs or outreach [Table 4.1]) and habitat-focused actions (affecting GCN species within each of 12 key habitats).

There is no implied order of importance in the numbering of conservation actions or research needs because each is considered to be of high priority. Iterative culling of numerous low and medium ranked actions left only those needs that were identified as highest priority and most feasible. In addition to ensuring that each threat was adequately addressed, the CWCS process included careful consideration of how implementation of each need and action would be evaluated. The resulting performance measures are listed in specific detail after each need and action. GCN species-focused research needs or conservation actions are listed under the habitats with which the species have been associated (see lists of GCN species under each of the key habitats).

Statewide Conservation Actions

During the process of identifying conservation actions for GCN species and key habitats, recurring patterns and priorities emerged that crossed taxonomic and ecological boundaries. These statewide conservation actions were recognized to have broad impacts

across taxa and habitats (Appendices 1a, 1e). These broad conservation actions best address the primary statewide threats identified in Chapter 3 (Table 3.1). Some of the identified actions, such as comprehensive natural resource inventories, surveys, and collection of life-history information by DEP staff, experts, and partners, directly address the need for additional scientific knowledge regarding habitats and the species distribution, abundance, and condition of associated wildlife. Implementing these actions may allow for documenting species' responses to broad and long-term impacts, such as climate change. The new information obtained from additional surveys will be used to identify limiting factors and habitat requirements for all GCN species and to identify Geographic Information Systems (GIS) mapping and database management needs. Other broad conservation actions will attempt to minimize habitat stressors and improve habitat for GCN species.

Implementing the CAs identified in this Chapter presents an extremely ambitious challenge to the BNR. Fortunately, over the years, the BNR has developed a successful working relationship with many conservation partners to meet research and management needs. Federal partners, especially the U.S. Fish and Wildlife Service, and national, state, and local non-governmental conservation groups have worked with the BNR to benefit the conservation of fish and wildlife. These partnerships will have to expand if the conservation actions and research needs proposed in this document are to be accomplished. It is the intent of the BNR to maximize the use of our conservation partners in the implementation of this CWCS.

Table 4.1 Statewide Conservation Actions and Performance Measures for Species of Greatest Conservation Need

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Statewide Conservation Actions

Overarching:

- Determine the distribution, abundance, condition and limiting factors (threats) for all GCN species and key habitats. *Measure:* number of research and survey efforts initiated.

- Evaluate the impact of invasive plant and animal species on GCN species and their habitats and develop/implement applicable management strategies. *Measure*: number of management strategies developed; number of management actions implemented.

- Develop statewide guidelines to minimize the impacts of residential/industrial development on GCN species. *Measure*: number of guideline "tools" (e.g., Best Management Practices (BMPs) manuals, management plans) developed.

- Continue to participate in regional conservation efforts for GCN species such as Indiana bat, Puritan tiger beetle, New England cottontail, timber rattlesnake, golden-winged warbler, cerulean warbler, Atlantic and shortnose sturgeon, American eel, and winter flounder. *Measure:* number of regional conservation efforts in which DEP participates for each taxon.

- Implement all existing recovery plans and management plans for GCN species in Connecticut. *Measure:* number of plans implemented.

- Develop and implement inventory, survey, and monitoring protocols to determine and track the status and condition of key habitats. *Measure:* number of inventories developed.

- Develop an improved data collection, management, and retrieval system to track the status of GCN species and key habitats. *Measure:* development of a data management system.

- Map key habitats at the landscape level to determine and monitor their status and condition in Connecticut. *Measure:* number of landscape level maps and mapping tools developed.

- Enhance efforts to provide current information and guidance on GCN species and key habitats to land use planners, decision-makers, and the public at the local, region, and statewide scale. *Measure:* number of information/outreach products developed and distributed.

- Implement programs promoting conservation of GCN species and their habitats. *Measure:* number of programs implemented.

- Work with conservation partners to conserve GCN species and key habitats

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statewide. *Measure*: number of projects implemented with partners; number of acres conserved.

- Reduce the impacts from human disturbance to GCN species. *Measure:* number of management actions and outreach efforts initiated to reduce human impacts.

- Enhance conservation of collectible/poached species by improving monitoring of sites and law enforcement efforts. *Measure:* number of sites monitored; number of law enforcement actions.

Mammals:

- Develop BMPs for GCN bats for use by federal, state, municipal, and private land managers to conserve and enhance bat populations. *Measure:* number of BMPs developed.

- Identify key GCN bat flight and migratory corridors and enhance roosting, nursery, and feeding habitats and water resources. *Measure:* number of areas identified.

- Promote public awareness about urban GCN mammals and their habitats *Measure:* number of informational programs developed.

Birds:

- Conserve/increase populations of avian species for which Connecticut has a "global responsibility" for conservation such as blue-winged warbler, saltmarsh sharp-tailed sparrow, greater scaup and worm-eating warbler. *Measure:* number of conservation projects focused on global responsibility species.

- Determine the population status and distribution of GCN raptor species and establish monitoring protocols. *Measure:* number of species for which population status and distribution has been determined; monitoring protocols established.

Reptile/Amphibians:

- Develop and promote legislation to protect GCN herpetofauna species. *Measure:* General Assembly approval of conservation legislation.

- Develop BMPs for the conservation of GCN herpetofauna species for use by municipalities and land managers. *Measure:* number of BMPs developed.

- Develop standards for road crossings/road design (curbs, box culverts, etc.) to reduce road mortality of GCN herpetofauna species. *Measure:* number of municipalities using new standards.

- Increase law enforcement efforts (including inter-agency cooperation) to stop illegal trade and commercialization of GCN species. *Measure:* number man-hours devoted to the stopping the illegal trade and commercialization of GCN species.

- Determine demographic and habitat use for GCN herpetofauna species. *Measure:* number of GCN species for which demography and habitat use has been determined.

Freshwater and Diadromous Fish:

- Promote effective state and local regulations for the conservation of aquatic habitats. *Measure:* number of state and local regulations developed that benefit aquatic habitats.

- Provide technical assistance to DEP regulatory staff to minimize degradation of habitat and effects on fishes due to dredging and other habitat alterations. *Measure:* reduction in the extent of habitat degradation.

- Protect critical habitat, groundwater, and minimum flows for lakes and streams containing fish populations. *Measure:* number of information and outreach products developed; number of regulations implemented; and extent of habitats protected.

- Disseminate information to local commissions and other constituents to increase awareness of fish populations and habitats. *Measure:* number of information/outreach products developed; and number of presentations given.

- Develop long-term monitoring protocol for Connecticut fish species. *Measure:* effective monitoring protocols established.

Marine Fish and Invertebrates:

- Monitor stock structure, species movements, abundance, and distribution by life stage. *Measure:* number of species for which this information has been collected.

- Reverse the decline of marine fish and invertebrate populations where the cause is known and effective action can be identified. *Measure*: number of management plans developed; number of management actions implemented.

- Develop long-term monitoring protocols, and participate in coast-wide research and management activities for marine fish and invertebrates. *Measure:* number of research and monitoring efforts undertaken.

- Examine population dynamics of marine fish and invertebrates, including effects of density dependent and density independent (e.g., abiotic) factors. *Measure*: number of research efforts undertaken.

- Investigate the causes of reduced stock abundance when the cause is not apparent (e.g., fishing), including whether specific life stages are limited by distribution/abundance of critical habitats. *Measure:* number of research efforts undertaken.

Terrestrial Invertebrates:

- Enhance conservation of GCN invertebrate species by developing an online database that provides information to the public and facilitates the submission of data by the scientific community. *Measure:* development of online database.

- Assess the status and distribution of bees in Connecticut. *Measure:* number of research efforts undertaken; number of bee species for which status and distribution has been determined.

As data collection and management improve, landscape-level maps and plans can be developed that identify wildlife habitat to assist local land-use boards and commissions in reviewing development projects that will adversely impact GCN species or their habitats. A more comprehensive wildlife database addressing current status and distribution through GIS mapping will support the development of improved statewide strategies for specific key habitats on state and private lands. Management guidelines can then be designed to benefit all wildlife and balance competing needs of different taxa. Providing this information to partners, private landowners, local or town land managers, and land-use decision-making bodies is crucial to addressing the problems created by continued development in sensitive areas.

Current scientific inventory and geo-spatial databases in Connecticut are not sufficient to produce accurate distribution and status maps for GCN species, all 12 of the key habitats, or the 43 sub-habitats identified during the CWCS process. The field inventories and analyses to provide the data and mapping capabilities for the conservation of these GCN fish and wildlife species, as well as key habitats, remain a priority research and planning need.

Mapping of key habitats statewide is needed to help direct distribution and abundance surveys of GCN species (particularly invertebrates) within these habitats and associated vegetative communities. This effort will help determine the locations and relative conditions of key habitats essential to the conservation of GCN species characteristic of or restricted to these habitats. Further mapping of landscapes could identify and delineate land areas with similar topography, bedrock type, soils, surface hydrology, vegetation, and land use to further predict and focus field surveys. This also will allow analyses of the key habitats within ecological contexts and help to develop a framework for conservation within Connecticut's land and waterscapes.

Conservation Actions for GCN Species and Their Key Habitats

GCN species, threats and proposed research/survey/monitoring needs and conservation actions with associated measures are outlined for each of the 12 key habitats (and in some

cases for sub-habitats). Note that for many habitats, sub-habitats, and vegetative communities, little quantitative data exists on their condition. The best available information is the professional judgment of BNR biologists and other experts. Condition is described in general terms such as excellent, good, fair or poor for these habitats.

Upland Forest – Habitat 1

Upland Forest

Description, Location, and Condition of Upland Forest Habitat

Upland Forest habitats are characterized by deciduous trees, evergreen trees, or mixed evergreen-deciduous trees with overlapping crowns forming between 60-100% canopy cover. This key habitat classification includes four sub-habitats identified as important to wildlife: **(a) Dry Oak Forests, (b) Calcareous Forests, (c) Coniferous Forests,** and **(d) Old Growth Forests.**

Upland Forest is the predominant (60%) vegetation type in Connecticut, and is currently dominated by trees in the 80-100 year class. Privately-owned forests account for 83% of Connecticut's forests, with 85% of these forests being fragmented sites of less than 20 acres, a result of extensive development. Hardwood forests make up 80% of Connecticut's forests, with oak/hickory accounting for 51% and northern hardwoods for 29%. Forest stand classification is 69% sawtimber, 25% pole timber and 6% seedling stage. Thus, Connecticut's forests generally lack stand age and structural diversity that

are beneficial to wildlife diversity. A well-developed understory and shrub layer is generally present, but often lacks diversity. Representative examples of Upland Forests occur in Housatonic State Forest in the northwest corner and Meshomasic State Forest in central Connecticut.

Upland Forests have been over grazed by deer, especially in coastal areas and throughout Fairfield County. Invasive non-native plants that out compete and displace native plants also have negatively affected these habitats. The severity of these pressures varies by community type, location, and many other factors; however, it represents a major source of habitat degradation.

The area of this habitat has increased in recent decades as small farms have reverted to forest. Although the quantity of Upland Forest in Connecticut is increasing, the condition can only be considered fair due to the impacts to this habitat described above.

(a) Dry Oak Forests are found on sand, gravel, or shallow soil over bedrock and are dominated by oaks, such as scarlet and chestnut oak, with mixtures of pine and understory shrubs, like huckleberry or lowbush blueberry.

Dry Oak Forests are scattered throughout Connecticut in low-lying valleys with sands and gravels and on bedrock summits with shallow soils. Most are remnants or in poor condition. A few examples in good condition can be seen at the Canaan Mountain Natural Area Preserve (Canaan), Pachaug and Meshomasic State Forests (Voluntown, Hebron, Glastonbury, Portland, East Hampton), and Hurd State Park (East Hampton). Historical occurrences in Glastonbury and Windsor have been diminished by development. Information is needed on size and juxtapositions of these Dry Oak Forests.

(b) Calcareous Forests are found on pH-neutral soils often associated with limestone bedrock. They are characterized by sugar maple, red oak, and red cedar, with white ash and tulip poplar being found at the base of slopes.

The condition of Calcareous Forests is generally fair. Most areas that have reverted after agricultural abandonment are in poor to fair condition because they are dominated by invasive plants. Examples of Calcareous Forests in good condition can be found in the towns of Salisbury, Canaan, Sharon, and Kent.

(c) Coniferous Forests are found throughout the state on a variety of soil types, either as pure or mixed stands. Overall condition for these habitats statewide is fair. Eastern hemlock is most prevalent, but has recently declined especially in the southern portion of the state due to infestation by the hemlock wooly adelgid. White pine occurs with its greatest abundance in the northern and eastern portions of the state. Examples of white pine forests in good to excellent condition can be found in Peoples State Forest (Barkhamsted), Nipmuck State Forest (Union) and Pachaug State Forest (Voluntown). Plantations of red pine and spruce are scattered throughout the state. Many red pine stands have reached senescense and have been harvested.

Relatively healthy Coniferous Forests are found at Tunxis and Housatonic State Forests, and other public lands in northwestern Connecticut. The destruction of hemlocks caused by woolly adelgid infestations is visible in other Coniferous Forests.

(d) Old Growth Forests include both coniferous and deciduous forests that have not been disturbed by timbering or other human activities.

Few examples of Old Growth Forests remain and are small in size. Thus, the condition of these forests is poor. Some small remnants can be found in Connecticut, mostly in the northwest (e.g., Gold's Pines Natural Area Preserve in Cornwall and Ballyhack Preserve, a The Nature Conservancy (TNC) property in Cornwall).

Upland Forest (Habitat 1)
GCN Species by Taxon

Mammal

Most Important

Eastern Small-footed Bat
Hoary Bat
Indiana Bat
Red Bat
Silver-haired Bat

Very Important

Bobcat
Deer Mouse
Northern Flying Squirrel

Important

Black Bear
Eastern Pipistrelle
Hairy-tailed Mole
Little Brown Bat
Long-tailed Weasel
Northern Long-eared Bat
Short-tailed Weasel
Southern Red-backed Vole
Woodland Vole

Bird

Very Important

Acadian Flycatcher
Bald Eagle
Black-and-white Warbler
Black-throated Blue Warbler
Blue-headed Vireo
Cerulean Warbler
Golden-crowned Kinglet
Great Crested Flycatcher
Hermit Thrush
Long-eared Owl
Northern Saw-whet Owl
Rose-breasted Grosbeak
Ruffed Grouse
Sharp-shinned Hawk
Wood Thrush
Worm-eating Warbler

Bird (cont.)

Important

Barred Owl
Bay-breasted Warbler
Blackburnian Warbler
Black-throated Green Warbler
Broad-winged Hawk
Brown Creeper
Cape May Warbler
Cooper's Hawk
Dark-eyed Junco
Eastern Wood-pewee
Gray-cheeked Thrush
Great Horned Owl
Hooded Warbler
Louisiana Waterthrush
Magnolia Warbler
Northern Flicker
Northern Goshawk
Northern Parula
Olive-sided Flycatcher
Ovenbird
Pileated Woodpecker
Purple Finch
Red-breasted Nuthatch
Scarlet Tanager
Swainson's Thrush
Winter Wren
Yellow-rumped Warbler
Yellow-throated Vireo

Reptile/Amphibian

Most Important

Blue-spotted salamander (diploid)
Eastern Spadefoot
Timber Rattlesnake

Very Important

Blue-spotted Salamander (complex)
Common Five-lined Skink
Eastern Box Turtle
Eastern Hog-nosed Snake
Eastern Ribbonsnake
Jefferson Salamander
Northern Leopard Frog
Northern Slimy Salamander
Northern Spring Salamander
Spotted Turtle
Wood Turtle

Important

Copperhead
Eastern Newt
Eastern Racer
Fowler's Toad
Gray Treefrog
Marbled Salamander
Northern Dusky Salamander
Spotted Salamander
Wood Frog

Invertebrate

Most Important

Columbine Duskywing

Very Important

Common Roadside Skipper

Important

American Burying Beetle
Atlantis Fritillary
Aureolaria Seed Borer
Black Lordithon Rove Beetle
Calosoma wilcoxi
Carabus sylvosus
Cicada
Columbine Borer
Gray Comma
Imperial Moth
Purse-web Spider
Regal Moth

Threats Affecting GCN Species in Upland Forest Habitat

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance and condition).

- Loss, degradation or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species.

- Loss of large forest blocks (e.g., 2,000 + acres) with unbroken canopy structure.

- Lack of stand age or structural diversity and understory diversity among upland forests.

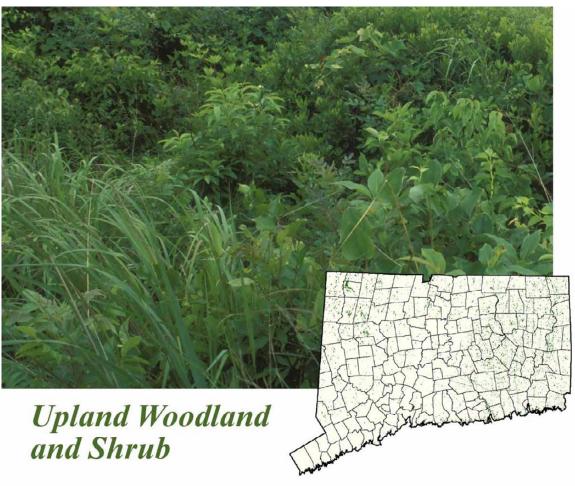- Degradation of habitat from over-browsing by deer.

Priority Research/ Survey/ Monitoring Needs for Upland Forest Habitat

- Enhance inventory and conservation efforts for butterfly species. *Measure:* number of new monitoring sites or species protocols established.

- Determine eastern box turtle distribution, habitat use, and demographics as well as identify core populations and evaluate their long-term viability. *Measure:* number of GIS data layers produced; number of acres surveyed; number of new sites surveyed; compilation of new data collected on distribution; number of eastern box turtles located; number of life history measures established.

- Determine and map the distribution of blue-spotted salamander (diploid) populations. *Measure:* number of GIS data layers produced.

- Determine the life history, abundance, distribution, and habitat requirements for GCN bat species, especially the Indiana bat. *Measure:* number of GIS data layers produced; and number of life history measures established.

- Monitor population trends of GCN forest interior bird species (e.g., worm-eating warbler, cerulean warbler) that are not well covered by Breeding Bird Survey (BBS) efforts. *Measure:* number of species added to improved monitoring protocols.

- Determine the population status and distribution of ruffed grouse. *Measure:* number of GIS data layers produced of all known sites; effective monitoring protocol produced.

Priority Conservation Actions for Upland Forest Habitat

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN moth species for which data is collected and incorporated into a database.

- Promote public awareness of the vulnerability of box turtle populations and the negative impacts of removing turtles from the wild. *Measure:* number of informational or outreach products developed; number of presentations given.

- Evaluate and implement options to minimize impacts from over browsing by deer to GCN species. *Measure:* number of options evaluated and implemented.

Upland Woodland and Shrub

Description, Location, and Condition of Upland Woodland and Shrub Habitat

Upland Woodland and Shrub habitats are characterized by open forests where tree crowns usually do not touch (between 25-60% canopy cover). These woodlands are dominated by evergreen and or or deciduous trees with a variety of shrubs, herbs and non-vascular plants in the understory and groundcover. This key habitat classification includes three sub-habitats determined to be important to wildlife: **(a) Red Cedar Glades, (b) Pitch Pine/Scrub Oak Woodlands,** and **(c) Coastal Shrublands**. The overall status and distribution of **Upland Woodlands and Shrub** habitats in Connecticut is not well known at this time.

(a) Red Cedar Glades are found on exposed summits, ledges, and outcrops and include red cedar, low shrubs, and medium-tall grasses/herbs, such as little bluestem. In the western Marble Valleys, red cedar is mixed with hop hornbeam and hickories, with a diverse herbaceous understory that is a unique mixture of plants characteristic of dry sites and those limited to calcareous soils.

The upland calcareous Red Cedar Glades have been heavily impacted by limestone quarry activities. Calcareous uplands are included as one of the 13 most imperiled

ecosystems in Connecticut (Metzler and Wagner 1998). There are few areas remaining with representative native vegetation. Occurrences include areas in the towns of Salisbury, Canaan, Sharon, and Kent. Other Red Cedar Glades on basalt (trap rock) outcrops are in relatively good condition, such as those found at West Rock Ridge State Park in Hamden.

(b) Pitch Pine/Scrub Oak Woodlands are dry forests found on sand and gravel or bedrock, typically including pitch pine, bear oak, and lowbush blueberry. An estimated 95% of Pitch Pine/Scrub Oak Woodlands have been degraded and consequently, are the most impacted terrestrial habitat in Connecticut (Metzler and Wagner 1998). Small remnants are in poor condition due to lack of fire. These woodlands are found in eastern and central Connecticut, historically north to Hartford, and include areas on acidic, dry, rocky summits throughout Connecticut. Examples include Hopeville Pond Natural Area Preserve (Griswold), Pachaug State Forest (Voluntown), and Meshomasic State Forest (Glastonbury, Hebron, Portland, East Hampton). Other examples can be found at Lantern Hill (Ledyard Mashentucket Pequot Tribal lands) and Wharton Brook State Park (Wallingford). Historically, they were found at North Haven-Wallingford sandplains, Mansfield Hollow State Park, and Windsor Locks sandplains.

(c) Coastal Shrublands include dry coastal headlands and dry to moist coastal or maritime forests that are exposed to wind and salt spray effects. Typical trees of Coastal Shrublands include pitch pine, post oak, red oak, American beech, white oak, tulip tree, scarlet oak, and sassafras. Coastal Shrubland understory or groundcover typically includes bayberry, beach plum, flowering dogwood, and switchgrass.

Coastal Shrublands are associated with Long Island Sound and the entrance of major rivers into the Sound. The remaining habitats are limited in distribution and impacted by invasive species and recreational overuse, and thus are in generally poor condition. An exemplary bayberry/beach plum shrub community on well-drained coastal moraines can be found at Meig's Point, Hammonasset Natural Area Preserve (Madison).

Upland Woodland & Shrub (Habitat 2)
GCN Species by Taxon

Mammal

Most Important

Eastern Small-footed Bat
Hoary Bat
Indiana Bat
Least Shrew
New England Cottontail
Red Bat
Silver-haired Bat

Very Important

Bobcat
Meadow Jumping Mouse

Important

Black Bear
Eastern Pipistrelle
Long-tailed Weasel
Short-tailed Weasel
Southern Red-backed Vole
Woodland Vole

Bird

Most Important

Golden-winged Warbler
Northern Harrier

Very Important

American Kestrel
Brown Thrasher
Chestnut-sided Warbler
Common Raven
Eastern Towhee
Glossy Ibis
Great Crested Flycatcher
Ipswich Sparrow
Northern Bobwhite
Peregrine Falcon
Short-eared Owl
Whip-poor-will
Worm-eating Warbler
Yellow-crowned Night-heron

Bird (cont.)

Important

Bank Swallow
Black-crowned Night-heron
Black-throated Green Warbler
Cape May Warbler
Eastern Kingbird
Eastern Wood-pewee
Gray-cheeked Thrush
Great Horned Owl
Northern Flicker
Purple Martin
Snowy Owl
White-eyed Vireo
Yellow-rumped Warbler

Reptile/Amphibian

Most Important

Blue-spotted Salamander (diploid)
Eastern Spadefoot
Timber Rattlesnake

Very Important

Blue-spotted Salamander (complex)
Common Five-lined Skink
Eastern Box Turtle
Eastern Hog-nosed Snake
Eastern Ribbonsnake
Northern Leopard Frog
Spotted Turtle

Important

Copperhead
Eastern Newt
Eastern Racer
Fowler's Toad
Marbled Salamander
Smooth Greensnake
Spotted Salamander
Wood Frog

Invertebrate

Most Important

Buck Moth
Columbine Duskywing
Northern Metalmark
Persius Duskywing
Silvery Checkerspot

Very Important

Barrens Itame
Coastal Heathland Cutworm
Frosted Elfin
Herodias Underwing
Pink Sallow
Slender Clearwing
Violet Dart Moth
Zale submediana

Important

Acronicta lanceolaria
Barrens Dagger Moth
Barrens Metarranthis Moth
Chaetaglaea cerata
Eucoptocnemis fimbriaris
Hoary Elfin
Horace's Duskywing
Lemmer's Noctuid Moth
Mottled Duskywing
New Jersey Tea Inchworm
Pale Green Pinion Moth
Pine Barrens Zanclognatha
Purse-web Spider
Schinia spinosae
Scrub Euchlaena
Spotted Dart
Yellow-horned Beaded Lacewing
Zale curema
Zale obiqua

Threats Affecting GCN Species in Upland Woodland and Shrub Habitat

- Insufficient scientific knowledge base regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation or fragmentation of habitat from development or changes in land use.

- Degradation of habitats by non-native invasive species.

- Degradation of habitat from over-browsing by deer.

- Lack of fire needed to maintain certain habitats.

- Loss of early successional habitats through natural succession.

Priority Research/ Survey/ Monitoring Needs for Upland Woodland and Shrub Habitat

- Monitor population trends of GCN forest bird species (e.g., worm-eating warbler) that are not well covered by BBS efforts. *Measure:* number of species added to improved monitoring protocols.

- Determine eastern box turtle distribution, habitat use, and demographics as well as identify core populations and evaluate their long-term viability. *Measure:* number of GIS data layers produced; number of acres surveyed; number of new sites surveyed; compilation of new data collected on distribution; number eastern box turtles located; number of life history measures established.

- Determine the life history, abundance, distribution and habitat requirements for GCN bat species, especially the Indiana bat. *Measure:* number of GIS data layers produced; number of life history measures established.

- Conserve existing populations of least shrews and determine statewide distribution and abundance. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

- Enhance inventory and conservation efforts for butterfly species. *Measure:* number of new monitoring sites or species protocols established.

- Determine and map the distribution of blue-spotted salamander (diploid) populations. *Measure:* number of GIS data layers produced.

Priority Conservation Actions for Upland Woodland and Shrub Habitat

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN moth species for which data is collected and incorporated into a database.

- Conserve and increase New England cottontails and their habitats. *Measure:* number of habitat areas restored; number of populations located.

- Promote public awareness of the vulnerability of box turtle populations and the negative impacts of removing turtles from the wild. *Measure:* number of media and outreach products developed; number of presentations given.

- Conserve and increase breeding populations of GCN early successional birds, especially the golden-winged warbler. *Measure:* number of known breeding pairs located statewide.

- Implement specialized management techniques (e.g., burning) to benefit certain GCN species. *Measure:* number of acres managed.

- Evaluate and implement options to minimize impacts from over-browsing by deer to GCN species. *Measure:* number of options evaluated and implemented.

Upland Herbaceous – Habitat 3

Upland Herbaceous

Description, Location, and Condition of Upland Herbaceous Habitat

Upland Herbaceous habitats are characterized by herbaceous plants such as grasses, herbs and ferns, that form 25% or more of the ground cover. Areas with scattered trees, shrubs and dwarf-shrubs are included as long as they provide less than 25% cover. This key habitat classification includes four sub-habitats determined to be important to wildlife: **(a) Coastal Dunes, (b) Grassy Glades and Balds, (c) Sandplain and Other Warm Season Grasslands,** and **(d) Sparsely Vegetated Sand and Gravel**.

Upland Herbaceous habitats are scarce and declining in Connecticut. Three of the sub-habitats included in this habitat classification are included among the 13 most imperiled ecosystems in Connecticut (Metzler and Wagner 1998).

(a) Coastal Dunes are found adjacent to low energy beaches along Long Island Sound. Coastal Dune vegetation typically includes beach grass, switchgrass, beach plum, and bayberry.

Connecticut's Coastal Dunes are generally small and in good to fair condition. These areas are used by several GCN bird species, notably the piping plover (state and federally

threatened) and least tern (state threatened). Most of the sandy beaches with Coastal Dunes are under private ownership. Examples of publicly accessible Coastal Dunes are found at Waterford town beach, Meig's Point in Clinton, and Bushy Point Beach in Groton.

(b) Grassy Glades and Balds are found on dry exposed summits, ledges, and outcrops, including acidic (gneiss, schist, granite), subacidic (basalt, diabase, calcareous schists) and pH neutral (marble, dolerite) soil types. Grassy Glade and Bald vegetation is typically low shrubs, grasses, and herbs, including bearberry, lowbush blueberry, sand cherry, poverty grass, and little bluestem.

Grassy Glades and Balds associated with ridge tops are conserved through either state or non-profit ownership. However, recreational use has had a major impact on this habitat (e.g., trampling by hikers, dirt bikes). In some areas, a long history of mining for coarse aggregate or the recent increase in residential development have had impacts. Grassy Glades and Balds are found in Central Connecticut (Hartford, Middlesex, New Haven Counties) and in western Connecticut and the Pomperaug Valley (Litchfield and New Haven Counties). Examples may be found at Canaan Mountain, Pond Mountain Natural Area, Kent (Pond Mountain Trust), Talcott Mountain State Park, Simsbury, Onion Mountain, West Rock Ridge (Hamden), Higby Mountain, and Sleeping Giant State Park (Hamden).

(c) Sandplain and Other Warm Season Grasslands are found on fine deposits from glacial outwash, distributed primarily in the coastal counties and also historically in the Connecticut Valley north to Hartford. These grasslands include shrubby or grassy vegetation maintained by fire, including bear oak, big bluestem, little bluestem, Indian grass, orange grass, and poverty grass.

Sandplain Grasslands are one of the most impacted terrestrial habitats in Connecticut, second only to Pitch Pine/Scrub Oak barrens (Metzler and Wagner 1998). The condition of natural Sandplain Grasslands is poor. Some managed Warm Season Grasslands are in acceptable condition but require continued management by mowing to remain viable. Examples of Sandplain Grasslands are found at Mattianuck sand dunes, and also at the Clarkhurst Wildlife Management Area within George Dudley Seymour State Park (Haddam), where Warm Season Grasslands may also be found. Other grasslands may be found at numerous airports around the state.

(d) Sparsely Vegetated Sand and Gravel habitat is found on unconsolidated sands and gravel that may be stable or actively moving, including actively eroding inland dunes. Plants are usually scattered, covering less than 25% of the substrate. Some areas may be completely void of vegetation, depending upon moisture availability and shading. Pioneer species, such as mosses and lichens, may have moderate coverage. Herbaceous vegetation is generally perennial, acidic, and xerophytic (i.e., dry-loving), often with adaptations to the movement and weathering of the substrate. Typical vegetation includes warm season grasses, little bluestem, poverty grass, orange weed, and bluecurls.

Sparsely Vegetated Sand and Gravel areas are scattered throughout Connecticut. Iinsufficient information is available on their distribution and status to provide distribution maps. However Sparsely Vegetated Sand and Gravel typically merges into Sandplain and Other Warm Season Grasslands. Natural succession and invasive plant species are likely having an impact on their condition. This community is most important to invertebrate species (e.g., tiger beetles).

Cliffs and other consolidated rock communities are similar to Sparsely Vegetated Sand and Gravel habitats. Even so, they do differ in vegetation and rock consistency. On cliffs, plants are usually scattered, covering less than 25% of the substrate, often occurring as small tufts lodged in cracks or crevices. The area may be open or shaded by adjacent overhanging trees and, in some areas, vegetation may be completely absent, depending upon moisture availability and shading. Pioneer species, such as mosses and lichens, may have moderate coverage on cliffs. Herbaceous vegetation is generally perennial and xerophytic, often with adaptations to the movement and weathering of the substrate. Typical vegetation includes mountain spleenwort, wallrue spleenwort, maidenhair spleenwort, purple cliffbrake, bluebell bellflower, red columbine, mosses, narrowleaf pinweed, rusty woodsia, little bluestem, churchmouse threeawn, rock harlequin, poverty grass, and early saxifrage.

Open calcareous cliff communities are limited to the Marble Valleys of western Connecticut. Other acidic cliff areas on pegmatite, gneiss, and schist are found in eastern and western Connecticut, including Naugatuck State Forest. A typical talus slope habitat is found in central Connecticut at Talcott Mountain State Park, Simsbury.

Upland Herbaceous (Habitat 3)
GCN Species by Taxon

Mammal

Most Important
  Eastern Small-footed Bat
  Hoary Bat
  Indiana Bat
  Least Shrew
  Red Bat
  Silver-haired Bat
Very Important
  Bobcat
  Meadow Jumping Mouse
Important
  Eastern Pipistrelle
  Little Brown Bat
  Northern Long-eared Bat

Bird

Most Important
  Barn Owl
  Common Nighthawk
  Grasshopper Sparrow
  Golden-winged Warbler
  Horned Lark
  Least Tern
  Northern Harrier
  Piping Plover
  Roseate Tern
  Upland Sandpiper
  Vesper Sparrow
Very Important
  American Kestrel
  American Oystercatcher
  Bobolink
  Common Tern
  Eastern Meadowlark
  Ipswich Sparrow
  Long-eared Owl
  Peregrine Falcon
  Savannah Sparrow
  Short-eared Owl

Bird (cont.)

Important
  Bank Swallow
  Black-crowned Night-heron
  Black-throated Green Warbler
  Cape May Warbler
  Great Horned Owl
  Osprey
  Purple Martin
  Rough-legged Hawk
  Ruby-throated Hummingbird
  Ruddy Turnstone
  Sanderling
  Semipalmated Sandpiper
  Snowy Owl
  Spotted Sandpiper
  Yellow-rumped Warbler

Reptile/Amphibian

Most Important
  Blue-spotted salamander (diploid)
  Eastern Spadefoot
  Timber Rattlesnake
Very Important
  Blue-spotted Salamander (complex)
  Eastern Box Turtle
  Eastern Hog-nosed Snake
  Eastern Ribbonsnake
  Spotted Turtle
  Wood Turtle
Important
  Copperhead
  Diamond-backed Terrapin
  Eastern Newt
  Eastern Racer
  Fowler's Toad
  Marbled Salamander
  Smooth Greensnake
  Spotted Salamander
  Wood Frog

Invertebrate

Most Important
  Columbine Duskywing
  Dune Ghost Tiger Beetle
  Northern Metalmark
  Persius Duskywing
  Silvery Checkerspot
Very Important
  Appalachian Blue
  Barrens Itame
  Coastal Heathland Cutworm
  Common Roadside Skipper
  Frosted Elfin
  Herodias Underwing
  Sleepy Duskywing
  Slender Clearwing
  Violet Dart Moth
Important
  Amara chalcea
  Apamea burgessi
  Carabus serratus
  Cucullia speyeri
  Dark-bellied Tiger Beetle
  Euxoa pleuritica
  Geopinus incrassatus
  Grassland Thaumatopsis
  Harpalus eraticus
  Helluomorphoides praeustus bicolor
  Horace's Duskywing
  Mixogaster johnsoni
  Mottled Duskywing
  New Jersey Tea Inchworm
  Northern Beach Tiger Beetle
  Panagaeus fasciatus
  Phyllira Tiger Moth
  Pine Barrens Tiger Beetle
  Regal Fritillary
  Schinia Spinosae
  Scribbled Sallow
  Scrub Euchlaena
  Spotted Dart
  Yellow-horned Beaded Lacewing

Threats Affecting GCN Species in Upland Herbaceous Habitat

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species.

- Impacts from human disturbance.

- Lack of fire needed to maintain certain habitats.

- Loss of early successional habitats through natural succession.

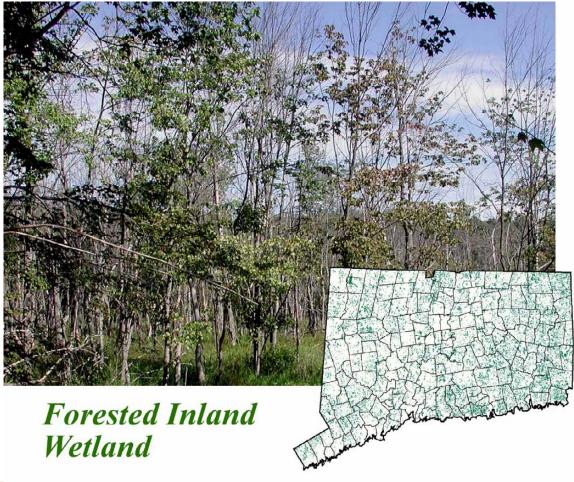**Priority Research/ Survey/ Monitoring Needs for Upland Herbaceous Habitat**

- Determine the population status and distribution of breeding populations of common nighthawks. *Measure:* number of GIS data layers produced of all known sites; production of effective monitoring protocols.

- Determine eastern box turtle distribution, habitat use, and demographics as well as identify core populations and evaluate their long-term viability. *Measure:* number of GIS data layers produced; number of acres surveyed; number of new sites surveyed; compilation of new data collected on distribution; number of eastern box turtles located; number of life history measures established.

- Determine and map the distribution of blue-spotted salamander (diploid) populations. *Measure:* number of GIS data layers produced.

- Determine the status and distribution of GCN ground beetle populations. *Measure:* number of GIS data layers produced; number of areas surveyed; number of species and populations located.

- Enhance inventory and conservation efforts for butterfly species. *Measure:* number of new monitoring sites or species protocols established.

- Determine the life history, abundance, distribution, and habitat requirements for GCN bat species. *Measure:* number of GIS data layers produced; number of life history measures established.

- Conserve existing populations of least shrews and determine statewide distribution and abundance. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

- Monitor population trends of grassland birds within Connecticut and as part of regional efforts among other Northeastern states. *Measure:* report annual trend of grassland birds at Connecticut sites surveyed.

- Assess invertebrate populations occurring in coastal sand, trap rock ridges, and high elevation bald habitats. *Measure:* number of GIS data layers produced; number of areas surveyed; number of species or populations located; compilation of new data collected.

Priority Conservation Actions for Upland Herbaceous Habitat

- Develop a statewide database for tabanid and syrphid flies that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN fly species for which data is collected and incorporated into a database.

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN moth species for which data is collected and incorporated into a database.

- Conserve and increase breeding populations of GCN colonial or beach nesting birds. *Measure:* number of known breeding pairs statewide based on regional triennial survey.

- Conserve and increase breeding populations of GCN early successional birds, especially the golden-winged warbler. *Measure:* number known breeding pairs statewide.

- Conserve and increase breeding populations of GCN grassland birds, especially the upland sandpiper. *Measure:* number of breeding pairs.

- Identify and protect key grassland areas. *Measure:* number of sites identified in each of 169 towns; percentage of these sites protected.

- Identify, protect, and manage diamond-backed terrapin populations. *Measure:* number of nesting sites identified and protected.

- Promote public awareness of the vulnerability of box turtle populations and the negative impacts of removing turtles from the wild. *Measure:* number of media and outreach products developed; number of presentations given.

- Implement management techniques (e.g., burning) needed to maintain or create early successional habitats. *Measure:* number of acres or sites where early successional habitats have been maintained or created.

Forested Inland Wetland – Habitat 4

Forested Inland Wetland

Description, Location, and Condition of Forested Inland Wetland Habitat

Forested Inland Wetland habitats are characterized by wetland soils, and dominated by evergreen or deciduous trees with crowns forming 60-100 % cover. Connecticut has about 100,000 acres of Forested Inland Wetlands, with red maple forests being the most common. This key habitat classification includes four sub-habitats determined to be important to wildlife: **(a) Atlantic White Cedar Swamps, (b) Red/Black Spruce Swamps, (c) Northern White Cedar Swamps,** and **(d) Floodplain Forests**.

The Atlantic White Cedar, Red/Black Spruce and Northern White Cedar Swamps all have slow or stagnant water in topographical basins on decomposed peats and mucks, with the distinction based on the dominant tree species.

(a) Atlantic White Cedar Swamps and seasonally flooded forests are dominated by Atlantic white cedar, and include highbush blueberry, rosebay rhododendron, swamp azalea, red maple, and yellow birch. They have a variable shrub and herbaceous layer, which can range from poorly developed to well developed, to diverse, depending upon canopy light penetration.

Atlantic White Cedar Swamps are considered one of the 13 most imperiled ecosystems in Connecticut (Metzler and Wagner 1998). Most are in poor condition. Cedar reproduction is poor in these wetland habitats, except in streamside and lakeside flooded habitats without extreme water level fluctuations. These habitats are showing little regeneration and are being succeeded by hemlock. Southeastern Connecticut has scattered occurrences of Atlantic White Cedar Swamps in Middlesex and New Haven Counties (Metzler and Wagner 1998). Other examples of Atlantic White Cedar Swamps in various conditions are found at Pachaug Great Meadow Rhododendron Sanctuary Natural Area Preserve (Voluntown), and Chester Cedar Swamp National Natural Landmark (Chester).

(b) Red/Black Spruce Swamps are saturated bog forests of northwestern Connecticut, dominated by red spruce or black spruce. The condition of these habitats is unknown. It is often dense, depending upon variable tree cover due to blow-downs from storms. Shrub and herbaceous cover is patchy typically includes mountain holly, sheep laurel, and highbush blueberry. Red/Black Spruce Swamps of relatively good condition are limited to northwestern Connecticut. Examples of Red Spruce Swamps may be found at Holleran Swamp, TNC, (Colebrook), while the only occurrence of a Black Spruce Swamp is found at Mohawk Mountain Black Spruce Bog Natural Preserve (Cornwall).

(c) Northern White Cedar Swamps are seasonally flooded forests dominated by white cedar. There is not much historical information on the extent of Northern White Cedar Swamps in Connecticut. Presently, they are rare in the state, with a single known occurrence on poorly-drained, seasonally flooded, calcium-rich soils at Robbins Swamp Natural Preserve (Canaan). This site is in poor condition.

(d) Floodplain Forests have well-drained, nutrient rich soils, including stream bottom forests, floodplain forests, and periodically flooded alluvial swamps adjacent to rivers or streams. This forest typically includes bitternut hickory, silver maple, cottonwood, pin oak, green ash, sycamore, boxelder, sensitive fern, white snakeroot, and false nettle. These temporarily flooded, deciduous forests vary in the diversity of shrub and groundcover layers. Low floodplains and levees along major rivers include silver maple, cottonwood, sensitive ferns, and nettles. Alluvial flood plains of small and mid-gradient rivers include pin oak, green ash, sycamore, boxelder, white snakeroot, sensitive fern, and false nettle.

Low Floodplain Forests are still found along the Connecticut River. Best examples include Wangunk Meadows Wildlife Management Area (Portland) and Folly Brook Natural Area (Wethersfield), Great Meadows Land Trust (Wethersfield). Few examples of high Floodplain Forests remain. They were historically fragmented by agricultural activities because they are typically found on prime soils. Examples are found at Fisher's Meadow Park (Avon). Alluvial Floodplain Forests, along small and mid-gradient rivers, are found at Quinnipiac River State Park (North Haven and Wallingford), Nepaug State Forest (New Hartford), and Satan's Kingdom (New Hartford).

Forested Inland Wetland (Habitat 4)
GCN Species by Taxon

Mammal

Most Important
- Eastern Small-footed Bat
- Hoary Bat
- Indiana Bat
- Red Bat
- Silver-haired Bat
- Southern Bog Lemming

Very Important
- Bobcat
- Northern Water Shrew

Important
- Black Bear
- Eastern Pipistrelle
- Hairy-tailed Mole
- Little Brown Bat
- Mink
- Northern Long-eared Bat

Bird

Very Important
- American Black Duck
- American Woodcock
- Black-billed Cuckoo
- Black-throated Blue Warbler
- Canada Warbler
- Cerulean Warbler
- Chestnut-sided Warbler
- Green Heron
- Hermit Thrush
- Hooded Merganser
- Least Flycatcher
- Northern Saw-whet Owl
- Rose-breasted Grosbeak
- Yellow-billed Cuckoo

Bird (cont.)

Important
- American Redstart
- Baltimore Oriole
- Barred Owl
- Black-throated Green Warbler
- Broad-winged Hawk
- Eastern Kingbird
- Eastern Screech-owl
- Gray-cheeked Thrush
- Great Blue Heron
- Louisiana Waterthrush
- Northern Flicker
- Northern Parula
- Northern Waterthrush
- Purple Martin
- Red-shouldered Hawk
- Veery
- Winter Wren
- Yellow-throated Vireo

Reptile/Amphibian

Most Important
- Blue-spotted salamander (diploid)
- Eastern Spadefoot

Very Important
- Blue-spotted Salamander (complex)
- Eastern Box Turtle
- Eastern Ribbonsnake
- Spotted Turtle
- Wood Turtle

Important
- Eastern Newt
- Fowler's Toad
- Marbled Salamander
- Spotted Salamander
- Wood Frog

Invertebrate

Most Important
- Hessel's Hairstreak

Very Important
- Pink Streak
- Two-spotted Skipper

Important
- Annointed Sallow Moth
- *Bembidion semicinctum*
- *Brachinus cyanipennis*
- *Carabus vinctus*
- Coastal Pond Amphipod
- *Goniops chrysocoma*
- Gray Comma
- *Hybomitra trepida*
- *Hybomitra typhus*
- *Lemmer's Noctuid Moth*
- *Loxandrus vitiosus*
- Mystic Valley Amphipod

Threats Affecting GCN Species in Forested Inland Wetland Habitat

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive plants and wildlife (e.g., *phragmites*, purple loosestrife, mute swan).

- Loss of wetland habitat from historic filling, dredging, and ditching.

- Loss of habitat value due to hydrologic impacts from development, new roads, impervious surfaces, and culverts.

Priority Research/ Survey/ Monitoring Needs for Forested Inland Wetland Habitat

- Monitor population trends of GCN bird species (e.g., cerulean warbler) that are not well covered by BBS efforts. *Measure:* number of species added to improved monitoring protocols.

- Determine the population status, distribution, and breeding success of the American woodcock. *Measure:* quantify and map breeding population of American woodcock and produce and update conservation plans.

- Enhance inventory and conservation efforts for butterfly species. *Measure:* number of new monitoring sites or species protocols established.

- Determine the distribution, abundance, and breeding success of American black ducks and assess winter habitat use. *Measure:* quantify and map breeding population and winter habitats of American black ducks and produce and update conservation plans.

- Determine the population status and distribution of yellow-billed and black-billed cuckoos. *Measure:* number of GIS data layers produced of all known nesting sites; develop effective monitoring protocols.

- Monitor GCN freshwater wetland birds in coordination with Partners In Flight and Colonial Bird Monitoring protocols. *Measure:* number of sites monitored in Connecticut.

- Determine distribution, abundance, habitat requirements, and demography of southern bog lemmings. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

- Determine the life history, abundance, distribution, and habitat requirements for GCN bat species, especially Indiana bats. *Measure:* number of GIS data layers produced; number of life history measures established.

- Determine and map the distribution of blue-spotted salamander (diploid) populations. *Measure:* number of GIS data layers produced.

- Determine eastern box turtle distribution, habitat use, and demographics, as well as identify core populations and evaluate their long-term viability. *Measure:* number of GIS data layers produced; number of acres surveyed; number of new sites surveyed; compilation of new data collected on distribution; number of eastern box turtles located; number of life history measures established.

- Determine distribution and abundance, habitat requirements, and demography of northern water shrews. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

Priority Conservation Actions for Forested Inland Wetland Habitat

- Conserve and increase breeding populations of GCN freshwater wetland birds. *Measure:* number of breeding pairs identified statewide.

- Conserve temporary and vernal pool breeding sites and their surrounding upland habitats. *Measure:* number of vernal pools identified and protected.

- Promote public awareness of the vulnerability of box turtle populations and the negative impacts of removing turtles from the wild. *Measure:* number of media and outreach products developed; number of presentations given.

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN moth species for which data is collected and incorporated into a database.

- Develop a statewide database for tabanid and syrphid flies that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN fly species for which data is collected and incorporated into a database.

Shrub Inland Wetland – Habitat 5

Shrub Inland Wetland

Description, Location, and Condition of Shrub Inland Wetland Habitat

Shrub Inland Wetlands are dominated by wetland soils and woody vegetation greater than 1.5 feet and less than 20 feet in height, arranged individually or clumped. The shrub layer generally forms more than 25% of the canopy cover, with whatever trees are present forming less than 25% of the canopy. This habitat includes shrub thickets, bogs, and fens. Shrub thickets are variable in composition and include red maple sapling swamps, willow and alder thickets, and highbush blueberry/swamp azalea swamps. Bogs and fens are natural peatlands that occur in topographic basins influenced by ground water. Spring fens are characterized by saturated wetland soils that receive groundwater discharge throughout the year. Of these, bogs and fens are most imperiled and are considered important to wildlife.

The topography is generally hummocky, with a herbaceous layer that includes wetland plants, grasses, sedges, ferns, and mosses. Typical vegetation may include bog birch, hoary willow, silky dogwood, leatherleaf, highbush blueberry, black huckleberry, sweet gale, black spruce, bog cinquefoil, sedges, white beak sedge, beaked spikerush, cattails, rushes, bog moss, sundew, marsh St. Johnswort, and cinnamon fern.

The overall status and distribution of Shrub Inland Wetland habitats in Connecticut is not well known at this time. Most of Connecticut's bogs have escaped serious degradation. However, nutrient input from surrounding development and beaver impoundments threatens some occurrences. Still, bogs, fens and seeps are grouped together as one of Connecticut's thirteen most imperiled ecosystems. There are several imperiled plants associated exclusively with these habitats and imperiled wildlife includes a variety of invertebrates, amphibians, and the southern bog lemming (Metzler and Wagner 1998).

Bogs, seeps and fens are vegetatively diverse and found throughout Connecticut; however, they are not abundant. Bogs are found primarily in Litchfield County, with a few scattered occurrences in New Haven and Hartford Counties. Scattered examples of non-calcareous fens may be found throughout Connecticut, except in the western Marble Valleys (see Calcareous Spring Fens in Habitat 6). Sea-level fens develop where sufficient upland groundwater discharge occurs adjacent to an estuarine marsh. Seeps are scattered throughout Connecticut, within forested habitats.

Examples of bogs in fair to good condition are mostly closed to the public. Few bogs, like Mohawk Mountain Black Spruce Bog (Cornwall), have public access.

Fens are less widespread than Bogs, with some in good condition and others threatened by development. Rich fens are small and plagued by invasive species; the condition of acidic fens is unknown. Examples of fens are found at Pachaug State Forest (Voluntown), Hampton Reservoir (Hampton), Morey Pond (Ashford), Cromwell Meadows Wildlife Management Area (Cromwell), and Babcock Pond Wildlife Management Area (Colchester). A rare "sea-level fen" is found at Barn Island Wildlife Management Area (Stonington).

Little information on the condition of seeps is available. The scattered seeps are difficult to survey and are probably threatened by water quality impacts from surrounding forest and land use. These seeps are often associated with Sparsely Vegetated Inland Wetland Surface Springs (Habitat 7) that are scattered throughout Connecticut, most of which have been modified by historic human activity.

Shrub Inland Wetland (Habitat 5)
GCN Species by Taxon

Mammal

Most Important
- Eastern Small-footed Bat
- Hoary Bat
- Indiana Bat
- New England Cottontail
- Red Bat
- Silver-haired Bat
- Southern Bog Lemming

Very Important
- Bobcat
- Northern Water Shrew

Important
- Black Bear
- Mink

Bird

Very Important
- Alder Flycatcher
- American Woodcock

Important
- Gray Catbird
- Louisiana Waterthrush
- Northern Waterthrush
- Willow Flycatcher

Reptile/Amphibian

Most Important
- Blue-spotted salamander (diploid)

Very Important
- Blue-spotted Salamander (complex)
- Eastern Box Turtle
- Eastern Ribbonsnake
- Northern Spring Salamander
- Spotted Turtle
- Wood Turtle

Important
- Eastern Newt
- Marbled Salamander
- Northern Dusky Salamander
- Smooth Greensnake
- Spotted Salamander
- Wood Frog

Invertebrate

Most Important
- Banded Bog Skimmer
- Bog Tiger Moth
- *Hybomitra longiglossa*
- Labrador Tea Tentiform Leafminer
- Pitcher Plant Borer Moth
- Yellow Bog Anarta

Very Important
- Crimson-ringed Whiteface
- *Hybomitra frosti*
- Sedge Skipper
- Slender Clearwing
- Two-spotted Skipper

Important
- *Agonum darlingtoni*
- *Agonum mutatum*
- *Atylotus ohioensis*
- *Bembidion quadratulum*
- Bog Copper
- Henry's Elfin
- *Hybomitra lurida*
- *Merycomyia whitneyi*
- Pitcher Plant Moth
- *Sargus fasciatus*
- Ski-tailed Emerald
- *Tabanus fulvicallus*

Threats Affecting GCN Species in Shrub Inland Wetland Habitat

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive plants and wildlife (e.g., *phragmites*, purple loosestrife, mute swan).

- Loss of wetland habitat from historic filling, dredging and ditching.

- Loss of habitat value due to hydrologic impacts from development, new roads, impervious surfaces, and culverts.

Priority Research/ Survey/ Monitoring Needs for Shrub Inland Wetland Habitat

- Determine the life history, abundance, distribution, and habitat requirements for GCN bat species, especially Indiana bats. *Measure:* number of GIS data layers produced; number of life history measures established.

- Enhance inventory and conservation efforts for butterfly species. *Measure:* number of new monitoring sites or species protocols established.

- Enhance inventory and conservation efforts for Odonate species. *Measure:* number of new monitoring sites or species protocols established.

- Determine the population status, distribution, and breeding success of the American woodcock. *Measure:* quantify and map breeding population of American woodcock and produce and update conservation plans.

- Determine distribution and abundance, habitat requirements and demography of northern water shrews. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

- Determine and map the distribution of blue-spotted salamander (diploid) populations. *Measure:* number of GIS data layers produced.

- Determine the status and distribution of GCN ground beetle populations. *Measure:* number of GIS data layers produced; number of areas surveyed; number of species or populations located.

- Determine eastern box turtle distribution, habitat use, and demographics, as well as identify core populations and evaluate their long-term viability. *Measure:* number of GIS data layers produced; number of acres surveyed; number of new sites surveyed; compilation of new data collected on distribution; number of eastern box turtles located; number of life history measures established.

- Determine distribution, abundance, habitat requirements, and demography of southern bog lemmings. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

Priority Conservation Actions for Shrub Inland Wetland Habitat

- Conserve and increase New England cottontails and their habitats. *Measure:* number of habitat areas restored; number of populations located.

- Develop a statewide database for tabanid and syrphid flies that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN fly species for which data is collected and incorporated into a database.

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN moth species for which data is collected and incorporated into a database.

- Promote public awareness of the vulnerability of box turtle populations and the negative impacts of removing turtles from the wild. *Measure:* number of media and outreach products developed; number of presentations given.

- Conserve and increase breeding populations of GCN freshwater and coastal wetland birds. *Measure:* number of breeding pairs identified statewide.

- Conserve and enhance bog turtle populations and their habitats. *Measure:* number of acres protected in buffers, conservation easements, or purchases; number of plans or permits on which DEP has commented; number of cooperative habitat protection projects.

Herbaceous Inland Wetland – Habitat 6

Herbaceous Inland Wetland

Description, Location, and Condition of Herbaceous Inland Wetland Habitat

Herbaceous Inland Wetland habitat is dominated by a herbaceous layer of grasses, forbs, and ferns and includes less than 25% of scattered tree, shrub, and dwarf-shrub cover. This key habitat classification includes two sub-habitats determined to be important to wildlife: **(a) Calcareous Spring Fens** and **(b) Freshwater Marshes**.

The condition of Herbaceous Inland Wetland habitats is poor and declining in Connecticut. Calcareous Spring Fens are one of the 13 most imperiled ecosystems in Connecticut (Metzler and Wagner 1998). Freshwater Marshes are vital and irreplaceable resources in Connecticut. Undisturbed wetlands provide significant habitats for fish and wildlife, and act as buffers between terrestrial and aquatic environments. The ability of these unique areas to moderate effects of flooding and drought, and to trap and filter

sediments, nutrients, and contaminants makes them essential to the protection of water quality and quantity throughout the state.

(a) Calcareous Spring Fens are naturally open wetlands occupying groundwater discharge sites. In the Marble Valleys, the vegetation is influenced by base-rich organic soils with minimal peat accumulation. Typical vegetation includes inland sedge, bristle-stalked sedge, and other kinds of sedges, with scattered shrubs, such as bush cinquefoil and gray dogwood.

Calcareous Spring Fens are rare and limited to western Connecticut, including the western Marble Valleys in Fairfield and Litchfield counties. Historically, these wetlands were impacted by damming, draining, and nutrient input. Although many are now under the protection of The Nature Conservancy, open Calcareous Spring Fens are presently threatened by invasive species (e.g., *phragmites*, purple loosestrife) and natural succession. Nutrient input from non-point sources and poor agricultural practices also remain threats. Examples of Calcareous Spring Fens are found at Beeslick Pond (Salisbury), Benton Hill Fen (Sharon), and Bauer Woods (Salisbury). All three locations are under TNC protection.

(b) Freshwater Marshes are typically adjacent to rivers and streams, and periodically flooded and influenced by run-off from adjacent upland areas. Basin Freshwater Marshes also are found in glacial kettles. Typical plants include cattail, buttonbush, highbush blueberry, water willow, and swamp loosestrife.

Estimates of wetland loss since colonial times vary widely between authors. Metzler and Tiner (1992) contend that Connecticut has lost between one-third and one-half of its original wetlands based on existing data and personal observation of land development across the state. Passage of the Inland Wetlands and Watercourses Act in 1972 greatly slowed the loss of wetlands in the state.

Freshwater Marshes have been and are degraded from a variety of sources, including direct discharges, sedimentation, and contaminated stormwater or groundwater. Ongoing and pending stormwater permit programs will help reduce the effects of stormwater on fresh wetlands. Some emergent wetland areas are man-made. These man-made Freshwater Marshes are well distributed throughout Connecticut. A typical example is found at Charter Marsh (Tolland).

Herbaceous Inland Wetland (Habitat 6)
GCN Species by Taxon

Mammal	Bird	Reptile/Amphibian
Most Important	**Most Important**	**Most Important**
Eastern Small-footed Bat	American Bittern	Blue-spotted salamander (diploid)
Hoary Bat	King Rail	Bog Turtle
Indiana Bat	Least Bittern	**Very Important**
Red Bat	Pied-billed Grebe	Blue-spotted Salamander (complex)
Silver-haired Bat	Sedge Wren	Eastern Box Turtle
Very Important	**Very Important**	Eastern Ribbonsnake
Northern Water Shrew	Alder Flycatcher	Northern Spring Salamander
Important	American Black Duck	Spotted Turtle
Black Bear	Blue-winged Teal	Wood Turtle
Eastern Pipistrelle	Canada Warbler	**Important**
Little Brown Bat	Common Moorhen	Northern Dusky Salamander
Mink	Green Heron	**Fish**
Muskrat	Hooded Merganser	**Most Important**
Northern Long-eared Bat	Marsh Wren	Banded Sunfish
Woodland Vole	Northern Saw-whet Owl	**Invertebrate**
	Sora	**Very Important**
	Important	Sedge Skipper
	Black-crowned Night-heron	Two-spotted Skipper
	Eastern Kingbird	**Important**
	Gray Catbird	*Bembidion pseudocautum*
	Rough-legged Hawk	*Brachinus cyanipennis*
	Virginia Rail	Eyed Brown
	Willow Flycatcher	*Merycomyia whitneyi*
		Newman's Brocade
		Sargus fasciatus

Threats Affecting GCN Species in Herbaceous Inland Wetland Habitat

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Loss of habitat value due to hydrologic impacts from development, new roads, impervious surfaces, and culverts.

- Degradation of habitats by non-native invasive species.

- Loss of early successional habitats through natural succession.

- Loss of wetland habitat from historic filling, dredging, and ditching.

Priority Research/ Survey/ Monitoring Needs for Herbaceous Inland Wetland Habitat

- Determine the life history, abundance, distribution, and habitat requirements of GCN bat species, especially the Indiana bat. *Measure:* number of GIS data layers produced; number of life history measures established.

- Determine the distribution, abundance, and breeding success of American black ducks and assess winter habitat use. *Measure:* quantify and map breeding population and winter habitats of American black duck; produce and update conservation plans.

- Enhance inventory and conservation efforts for butterfly species. *Measure:* number of new monitoring sites or species protocols established.

- Monitor GCN freshwater and coastal wetland birds in coordination with Partners In Flight and Colonial Bird Monitoring protocols. *Measure:* number of sites monitored in Connecticut.

- Determine distribution, abundance, habitat requirements, and demography of northern water shrews. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

- Determine eastern box turtle distribution, habitat use and demographics, as well as identify core populations and evaluate their long-term viability. *Measure:* number of GIS data layers produced; number of acres surveyed; number of new sites surveyed; compilation of new data collected on distribution; number of eastern box turtles located; number of life history measures established.

- Determine and map the distribution of blue-spotted salamander (diploid) populations. *Measure:* number of GIS data layers produced.

- Determine and map the current and historic distribution of bog turtles. *Measure:* number of GIS data layers produced; number of areas surveyed; number of new sites surveyed.

Priority Conservation Actions for Herbaceous Inland Wetland Habitat

- Conserve and increase breeding populations of GCN freshwater and coastal wetland birds. *Measure:* number of breeding pairs identified statewide

- Conserve and enhance bog turtle populations and their habitats. *Measure:* number of acres protected in buffers, conservation easements, or purchases; number of plans or permits commented on; number of cooperative habitat protection projects.

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN moth species for which data is collected and incorporated into a database.

- Develop a statewide database for tabanid and syrphid flies that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN fly species for which data is collected and incorporated into a database.

- Promote public awareness of the vulnerability of box turtle populations and the negative impacts of removing turtles from the wild. *Measure:* number of media and outreach products developed; number of presentations given.

- Implement wetland restoration or enhancement projects that benefit GCN species. *Measure:* number of wetland restoration projects conducted; number of acres restored.

- Implement specialized habitat management techniques to benefit GCN species. *Measure:* number of projects implemented; number of acres managed.

Sparsely Vegetated Inland Wetland – Habitat 7

Sparsely Vegetated Inland Wetland

Description, Location, and Condition of Sparsely Vegetated Inland Wetland Habitat
The **Sparsely Vegetated Inland Wetland** habitat is characterized by open water or open mineral substrates with scattered, if any, plants. This key habitat includes two aquatic communities determined to be important to wildlife: **(a) Surface Springs** and **(b) Vernal Pools.**

The overall status and distribution of Sparsely Vegetated Inland Wetland habitats in Connecticut is not well known at this time. Some are mapped town by town as a consequence of increased residential development in certain areas.

(a) Surface Springs are distributed throughout Connecticut, and are often associated with seeps or cold headwater streams. It is rare to find a Surface Spring with year round runs of more than 50 feet.

Surface Springs are one of Connecticut's 13 most imperiled communities and are found statewide (Metzler and Wagner 1998). It is likely that more than 95% of them have been modified. Historically, these springs were captured by early colonists for a water supply. An example of a Surface Spring is found at Dismal Swamp (Milford). Associated wildlife of conservation concern includes invertebrates and the state-threatened northern spring salamander. Native brook trout also are associated with the cold water streams fed by these springs.

(b) Vernal Pools fill with water seasonally, often with the rising water table in fall and winter, or with meltwater and runoff of snow and spring rain. After containing water for a few months in spring to early summer, Vernal Pools generally, but not always, are dry by late summer.

Vernal Pools of various conditions are scattered throughout Connecticut. They may be found in low areas of forests, in a river or stream floodplain, within vegetated wetlands, in open fields, between coastal dunes, or in other areas where water might pool, such as abandoned quarries or natural rock formations. They are frequently impacted by recreational disturbance. Mining for coarse aggregate for long periods of time has a major impact, modifying habitat distribution and relief. Encroachment by development and discharge from adjacent residential areas have led to habitat loss and degradation in recent years.

Sparsely Vegetated Inland Wetland (Habitat 7) **GCN Species by Taxon**		
Mammal *Most Important* Eastern Small-footed Bat Hoary Bat Indiana Bat Red Bat Silver-haired Bat *Very Important* Northern Water Shrew Woodland Jumping Mouse *Important* Eastern Pipistrelle Little Brown Bat Mink Northern Long-eared Bat **Bird** *Most Important* American Bittern King Rail *Very Important* American Woodcock Sora	**Bird (cont.)** *Important* Barred Owl Eastern Kingbird Great Blue Heron Louisiana Waterthrush Northern Waterthrush Semipalmated Sandpiper **Reptile/Amphibian** *Most Important* Blue-spotted salamander (diploid) Eastern Spadefoot *Very Important* Blue-spotted Salamander (complex) Eastern Box Turtle Eastern Ribbonsnake Jefferson Salamander Northern Spring Salamander Spotted Turtle Wood Turtle	**Reptile/Amphibian (cont.)** *Important* Eastern Newt Fowler's Toad Gray Treefrog Marbled Salamander Northern Dusky Salamander Spotted Salamander Wood Frog **Invertebrate** *Very Important* Sedge Skipper *Important* Clam Shrimp Piedmont Groundwater Amphipod

Threats Affecting GCN Species in Sparsely Vegetated Inland Wetland Habitat

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Loss of habitat value due to hydrologic impacts from development, new roads, impervious surfaces, and culverts.

- Impacts from development to upland migration corridors associated with vernal pools.

- Impacts from development in upland buffers.

- Degradation of habitats by non-native invasive species.

Priority Research/ Survey/ Monitoring Needs for Sparsely Vegetated Inland Wetland Habitat

- Enhance inventory and conservation efforts for butterfly species. *Measure:* number of new monitoring sites or species protocols established.

- Determine the life history, abundance, distribution, and habitat requirements for GCN bat species, especially the Indiana bat. *Measure:* number of GIS data layers produced; number of life history measures established.

- Monitor GCN freshwater wetland birds in coordination with Partners In Flight and Colonial Bird Monitoring protocols. *Measure:* number of sites monitored in Connecticut.

- Determine the population status, distribution, and breeding success of the American woodcock. *Measure:* quantify and map breeding population of American woodcock; produce and update conservation plans.

- Determine distribution and abundance, habitat requirements, and demography of northern water shrews. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

- Determine and map the distribution of blue-spotted salamander (diploid) populations. *Measure:* number of GIS data layers produced.

- Determine eastern box turtle distribution, habitat use, and demographics, as well as identify core populations and evaluate their long-term viability. *Measure:* number of GIS data layers produced; number of acres surveyed; number of new sites surveyed; compilation of new data collected on distribution; number of eastern box turtles located; number of life history measures established.

Priority Conservation Actions for Sparsely Vegetated Inland Wetland Habitat

- Conserve and increase breeding populations of GCN freshwater wetland birds. *Measure:* number of breeding pairs identified statewide.

- Conserve temporary and vernal pool breeding sites and their surrounding upland habitats. *Measure:* number of vernal pools identified; percentage of recommendations implemented.

- Promote public awareness of the vulnerability of eastern box turtle populations and the negative impacts of removing turtles from the wild. *Measure:* number of media and outreach products developed; number of presentations given.

Tidal Wetland – Habitat 8

Tidal Wetland

Description, Location, and Condition of Tidal Wetland Habitat

The **Tidal Wetland** habitat is characterized by diurnally flooded areas, typically dominated by herbaceous plants. However, some may have trees or shrubs or be sparsely vegetated. This key habitat includes two sub-habitats determined to be important to wildlife: **(a) Tidal Wetlands** and **(b) Intertidal Beaches and Shores**.

Connecticut Tidal Wetlands have been reduced by approximately 50% since 1900 through filling, dredging, and ditching activities (Table 4.2). Today, there are approximately 17,500 acres of Tidal Wetlands. Past and ongoing activities contribute to Tidal Wetland habitat degradation.

Table 4.2 Present and historical Tidal Wetland and watercourse acreage in Connecticut.

Category	Acres	Percent of Total Acres
Connecticut total land area	3,116,130	100.0
Watercourses (excluding Long Island Sound)	86,496	2.8
Tidal wetlands	17,500	0.6
Estimated original tidal wetlands (1914)	23,360 (Goodwin and Niering 1966)	0.8

(a) Tidal Wetlands include salt, brackish, and fresh marshes, intertidal flats, and regularly flooded intertidal swamps. The overall condition of these habitats is considered good. The intertidal flats are regularly or irregularly exposed mud or sand areas with sparse to dense vegetation. The vegetation changes with the salinity of the water and with the duration and frequency of flooding throughout the lunar cycle. Different plant associations are found as one habitat grades into another, based on each plant's salinity tolerance range. Microelevational changes are clearly visible in these habitats, with changing plant communities and often sharp ecotones based on plant tolerance to root saturation. Typical salt marsh vegetation includes marsh elder, saltmarsh cordgrass, saltmeadow cordgrass, glasswort, switch grass, and spikegrass. Typical brackish marsh vegetation includes saltmarsh cordgrass, three-square bulrush, narrowleaf cattail, saltmeadow cordgrass, eastern lilaeopsis, salt-marsh bulrush, swamp rose-mallow, switch grass spikegrass, and creeping bentgrass. Typical freshwater tidal marsh vegetation includes wild rice, sweet flag, river bulrush, lake sedge, arrowleaf, sensitive fern, pickerelweed, bluejoint reedgrass, Canadian wild rye, straw-colored nutsedge, and river bulrush.

Tidal Wetlands have been impacted by structures and practices that alter normal tidal flow, such as tide gates, undersized culverts, and mosquito ditches. Restoration efforts have successfully reversed over 2,000 acres of damage caused by these activities. Stormwater runoff from developed lands may carry contaminants and sediments to Tidal Wetlands, interfere with the natural freshwater and saltwater balance, and exacerbate the spread of the invasive reed grass, *Phragmites australis.* Ongoing and pending stormwater permit programs will help regulate and reduce the effects of stormwater on Tidal Wetlands.

Remaining wetland areas are found adjacent to Long Island Sound and reaching upstream on the major rivers and streams under tidal influence. Charles E. Wheeler Wildlife Management Area (Milford) is an example of an outstanding Tidal Wetland. Seven focus areas have been identified for regional conservation priority by the Atlantic Coast Joint Venture Plan (2004).

(b) Intertidal Beaches and Shores are adjacent to these vegetated wetlands, extending from high tide to those areas only occasionally exposed along the coast. Intertidal Beaches and Shore vegetation and associations also vary with the salinity of the flooding waters. These may include three-square bulrush, water hemp, and arrowhead species. Sea rocket and pigweed are mostly found on salt shores and along a few tidal rivers.

Intertidal Beaches and Shores and associated coastal communities are one of the 13 most imperiled ecosystems in Connecticut (Metzler and Wagner 1998). Intertidal Beaches and Shores are usually located adjacent to the vegetative Tidal Wetlands along Long Island Sound. Most sandy beaches are under private ownership. Public access to certain sandy beaches needs to be limited because this habitat is important to many GCN species. Examples of Intertidal Beaches and Shores are found at Hammonasset Beach State Park (Clinton), Milford Point (Milford), and Bluff Point Coastal Reserve (Groton).

Tidal Wetland (Habitat 8)
GCN Species by Taxon

Mammal
Most Important
  Least Shrew
Important
  Mink
  Muskrat

Bird
Most Important
  American Bittern
  Barn Owl
  Great Egret
  Horned Lark
  King Rail
  Least Bittern
  Least Tern
  Little Blue Heron
  Northern Harrier
  Pied-billed Grebe
  Piping Plover
  Roseate Tern
  Saltmarsh Sharp-tailed Sparrow
  Seaside Sparrow
Very Important
  American Black Duck
  American Oystercatcher
  Black Rail
  Blue-winged Teal
  Clapper Rail
  Common Tern
  Glossy Ibis
  Greater Scaup
  Hooded Merganser
  Ipswich Sparrow
  Long-eared Owl
  Long-tailed Duck
  Marsh Wren
  Peregrine Falcon
  Short-eared Owl
  Snowy Egret
  Sora
  Yellow-crowned Night-heron

Bird (cont.)
Important
  Bank Swallow
  Belted Kingfisher
  Black Skimmer
  Black-crowned Night-heron
  Canvasback
  Great Blue Heron
  Lesser Scaup
  Northern Rough-winged Swallow
  Osprey
  Purple Martin
  Rough-legged Hawk
  Ruddy Turnstone
  Sanderling
  Semipalmated Sandpiper
  Snowy Owl
  Spotted Sandpiper
  Virginia Rail
  Willet

Reptile/Amphibian
Very Important
  Eastern Box Turtle
  Eastern Ribbonsnake
  Spotted Turtle
  Wood Turtle
Important
  Diamond-backed Terrapin
  Fowler's Toad

Fish
Most Important
  American Eel
  Atlantic Sturgeon
  Atlantic Tomcod
  Cunner
  Longhorn Sculpin
  Rainbow Smelt
  Shortnose Sturgeon
  Tautog
  Windowpane Flounder
  Winter Flounder

Fish (cont.)
Very Important
  Fourspine Stickleback
  Hickory Shad
  Mummichog
  Spotfin Killifish
Important
  Atlantic Silversides
  Bay Anchovy
  Hogchoker
  Lined Seahorse
  Oyster Toadfish
  Sheepshead Minnow
  Striped Bass

Invertebrate
Most Important
  Bay Scallop
  Eastern Oyster
  Horseshoe Crab
  Puritan Tiger Beetle
Very Important
  Blue Crab
  Blue Mussel
  Channeled Whelk
  Coastal Heathland Cutworm
  Green Crab
  Knobbed Whelk
  Lady Crab
  Rock Crab
  Soft Shell Clam
Important
  Cicindela marginata
  Coastal Mud Shrimp
  Common Razor Clam
  Dark-bellied Tiger Beetle
  Fiddler Crabs
  Flat Claw Hermit Crab
  Ghost Shrimp
  Grass Shrimp
  Hairy-necked Tiger Beetle
  Jonah Crab
  Maritime Sunflower Borer
  Mud Crabs
  Sand Shrimp
  Seaside Goldenrod Stem Borer
  Shore Shrimp
  Spartina Borer Moth
  Spider Crab
  Spotted Dart
  Starfish spp.

Threats Affecting GCN Species in Tidal Wetland Habitat

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Disturbance, destruction, alteration, or loss of critical habitat structure or function.

- Loss of habitat value due to hydrologic impacts from development, new roads, impervious surfaces, and culverts.

- Degradation of habitats by non-native invasive plants and wildlife (e.g., *phragmites*, purple loosestrife, mute swan).

- Loss of wetland habitat from historic filling, dredging, and ditching.

- Impacts from human disturbance.

- Impacts from development to upland buffers.

- Unauthorized use of motorized vehicles (e.g., jet skis, boats) that disturb wildlife.

- Adverse impacts from temperature shifts, including widespread long-term (e.g., global warming) and local short-term impacts (temporary power plant shutdowns).

- Effects of residual levels of pollution in sediments, water contamination, nutrients and pesticides.

Priority Research/ Survey/ Monitoring Needs for Tidal Wetland Habitat

- Conserve existing populations of least shrews and determine statewide distribution and abundance. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

- Determine the status and distribution of breeding populations of saltmarsh sharp-tailed sparrows. *Measure:* number of GIS data layers produced of all known sites; prodtion of effective monitoring protocols.

- Determine the distribution, abundance and breeding success of American black ducks and assess winter habitat use. *Measure:* quantify and map breeding population and winter habitats of American black ducks; produce and update conservation plans.

- Monitor GCN coastal wetland birds in coordination with Partners In Flight and Colonial Bird Monitoring protocols. *Measure:* number of sites monitored in Connecticut

- Identify and map estuarine habitats, particularly spawning and nursery habitats, and quantify their use by estuarine species. *Measure:* number of GIS data layers produced; number of use assessments produced.

- Determine the value of estuarine habitats to resident fish and invertebrate populations. *Measure:* number of estuarine habitats evaluated.

- Determine and monitor the distribution, abundance, habitat use, and condition of GCN estuarine invertebrate species. *Measure:* number of GIS data layers produced; number of areas surveyed; number of species or populations located; compilation of new data collected.

Priority Conservation Actions for Tidal Wetland Habitat

- Conserve and increase breeding populations of GCN freshwater and coastal wetland birds. *Measure:* number of breeding pairs identified statewide.

- Identify, protect, and manage the diamond-backed terrapin populations. *Measure:* number of nesting sites identified; number of GIS data layers produced; quantify new information on distribution.

- Conserve and increase breeding populations of GCN colonial or beach nesting birds. *Measure:* number of known breeding pairs statewide based on regional triennial surveys.

- When pesticides must be used, encourage the use of those that have minimal effect on non-target species and the environment. *Measure:* number of technical assistance or outreach products developed and distributed; number of presentations given; meetings attended.

- Minimize disturbance of spawning habitat of horseshoe crabs. *Measure:* number of technical assistance or outreach products developed and distributed; number of spawning areas protected.

- Protect habitat in coastal coves and embayments that historically supported bay scallop populations. *Measure:* number of impact assessments conducted; number of habitat protection plans developed and implemented.

- Work with the DEP Environmental Quality Branch to mitigate the effects of residual levels of sediment pollution, water contamination, nutrients, and pesticides. *Measure:* number of mitigation strategies developed and implemented.

- Identify, monitor, and develop management plans to protect Puritan tiger beetle populations and their habitat. *Measure*: number of plans or permits on which the DEP has commented; number of cooperative habitat protection projects; number of project partnerships established.
- Implement wetland restoration or enhancement projects that benefit GCN species. *Measure:* number of wetland projects completed; number of acres restored or enhanced.

Freshwater Aquatic – Habitat 9

Freshwater Aquatic

Description, Location, and Condition of Freshwater Aquatic Habitat

Freshwater Aquatic habitats in Connecticut encompass a variety of bodies of water including large rivers, streams, lakes, and ponds. These include both vegetated shorelines and non-vegetated habitats. The vegetation may be either emergent or submerged. There are 15,000 miles of rivers and streams and 6,000 lakes and ponds in Connecticut and their current water quality data and maps are available through the Connecticut DEP Bureau of Water management (BWM) Rotating Basin Strategy and Lakes and Ponds Survey Program. This key habitat classification includes six sub-habitats determined to be important to wildlife: **(a) Large Rivers and Streams and Their Associated Riparian Zones, (b) Unrestricted Free-flowing Streams, (c) Cold Water Streams, (d) Head-of-Tide, (e) Lakes and their Shorelines,** and **(f) Coastal Plain Ponds.**

All freshwater aquatic habitats were addressed a sub-habitats of Habitat 9, as a matter of convenience. When considering comparative ecological units, each of these aquatic sub-habitats is analogous to the previously mentioned terrestrial habitats (i.e. Habitats 1 through 8).

Description, Location, and Condition of Large Rivers and Streams and their Associated Riparian Zones (Habitat 9a)

(a) The Large Rivers and Streams and their Associated Riparian Zones support a diverse assemblage of fishes, including resident and diadromous species and marine visitors. These deep freshwater habitats provide adult holding areas, migration staging areas, and foraging and spawning areas for many fish. The associated riparian zone includes flood-scoured rocky and gravelly riverbanks, riverside seeps, and riverside outcrops. Indicator communities in inland reaches are fish such as largemouth bass, smallmouth bass, redbreast sunfish, white and channel catfish, American eel, and spottail shiner. Seasonal diadromous indicator fish include American shad, blueback herring, alewives, and sea lamprey. Indicator communities in the lower estuaries include marine and estuarine fishes, such as striped bass, winter flounder, mummichog, tomcod, and hogchoker.

Connecticut contains a few large rivers, most notably the Connecticut, Housatonic, and Thames Rivers (and their major tributaries). Most of these habitats have been altered due to dam construction, navigational dredging, and consumptive water use. Development of upstream and downstream fish passage on many rivers has been initiated, leading toward restoration of riverine migratory corridors. Dam removal efforts that have recently been undertaken also restore habitat connectivity. Progress should continue on all fronts to restore riverine habitat conditions for the benefit of fish and wildlife resources.

The Connecticut River is our best example of a Large River. It includes large areas of open water and deep water, as well as associated floodplain forests, erosional banks, sand bars, and alluvial marshes. Numerous rare taxa have turned up in and along the Connecticut River the last decade as a result of improving water quality over the last 30 years. Portions of the Shetucket and Farmington Rivers also provide examples of viable Large River habitats. Large Rivers and Streams and their Associated Riparian Zones are considered one of the 13 most imperiled habitats in Connecticut (Metzler and Wagner 1998). Riverside development, water diversion, and discharges are the major threats to this ecosystem.

The overall condition of the habitat and living resources in our major rivers is generally best in the Connecticut River due to less industrial development and fewer dams. Other large rivers are impacted to a greater degree by dams (Housatonic, Shetucket, Farmington), pollution (PCBs in the Housatonic), and highly developed shorelines (Thames).

Large Rivers and their Riparian Zones (Habitat 9a)
GCN Species by Taxon

Mammal

Most Important
  Eastern Small-footed Bat
  Hoary Bat
  Indiana Bat
  Red Bat
  Silver-haired Bat
Very Important
  Meadow Jumping Mouse
Important
  Black Bear
  Eastern Pipistrelle
  Little Brown Bat
  Long-tailed Weasel
  Mink
  Muskrat
  Northern Long-eared Bat
  Short-tailed Weasel

Bird

Most Important
  Pied-billed Grebe
Very Important
  Alder Flycatcher
  American Black Duck
  American Woodcock
  Bald Eagle
  Black-and-white Warbler
  Blue-winged Teal
  Canada Warbler
  Cerulean Warbler
  Greater Scaup
  Least Flycatcher
Important
  American Redstart
  Bank Swallow
  Barred Owl
  Belted Kingfisher
  Blue-gray Gnatcatcher
  Canvasback
  Cliff Swallow
  Common Merganser
  Eastern Kingbird
  Eastern Screech-owl
  Great Cormorant
  Hooded Warbler
  Lesser Scaup
  Louisiana Waterthrush
  Northern Rough-winged Swallow
  Northern Waterthrush
  Orchard Oriole
  Osprey
  Red-necked Grebe
  Warbling Vireo
  Willow Flycatcher
  Yellow-throated Vireo

Reptile/Amphibian

Most Important
  Blue-spotted Salamander (diploid)
  Eastern Spadefoot
Very Important
  Blue-spotted Salamander (complex)
  Eastern Box Turtle
  Eastern Ribbonsnake
  Spotted Turtle
  Wood Turtle
Important
  Fowler's Toad

Fish

Most Important
  Alewife
  American Eel
  Atlantic Sturgeon
  Atlantic Tomcod
  Blueback Herring
  Burbot
  Rainbow Smelt
  Shortnose Sturgeon
Very Important
  American Shad
  Atlantic Salmon
  Chain Pickerel
  Fourspine Stickleback
  Hickory Shad
  Menhaden
  Sea Lamprey
Important
  Black Crappie
  Golden Shiner
  Hogchoker
  Largemouth Bass
  Pumpkinseed
  Redbreast Sunfish
  Smallmouth Bass
  Striped Bass
  White Sucker
  Yellow Perch

Invertebrate

Most Important
  Brook Floater
  Dwarf Wedge Mussel
  Puritan Tiger Beetle
  Virginia River Snail
Very Important
  Blue Crab
  Midland Clubtail
  Riverine Clubtail
  Sedge Skipper
  Tidewater Mucket
  Two-spotted Skipper
Important
  American Rubyspot
  Baetisca lacustris
  Baetisca obesa
  Bembidion carinula
  Bembidion lacunarium
  Brachinus fumans
  Brachinus medius
  Brachinus ovipennis
  Cicindela marginata
  Cobra Clubtail
  Dark-bellied Tiger Beetle
  Eastern Pearlshell
  Eastern Pond Mussel
  Fiddler Crabs
  Grass Shrimp
  Hairy-necked Tiger Beetle
  Lymnaeid Snail
  Nebria lacustris lacustris
  Sand Shrimp
  Shore Shrimp
  Skillet Clubtail
  Slender Walker
  Walker's Tusked Sprawler
  Woodland Pondsnail
  Yellow Lampmussel

Threats Affecting GCN Species in Large Rivers and Streams and their Associated Riparian Zones (Habitat 9a)

- Insufficient scientific knowledge regarding wildlife, freshwater, diadromous, and marine fish species and their habitats (distribution, abundance, and condition).

- Loss, degradation or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species (e.g., bowfin, asiatic clams).

- Degradation, alteration, and loss of habitat due to stream channel modifications, channelization, filling, dredging, development, vegetation control, and shoreline modification.

- Fragmentation of populations and loss of access to upstream and spawning habitat due to impediments to fish movements, such as dams, barriers, culverts, and tide gates.

- Impacts of water diversions that reduce stream flows, resulting in fish mortality, loss of habitat, and interference with migration.

- Impacts of point and non-point source pollution.

- Impacts to prey species from predation by striped bass in the Connecticut River

Priority Research/ Survey/ Monitoring Needs for Large Rivers and Streams and their Associated Riparian Zones (Habitat 9a)

- Research the effect of riparian buffer width on quality and stability of habitat in aquatic systems. *Measure:* number of before-and-after or correlation studies designed, funded, and conducted; appropriate buffer dimensions determined.

- Research effects of drawdowns, dredging, and other vegetation control activities. *Measure:* number of before-and-after or correlation studies designed, funded, and conducted; and number of BMPs developed and implemented.

- Identify and quantify threats to the survival of GCN species. *Measure:* number of threats identified; number of life history measures established.

- Research the basic ecology, biology, behavior, and population dynamics of GCN species. *Measure:* number of life history measures established.

- Identify existing free-flowing systems at-risk. *Measure:* number of risk assessments conducted; number of GIS data layers produced.

- Determine and map the distribution of blue-spotted salamander (diploid) populations. *Measure:* number of GIS data layers produced.

- Determine the status and distribution of GCN ground beetle populations. *Measure*: number of GIS data layers produced; number of areas surveyed; number of species or populations located.

- Enhance inventory and conservation efforts for butterfly species. *Measure*: number of new monitoring sites or species protocols established.

- Enhance inventory and conservation efforts for freshwater mussels. *Measure*: number of areas surveyed; number of new survey sites; number of species or populations located.

- Enhance inventory and conservation efforts for Odonate species. *Measure*: number of new monitoring sites or species protocols established.

- Determine the population status, distribution, and breeding success of the American woodcock. *Measure*: quantify and map breeding populations of American woodcock; produce and update conservation plans.

- Determine eastern box turtle distribution, habitat use, and demographics, as well as identify core populations and evaluate their long-term viability. *Measure*: number of GIS data layers produced; number of acres surveyed; number of new sites surveyed; compilation of new data collected on distribution; number of eastern box turtles located; number of life history measures established.

- Monitor GCN freshwater and coastal wetland birds in coordination with Partners In Flight and Colonial Bird Monitoring protocols. *Measure*: number of sites monitored in Connecticut.

- Determine the life history, abundance, distribution and habitat requirements for GCN bat species, especially the Indiana bat. *Measure*: number of GIS data layers produced; number of life history measures established.

- Determine the distribution, abundance and breeding success of American black ducks and assess winter habitat use. *Measure*: quantify and map breeding population and winter habitats of American black ducks; produce and update conservation plans.

Priority Conservation Actions for Large Rivers and Streams and their Associated Riparian Zones (Habitat 9a)

- Remove dams and barriers where appropriate. *Measure:* number of dams and barriers removed; number of stream miles restored.

- Encourage property owners to maintain natural shoreline habitat (e.g., riparian and shallow water vegetation, downed trees). *Measure:* number of media or outreach products developed; number of shoreline miles enhanced or restored.

- Encourage cooperation among agencies (DEP divisions, local governments, etc.) and other stakeholders to protect free-flowing streams from over-allocation of surface and groundwater resources. *Measure:* number of media or outreach products developed; number of presentations given; number of stakeholders contacted or assisted.

- Build fishways or refine methods for providing upstream passage where appropriate. *Measure:* number of fishways designed, funded or constructed.

- Assess the effectiveness of existing facilities to pass fish. *Measure:* number of sites surveyed; number of species and populations located; number of facilities identified as effective or ineffective for fish passage.

- Develop new populations in areas where native populations have been extirpated. *Measure:* number of fish captured and relocated to appropriate areas.

- Implement plan to prioritize and address problems caused by invasive aquatic nuisance species. *Measure:* number of media or outreach products developed; number of enforcement, monitoring efforts; rapid response, and control efforts undertaken.

- Provide technical assistance to regulatory staff to minimize impacts of fish entrainment at industrial water intakes. *Measure:* number of media or outreach products developed; number of presentations given; number of regulatory staff contacted or assisted.

- Promote public awareness of the vulnerability of eastern box turtle populations and the negative impacts of removing box turtles from the wild. *Measure*: number of media or outreach products developed; number of presentations given.

- Conserve and increase breeding populations of GCN freshwater wetland birds. *Measure*: number of breeding pairs identified statewide.

- Identify, monitor, and develop management plans to protect Puritan tiger beetle populations and their habitat. *Measure*: number of plans or permits on which the DEP has commented; number of cooperative habitat protection projects; number of project partnerships established.

Description, Location, and Condition of Unrestricted, Free-flowing Streams (Habitat 9b)

 (b) Unrestricted, Free-flowing Streams include riffles, rapids, and other mesohabitats that are unaffected by dams. Many support runs of anadromous fish. These habitats also support many of the indigenous fish of Connecticut because they depend on the habitats to complete their life cycle. Indicator communities include fishes such as white sucker, brown trout, fallfish, creek chub, cutlips minnow, smallmouth bass, redbreast sunfish, American eel, and grass pickerel.

There are no large undammed rivers in Connecticut. Damming changes sedimentation patterns and seasonal water flow, which is critical to the welfare of many freshwater mussels and certain life cycle stages of mayflies and dragonflies. Seasonal and daily flow changes also impact spawning of anadromous and resident fishes and can influence water temperatures, thus affecting survival of salmonids. Floodplain vegetation and sediment deposition also are impacted by regulated water flow and discharges.

Unrestricted, Free-flowing Streams are included as one of the 13 most imperiled ecosystems in Connecticut (Metzler and Wagner 1998). Nearly all of the state's streams

have been influenced by damming and the regulation of discharges and diversions. Segments of Hollenbeck River (South Canaan to Cornwall), Moore Brook (Salisbury), Eight-Mile River (East Hadaam, Salem, Lyme), Moodus River (East Hadaam), and Natchaug River (Eastford, Chaplin, Mansfield, Windham) provide examples of Unrestricted, Free-flowing Stream habitat.

The overall condition of the longer free-flowing stream segments in Connecticut is only fair due to the influence of upstream impoundments, water diversions, and development in the watersheds, all of which affect seasonal flows and water temperatures. Smaller free-flowing streams are still common and many are in relatively good condition. These waters need to be protected in order to conserve fluvial dependent biota.

Unrestricted, Free-flowing Streams (Habitat 9b)
GCN Species by Taxon

Mammal
Most Important
Eastern Small-footed Bat
Hoary Bat
Indiana Bat
Red Bat
Silver-haired Bat
Very Important
Northern Water Shrew
Woodland Jumping Mouse
Important
Eastern Pipistrelle
Little Brown Bat
Mink
Northern Long-eared Bat

Bird
Very Important
American Black Duck
Blue-winged Warbler
Hooded merganser
Important
Bank Swallow
Belted Kingfisher
Common Merganser
Louisiana Waterthrush
Northern Rough-winged Swallow
Olive-sided Flycatcher
Spotted Sandpiper
Warbling Vireo

Reptile/Amphibian
Most Important
Blue-spotted Salamander(diploid)
Very Important
Blue-spotted Salamander (complex)
Eastern Ribbonsnake
Northern Spring Salamander
Spotted Turtle
Wood Turtle
Important
Northern Dusky Salamander

Fish
Most Important
Alewife
American Brook Lamprey
American Eel
Atlantic Sturgeon
Blueback Herring
Bridle Shiner
Brook Trout (wild)
Brown Trout (wild)
Burbot
Rainbow Smelt
Shortnose Sturgeon
Swamp Darter
Very Important
Atlantic Salmon
Chain Pickerel
Creek Chubsucker
Fourspine Stickleback
Hickory Shad
Menhaden
Redfin Pickerel
Sea Lamprey

Fish (cont.)
Important
Black Crappie
Blacknose Dace
Common Shiner
Cutlips Minnow
Fallfish
Golden Shiner
Largemouth Bass
Longnose Dace
Pumpkinseed
Redbreast Sunfish
Smallmouth Bass
Striped Bass
White Sucker
Yellow Perch

Invertebrate
Most Important
Brook Floater
Dwarf Wedge Mussel
Important
American Rubyspot
Bembidion simplex
Brachinus fumans
Brachinus medius
Brachinus ovipennis
Cinygmula subaequalis
Eastern Pearlshell
Eastern Pond Mussel
Lymnaeid Snail
Sparkling Jewelwing

Threats Affecting GCN Species in Unrestricted, Free-flowing Streams (Habitat 9b)

- Insufficient scientific knowledge regarding wildlife and freshwater, diadromous, and marine fish species and their habitats (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species (e.g., yellow bullhead, goldfish, baitfish).

- Loss of habitat value due to hydrologic impacts from development, new roads, impervious surfaces, and culverts.

- Impacts of water diversions that reduce stream flows, resulting in fish mortality, loss of habitat, and interference with migration.

- Impacts to and loss of riparian habitat for wildlife corridors and insufficient buffer requirements to protect streams.

- Degradation, alteration, and loss of habitat due to stream channel modifications, channelization, filling, dredging, development, vegetation control, and shoreline modification.

- Fragmentation of populations and loss of access to upstream and spawning habitat due to impediments to fish movements, such as dams, barriers, culverts, and tide gates.

Priority Research/ Survey/ Monitoring Needs for Unrestricted, Free-flowing Streams (Habitat 9b)

- Determine fidelity of GCN fish to individual sites. *Measure:* number of areas surveyed; number of species or populations located; number of GIS data layers produced; number of life history measures established.

- Research the effect of riparian buffer width on quality and stability of habitat in aquatic systems. *Measure:* number of before-and-after or correlation studies designed; funded and conducted; appropriate buffer dimensions determined.

- Use genetic testing to determine if fish populations (e.g., burbot, brook lamprey) in Connecticut represent remnant (relic) populations vs. temporary range expansions. *Measure:* number of fish populations identified as remnant populations or temporary range expansions.

- Perform genetic analysis of selected trout populations to identify successful wild and hatchery strains and to determine if native strains still exist. *Measure:* number of sites surveyed; number of species or populations sampled; number of wild and hatchery strains identified; number of native strains identified.

- Enhance inventory and conservation efforts for freshwater mussels. *Measure*: number of areas surveyed; number of new survey sites; number of species or populations located.

- Evaluate performance of stocked Atlantic salmon in Connecticut habitat. *Measure:* number of marking and research projects designed, funded or conducted.

- Identify and quantify surface springs, seeps, coldwater streams and thermal refuges. *Measure:* number of sites surveyed; number of GIS data layers produced.

- Identify existing free-flowing systems at-risk. *Measure:* number of risk assessments conducted; number of GIS data layers produced.

- Determine and map the distribution of blue-spotted salamander (diploid) populations. *Measure:* number of GIS data layers produced.

- Determine the status and distribution of GCN ground beetle populations. *Measure*: number of GIS data layers produced; number of areas surveyed; number of species or populations located.

- Collect data on trout populations in rapidly developing watersheds where data are currently unavailable. *Measure:* number of development areas identified; number of sites surveyed; number of species or populations located; number of GIS data layers produced.

- Enhance inventory and conservation efforts for Odonate species. *Measure*: number of new monitoring sites or species protocols established.

- Determine distribution, abundance, habitat requirements, and demography of northern water shrews. *Measure*: number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

- Determine the life history, abundance, distribution and habitat requirements for GCN bat species, especially the Indiana bat. *Measure*: number of GIS data layers produced; number of life history measures established.

- Determine the distribution, abundance, and breeding success of American black ducks and assess winter habitat use. *Measure*: quantify and map breeding population and winter habitats of American black ducks; produce/update conservation plans.

- Determine the population status, distribution, and breeding success of the American woodcock. *Measure*: quantify and map breeding populations of American woodcock; produce and update conservation plans.

Priority Conservation Actions of Unrestricted, Free-flowing Streams (Habitat 9b)

- Stock trout strains most likely to establish self-sustaining wild populations into waters selected for special management. *Measure:* number of fish produced and released.

- Avoid stocking domestic trout on top of significant wild populations. *Measure:* criteria developed for identifying significant wild populations.

- Continue stocking juvenile life stages of Atlantic salmon. *Measure:* number of fish produced and released.

- Implement plan to prioritize and address problems caused by invasive aquatic nuisance species. *Measure:* number of media or outreach products developed; enforcement, monitoring, rapid response, and control efforts undertaken.

Description, Location, and Condition of Cold Water Streams (Habitat 9c)

(c) Cold Water Streams are rapidly flowing clear waters with gravelly or cobbly substrate. They include the smaller (< 30 ft wide) perennial streams located at the

headwaters of drainage systems, surface springs, seeps, and thermal refuges. These habitats support many of Connecticut's most sensitive fish, including the slimy sculpin and brook trout. These habitats have permanently flooded vegetation and riverweed is often the only vascular plant present, forming a low algal-like crust on submerged rocks. Some of the community indicator members are brook trout, slimy sculpin, white sucker, common shiner, blacknose dace, longnose dace, and tessellated darter.

Cold Water Streams are very sensitive areas that are often overlooked by local land use commissions. The overall health of a watershed depends on the conditions of its headwater streams. Cold Water Streams in Connecticut are typically associated with undeveloped forested areas, where shade from the forest canopy and inflow from groundwater and undisturbed wetlands maintain stable and suitable water temperatures, especially during summer. Cold Water Streams and undisturbed wetlands are most prevalent in rural areas. These habitats are largely non-existent in urban areas and are diminishing in suburban areas. Future suburban sprawl into outlying areas represents a long-term threat to these aquatic habitats. Localized riparian mismanagement and other anthropogenic actions (e.g., general development, road maintenance) represent threats to these habitats elsewhere. The distribution of typical riverweed vegetation is currently unknown due to its inconspicuous growth. It would serve, however, as a good indicator of the health of this easily perturbed habitat because of its response to poor water quality. Riverweed generally has little competition from other plants, although in some streams a variety of submerged bryophytes occur.

The overall condition of cold water streams in Connecticut is poor due to the cumulative warming effects on many streams by impoundments, water diversions and development of wetland areas. However, many exceptions do occur and these waters support healthy populations of cold water dependent fauna (Hagstrom et al. 1996, see Class 1 and Class 2 Wild Trout Management Areas in Connecticut Angler's Guide). Remaining cold water streams need to be protected in order to conserve cold water dependent biota.

Cold Water Streams (Habitat 9c)
GCN Species by Taxon

Mammal

Most Important
Eastern Small-footed Bat
Hoary Bat
Indiana Bat
Red Bat
Silver-haired Bat
Very Important
Northern Water Shrew
Woodland Jumping Mouse
Important
Eastern Pipistrelle
Little Brown Bat
Mink
Northern Long-eared Bat

Bird

Most Important
American Woodcock
Very Important
Louisiana Waterthrush
Northern Waterthrush
Olive-sided Flycatcher

Reptile/Amphibian

Very Important
Eastern Ribbonsnake
Northern Spring Salamander
Important
Northern Dusky Salamander

Fish

Most Important
American Brook Lamprey
American Eel
Brook Trout (wild)
Brown Trout (wild)
Burbot
Slimy Sculpin
Very Important
Fourspine Stickleback
Longnose Sucker
Important
Blacknose Dace
Common Shiner
Cutlips Minnow
Fallfish
Longnose Dace
White Sucker

Invertebrate

Very Important
Harpoon Clubtail
Mustached Clubtail
Rapids Clubtail
Tiger Spiketail
Important
American Rubyspot
Bembidion simplex
Brachinus fumans
Brachinus medius
Brachinus ovipennis
Cinygmula subaequalis
Ski-tailed Emerald

Threats Affecting GCN Species in Cold Water Streams (Habitat 9c)

- Insufficient scientific knowledge regarding wildlife and freshwater, diadromous, and marine fish species and their habitats (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Impacts to and loss of riparian habitat for wildlife corridors and insufficient buffer requirements to protect streams.

- Degradation, alteration, and loss of habitat due to stream channel modifications, channelization, filling, dredging, development, vegetation control, and shoreline modification.

- Instream flow alterations and increasing temperatures caused by consumptive withdrawals of surface or ground water and wetland loss.

- Impacts to fish habitats due to ineffective or insufficient land use regulations among towns.

- Loss of coldwater habitat due to decreased groundwater input or increased warming (e.g., filling of wetlands, impoundments, removal of riparian vegetation).

- Impacts to coldwater habitats from beaver dams that result in ponding and warming, fragmentation of habitat, and increased sedimentation and nutrient loading.

Priority Research/ Survey/ Monitoring Needs for Cold Water Streams (Habitat 9c)

- Monitor locations and nearby streams where fish populations that may been extirpated have been previously found. *Measure:* number of sites surveyed; number of new sites surveyed; number of species or populations located.

- Research the effect of riparian buffer width on quality and stability of habitat in aquatic systems. *Measure:* number of before-and-after or correlation studies designed, funded, and conducted; appropriate buffer dimensions determined.

- Identify and quantify threats to the survival of GCN species. *Measure:* number of threats identified; number of life history measures established.

- Research the basic ecology, biology, behavior, and populations dynamics of GCN species. *Measure:* number of life history measures established.

- Perform genetic analysis of selected trout populations to identify successful wild and hatchery strains and to determine if native strains still exist. *Measure:* number of sites surveyed; number of species or populations sampled; number of wild and hatchery strains identified; number of native strains identified.

- Evaluate performance of stocked Atlantic salmon in Connecticut habitat. *Measure:* number of marking and research projects designed, funded, or conducted.

- Identify and quantify surface springs, seeps, coldwater streams and thermal refuges. *Measure:* number of sites surveyed; number of GIS data layers produced.

- Inventory and determine the status of headwater stream habitats statewide. *Measure:* number of sites surveyed; number of GIS data layers produced; number of species located; number of risk assessments conducted.

- Enhance inventory and conservation efforts for freshwater mussels. *Measure*: number of areas surveyed; number of new survey sites; number of species or populations located.

- Collect data on trout populations in rapidly developing watersheds where data are currently unavailable. *Measure:* number of development areas identified; number of sites surveyed; number of species or populations located; number of GIS data layers produced.

- Determine the status and distribution of GCN ground beetle populations. *Measure*: number of GIS data layers produced; number of areas surveyed; number of species or populations located.

- Enhance inventory and conservation efforts for Odonate species. *Measure*: number of new monitoring sites or species protocols established.

- Determine the population status, distribution, and breeding success of the American woodcock. *Measure*: quantify and map breeding populations of American woodcock; produce and update conservation plans.

- Determine distribution, abundance, habitat requirements, and demography of northern water shrews. *Measure*: number of GIS data layers produced; number of areas surveyed; number of species and populations located; compilation of new data collected.

- Determine the life history, abundance, distribution and habitat requirements for GCN bat species, especially the Indiana bat. *Measure*: number of GIS data layers produced; number of life history measures established.
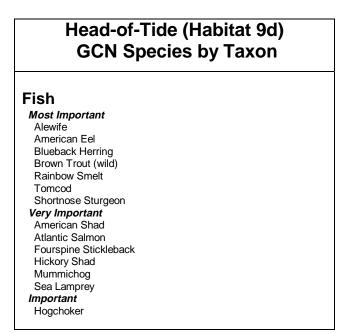
Priority Conservation Actions for Cold Water Streams (Habitat 9c)

- Remove dams and barriers where appropriate. *Measure:* number of dams and barriers removed; number of stream miles restored.

- Protect habitat in streams that support cold water fish communities. *Measure:* number of cold water streams identified; number of areas of habitat defined; number of stream miles protected.

- Encourage property owners to maintain natural shoreline habitat (e.g., riparian and shallow water vegetation, downed trees). *Measure:* number of media or outreach products developed; number of shoreline miles enhanced or restored.

- Encourage cooperation among agencies (DEP divisions, local governments, etc.) and other stakeholders to protect free-flowing streams from over-allocation of surface and groundwater resources. *Measure:* number of media or outreach products developed; number of presentations given; number of stakeholders contacted or assisted.

- Build fishways or refine methods for providing upstream passage where appropriate. *Measure:* number of fishways designed, funded, or constructed.

- Assess the effectiveness of existing facilities to pass fish. *Measure:* number of sites surveyed; number of species or populations located; number of facilities identified as effective or ineffective for fish passage.

- Develop new populations of GCN fish species in areas where native populations have been extirpated. *Measure:* number of fish captured and relocated to appropriate areas.

- Stock trout strains most likely to establish self-sustaining wild populations into waters selected for special management. *Measure:* number of fish produced and released.

- Avoid stocking domestic trout on top of significant wild populations. *Measure:* establish criteria for identifying significant wild populations.

- Continue stocking juvenile life stages of Atlantic salmon. *Measure:* number of fish produced and released.

Description, Location, and Condition of Head-of-Tide (Habitat 9d)

(d) Head-of-Tide habitat includes the upstream limit of waters affected by the tide. These staging areas are critical to the successful spawning migration of many diadromous fish. Indicator communities include diadromous species, such as American shad, blueback herring, and sea lamprey, as well as resident fishes, such as shortnose sturgeon (Connecticut River), hogchoker, and mummichog,

The relative condition of Head-of-Tide areas varies widely across the state. Many Heads-of-Tide coincide with heavily developed urban areas, offering little opportunity for functional restoration. Most other Heads-of-Tide have been subject to moderate degrees of alteration. As only a few of these areas remain truly pristine, efforts should be directed at studying and protecting these unique habitats, which serve as a linkage between upland and tidal areas and as important life history roles for various species of fish and wildlife.

Head-of-Tide (Habitat 9d)
GCN Species by Taxon

Fish
Most Important
  Alewife
  American Eel
  Blueback Herring
  Brown Trout (wild)
  Rainbow Smelt
  Tomcod
  Shortnose Sturgeon
Very Important
  American Shad
  Atlantic Salmon
  Fourspine Stickleback
  Hickory Shad
  Mummichog
  Sea Lamprey
Important
  Hogchoker

Threats Affecting GCN Species in Head-of-Tide (Habitat 9d)

- Insufficient scientific knowledge regarding wildlife and freshwater, diadromous, and marine fish species and their habitats (distribution, abundance, and condition).

- Loss, degradation or fragmentation of habitats from development or changes in land use.

- Impacts to and loss of riparian habitat for wildlife corridors and insufficient buffer requirements to protect streams.

- Degradation, alteration, and loss of habitat due to stream channel modifications, channelization, filling, dredging, development, vegetation control, and shoreline modification.

- Fragmentation of populations and loss of access to upstream and spawning habitat due to impediments to fish movements, such as dams, barriers, culverts, and tide gates.

- Impacts of point and non-point source pollution.

- Disruption of fish migrations due to dredging and development.

Priority Research/ Survey/ Monitoring Needs for Head-of-Tide (Habitat 9d)

- Investigate and delineate current distributions of fishes that spawn or congregate at the head-of-tide (e.g., rainbow smelt, sea lamprey, American eel). *Measure*: number of sites surveyed; number of GIS data layers produced.

- Inventory and delineate spawning areas of smelt and tomcod. *Measure*: number of sites surveyed; number of GIS data layers produced.

- Identify head-of-tide habitat within Connecticut. *Measure*: number of sites surveyed; number of GIS data layers produced.

- Determine level of existing degradation, threat of future degradation, and opportunities for conservation. *Measure*: number of sites surveyed; number studies conducted.

- Research the basic ecology, biology, behavior, and population dynamics of GCN species. *Measure*: number of life history measures established.

- Enhance inventory and conservation efforts for freshwater mussels. *Measure*: number of areas surveyed; number of new survey sites; number of species or populations located.

- Determine the life history, abundance, distribution, and habitat requirements for GCN bat species, especially the Indiana bat. *Measure*: number of GIS data layers produced; number of life history measures established.

Priority Conservation Actions for Head-of-Tide (Habitat 9d)

- Remove barriers or tidal modification structures whenever and wherever possible. *Measure*: number of barriers or structures removed.

- Develop partnerships (e.g., DEP divisions, NGOs, local governments) and encourage cooperation among agencies to protect head-of-tide locations that are relatively non-degraded through acquisition and appropriate management. *Measure*: number of partnerships developed; number of stakeholders or agencies contacted; number of outreach products produced; number presentations given.

- Provide technical assistance to regulatory staff to ensure head-of-tide habitats are offered maximum protection from degradation by future development. *Measure*: number media or outreach products developed; number of presentations given; number of regulatory staff contacted and assisted.

- Conduct comprehensive permit reviews on all regulated activities in this habitat type. *Measure*: number of permits reviewed.

- Develop fish passage projects at barriers. *Measure*: number of fishways designed, funded and constructed.

Description, Location, and Condition of Lakes and their Shorelines (Habitat 9e)

(e) Lakes and their Shorelines include an open water zone, a shallow littoral zone where light penetrates to the bottom, and the adjacent terrestrial shoreline. Lakes vary in depth and productivity. Some deep lakes with greater than average transparency are low to moderately productive, maintaining dissolved oxygen levels at or above 3 ppm during summer. Other less deep lakes are very productive, with low transparency and abundant aquatic plants, but may experience a drop in dissolved oxygen during summer because of the heavy accumulation of organic matter. Submerged and emergent vegetation are found in the littoral zone, including three-way sedge, bog loosestrife, arrow arum, and pickerelweed. Adjacent shoreline terrestrial vegetation includes black willow, fall panic grass, speckled alder, reed canarygrass, bluejoint reedgrass, bog white violet, and upright sedge. Inshore indicator communities include largemouth bass, smallmouth bass, chain pickerel, bluegill, pumpkinseed, golden shiner, and bullheads. Offshore pelagic indicator communities include brown trout, rainbow trout, kokanee, walleye, smelt, alewives, yellow perch, and white perch.

The status of Lakes and their Shorelines is well documented in Connecticut (Frink and Norvell 1984, CT DEP 1982, CT DEP 1991, Canavan and Siver 1995, Jacobs and O'Donnell 1996, Jacobs and O'Donnell 2002). Table 4.3 summarizes the trophic status of all assessed lakes. The overall condition of Lakes and their Shorelines in Connecticut is generally fair to poor. Lake shorelines unimpaired by residential development are rare in most public lakes in Connecticut and are under increasing threat due to an increased demand for waterfront property. Aside from water supply reservoirs and public lakes

with state-owned shorelines, the land adjacent to most Connecticut lakes is privately owned and zoned for residential development. As such, these areas are being developed at a relatively rapid pace, leaving little opportunity for maintaining natural conditions. New lakefront property owners often convert naturally vegetated shorelines into a landscaped monoculture of turf, causing increased nutrient loading when these areas are fertilized. Landscaping often continues to the shoreline, where seawalls and other hard armoring is constructed and into shallow waters where natural aquatic vegetation is often removed indiscriminately. Shoreline alterations often lead to future demands for winter drawdowns, furthering the stress on lake biota.

Table 4.3 Trophic Status of "Significant" and All Assessed Lakes, 2004 (Source: CT DEP 2004a)

	Significant Lakes		All Assessed Lakes	
Trophic Status	**Number**	**Total Size (acres)**	**Number**	**Total Size (acres)**
Eutrophic	22	5,753.3	27	6,280.9
Hypereutrophic	18	1,505.7	19	1,517.7
Mesotrophic	64	16,145.9	65	16,423.1
Oligotrophic	10	3,116.3	10	3,116.3
Unknown	2	31.1	24	501.9
Total	**116**	**26,552.3**	**145**	**27,839.9**

Watershed development and land use practices have greatly reduced the volume of oxygenated water entering lakes due to inputs of sediments and nutrients from watershed run-off. When sufficient nutrient levels have become established in these stratified lakes, they can be released each summer through internal loading, thereby fueling algae growth and leading to further declines in water quality. The resulting loss of coldwater habitat directly reduces or eliminates suitable pelagic habitat for coldwater fishes, including salmonids in many waters (Thorpe 1942, Wilde 1959, Shluntz and Bender 1993, Jacobs and O'Donnell 2002). Nutrient loading also can increase the density of aquatic vegetation. Both noxious algae blooms and nuisance levels of aquatic vegetation can impair the recreational and aesthetic values of these waters. The trophic status of naturally eutrophic lakes also has been accelerated through watershed development and unwise land use practices, resulting in increased incidence of algae blooms and aquatic vegetation. Potential sources of impairment are summarized in Table 4.4 (CT DEP 2004a). The adverse consequences for lentic fishes and aquatic vegetation can include reduced species diversity, increased incidence of winterkills, stunting, dense mono-cultures of invading aquatic species, and reduction in overall species diversity among plants, fish, and invertebrates.

About 2,300 lake-acres are considered impaired by exotic species and nuisance aquatic plants. Many more are considered threatened. This problem is largely attributable to the transport of vegetation from one lake to another when plant fragments attach to boats and boat trailers. Connecticut has an aggressive plant transport prevention program, and the state works with communities to control existing problems through the Connecticut

Lakes Grant Management Program. Excessive algal growth is identified as an impairing cause of about 3,300 lake acres in Connecticut. Most of these waters are impoundments of rivers, which drain large watersheds and carry runoff and treated effluents from numerous point sources. For the 2004 assessment cycle, 1,900 acres comprising Lake Lillinonah were added to the total of impaired acres due to nuisance algae and aquatic plant growth, as well as floating debris.

Water quality in 84% of assessed lake acres is considered suitable for primary contact. More than half of the affected acres are considered impaired due to extensive algal or aquatic weed growth rather than indicator bacteria. Impairments to use by Aquatic life can generally be attributed to eutrophication processes associated with human activities. Connecticut DEP has contracted with consultants to develop total maximum daily load (TMDL) assessments for four lakes identified with eutrophication issues.

A significant portion of the lake acres (3,150 of the 4,000) impaired for fish consumption can be attributed to PCB contamination of sediments in the large impoundments of the Housatonic River including Lakes Zoar and Lillinonah. Lake McDonough (Barkhamsted), Silver Lake (Berlin), Wyassup Lake (North Stonington) and Dodge Pond (East Lyme) carry advisories for mercury. Two urban ponds, Union Pond (Manchester) and Brewster Pond (Stratford), are affected by chlordane, a pesticide. As with rivers, a mercury-related statewide consumption advisory for freshwater fish results in all lakes of the state being technically classified as impaired for fish consumption by humans.

Despite the environmental impacts to Lakes and their Shorelines, many of Connecticut's lake and pond fish populations have proven very resilient. Introduced species, such as largmouth bass and bluegill, and native species, such as yellow perch, often thrive despite major alterations to lake environments. Populations of other species, such as brook trout, lake trout, bridel shiner, chain pickerel, and creek chubsucker, have been reduced or eliminated in many lakes. The condition of fish populations in these waters is monitored as part of Connecticut's Lakes and Ponds Survey Program (CT DEP 2004).

Table 4.4 Summary of Potential Sources Impairing Freshwater Lakes, 2004 (Source: CT DEP 2004a)

Source Category	Total Size (in acres)
Industrial Point Sources	3360.6
Municipal Point Sources	2168.0
Agriculture	2208.8
Urban Runoff/Storm Sewers	691.4
Highway/Road/Bridge Runoff	258.5
Erosion and Sedimentation	245.0
Resource Extraction	45.1
Land Disposal	90.5
Sludge	0.6
Landfills	0.6
Onsite Wastewater Systems (Septic Tanks)	89.9
Hydromodification	2225.0
Upstream Impoundment	325.0
Habitat Modification (other than Hydromodification)	114.5
Atmospheric Deposition	630.4
Waste Storage/Storage Tank Leaks	73.0
Spills	33.0
Contaminated Sediments	3443.6
Debris and Bottom Deposits	2156.0
Internal Nutrient Cycling (primarily lakes)	346.0
Natural Sources	56.0
Waterfowl	68.4
Source Unknown	2206.1
Sources outside State Jurisdiction or Borders	3203.2

Lakes and their Shorelines (Habitat 9e)
GCN Species by Taxon

Mammal
Most Important
- Eastern Small-footed Bat
- Hoary Bat
- Indiana Bat
- Red Bat
- Silver-haired Bat

Important
- Eastern Pipistrelle
- Little Brown Bat
- Northern Long-eared Bat

Bird
Very Important
- American Black Duck
- Bald Eagle
- Blue-winged Teal
- Common Loon
- Hooded Merganser

Important
- Bank Swallow
- Belted Kingfisher
- Canvasback
- Cliff Swallow
- Common Merganser
- Lesser Scaup
- Olive-sided Flycatcher
- Osprey
- Spotted Sandpiper

Reptile/Amphibian
Very Important
- Eastern Box Turtle
- Eastern Ribbonsnake
- Spotted Turtle
- Wood Turtle

Important
- Copperhead
- Fowler's Toad
- Smooth Greensnake

Fish
Most Important
- American Eel
- Banded Sunfish
- Bridle Shiner
- Swamp Darter

Very Important
- Chain Pickerel
- Creek Chubsucker
- Fourspine Stickleback

Important
- Black Crappie
- Golden Shiner
- Largemouth Bass
- Pumpkinseed
- Redbreast Sunfish
- Smallmouth Bass
- White Sucker
- Yellow Perch

Invertebrate
Very Important
- Tidewater Mucket

Important
- *Bembidion carinula*
- *Boreal Fossaria*
- *Brachinus fumans*
- *Brachinus medius*
- *Brachinus ovipennis*
- Dark-bellied Tiger Beetle
- Disc Gyro
- Eastern Pond Mussel
- Hairy-necked Tiger Beetle
- Lymnaeid Snail
- *Omophron tesselatum*
- Scarlet Bluet
- Turret Snail

Threats Affecting GCN Species in Lakes and their Shorelines (Habitat 9e)

- Insufficient scientific knowledge regarding wildlife and freshwater, diadromous and marine fish species and their habitats (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species (e.g., fanwort, zebra mussels, milfoil).

- Loss of habitat value due to hydrologic impacts from development, new roads, impervious surfaces, and culverts.

- Degradation, alteration, and loss of habitat due to stream channel modifications, channelization, filling, dredging, development, vegetation control, and shoreline modification.

- Impacts of point and non-point source pollution.

- Impacts to fish habitats due to ineffective or insufficient land use regulations among towns.

- Adverse impacts to fish from lake manipulations (e.g., excessive vegetation control, water level manipulation, dredging).

- Loss of oxygenated hypo- and meta-limnetic zone due to excessive nutrient run-off or vegetation control.

Priority Research/ Survey/ Monitoring for Lakes and their Shorelines (Habitat 9e)

- Periodically monitor fish and invertebrate communities and key physical and chemical indices in lakes and ponds. *Measure*: number of lakes surveyed.

- Quantify, delineate, and map habitat (e.g., vegetated areas) in lakes. *Measure*: number of lakes surveyed; number of GIS data layers produced.

- Research effects of drawdowns, dredging, and other vegetation control activities. *Measure:* number of before-and-after or correlation studies designed, funded, and conducted; number of BMPs developed and implemented.

- Collect data on trout populations in rapidly developing watersheds where data are currently unavailable. *Measure:* number of development areas identified; number of sites surveyed; number of species and populations located; number of GIS data layers produced.

- Determine the status and distribution of GCN ground beetle populations. *Measure*: number of GIS data layers produced; number of areas surveyed; number of species and populations located.

- Enhance inventory and conservation efforts for freshwater mussels. *Measure*: number of areas surveyed; number of new survey sites; number of species and populations located.

- Enhance inventory and conservation efforts for Odonate species. *Measure*: number of new monitoring sites or species protocols established.

- Determine eastern box turtle distribution, habitat use, and demographics, as well as identify core populations and evaluate their long-term viability. *Measure*: number of GIS data layers produced; number of acres surveyed; number of new sites surveyed; compilation of new data collected on distribution; number of eastern box turtles located; number of life history measures established.

- Determine the distribution, abundance, and breeding success of American black ducks and assess winter habitat use. *Measure*: quantify and map breeding population and winter habitats of American black ducks; and produce and update conservation plans.

Priority Conservation Actions for Lakes and their Shorelines (Habitat 9e)

- Encourage property owners to maintain natural shoreline habitat (e.g., riparian and shallow water vegetation, downed trees). *Measure:* number of media and outreach products developed; number of shoreline miles enhanced or restored.

- Encourage selective vegetation control as opposed to whole lake treatments. *Measure:* number of media and outreach products developed.

- Build fishways or refine methods for providing upstream passage where appropriate. *Measure:* number of fishways designed, funded, or constructed.

- Assess the effectiveness of existing facilities to pass fish. *Measure:* number of sites surveyed; number of species or populations located; number of facilities identified as effective or ineffective for fish passage.

- Mitigate impacts of drawdowns and chemical vegetation control. *Measure:* number of media or outreach products developed; number of regulations developed and implemented; number of research projects designed, funded or conducted; number of habitats enhanced or restored.

- Develop appropriate management strategies for lake watersheds to reduce eutrophication including stormwater management. *Measure:* literature review conducted, number of media and outreach products developed; and number of strategies for lake watersheds developed.

- Develop, promote, and enforce effective drawdown management. *Measure:* number of applied management recommendations identified from research results; number of media and outreach products developed; number of recommendations enforced through permits.

- Implement plan to prioritize and address problems caused by invasive aquatic nuisance species. *Measure:* number of media or outreach products, enforcement actions, monitoring efforts, rapid response, and control measures undertaken.

- Promote public awareness of the vulnerability of eastern box turtle populations and the negative impacts of removing turtles from the wild. *Measure*: number of media and outreach products developed; number of presentations given.

Description, Location, and Condition of Coastal Plain Ponds (Habitat 9f)

(f) Coastal Plain Ponds are associated with sandy substrate areas. They typically have low nutrient sandy soils and seasonally exposed sandy, gravelly, or muddy sediments. Typical submerged and emergent vegetation includes arrow arum, fringed sedge, pickerelweed, meadow beauty, golden hedge-hyssop, beaked-rush, witchgrass species, pipewort, and Dortmann's cardinal flower. Coastal ponded or slow-velocity waters support several sensitive fishes, such as banded sunfish and swamp darters. Other indicator community members are warm water lake fishes, such as largemouth bass, pumpkinseed, golden shiner, bullheads, and American eel.

Connecticut does not technically support a coastal plain habitat and thus should not technically include Coastal Plain Ponds. However, the bodies of water found in this freshwater aquatic habitat are associated with coastal sandy substrate areas, so for the purposes of this project, these bodies of water are referred to as such because the term "coastal plain pond" is widely used and understood.

Coastal Plain Ponds are one of the state's 13 most imperiled ecosystems (Metzler and Wagner 1998). They are geographically restricted and are found within a band extending down the eastern side of the Quinebaug River valley to the shore and then west as far as Wallingford. Most of the Coastal Plain Ponds have been impacted by waterfront development, recreational beach development, and water level manipulation. Particularly impacted are the sandy shorelines. For example, the shores of Beach Pond (Voluntown) are no longer suitable for many of its former coastal plain residents. Dams, consumptive water diversions, and other anthropogenic perturbations have altered some natural Coastal Plain Ponds.

The overall condition of Coastal Plain Pond habitat and associated biota in Connecticut is largely unknown. There are data on larger water bodies; however, little or no data have been collected from most of the smaller ponds. Given the suite of threats (invasive species, development, drawdowns, etc.) and the limited amount and distribution of Coastal Plain habitat, it is appropriate to consider this habitat imperiled.

Coastal Plain Ponds (Habitat 9f)
GCN Species by Taxon

Mammal	Reptile/Amphibian	Fish (cont.)
Important	***Very Important***	***Important***
Muskrat	Eastern Box Turtle	Black Crappie
	Eastern Ribbonsnake	Golden Shiner
Bird	***Important***	Largemouth Bass
Most Important	Fowler's Toad	Pumpkinseed
Great Egret		Redbreast Sunfish
Little Blue Heron	***Fish***	Smallmouth Bass
Pied-billed Grebe	***Most Important***	White Sucker
Very Important	Alewife	Yellow Perch
American Black Duck	American Eel	
Black Rail	Banded Sunfish	**Invertebrate**
Blue-winged Teal	Swamp Darter	***Important***
Greater Scaup	***Very Important***	Atlantic Bluet
Snowy Egret	Chain Pickerel	Blue Corporal Dragonfly
Yellow-crowned Night-heron	Fourspine Stickleback	Common Sanddragon
Important		Little Bluet
Black-crowned Night-heron		Scarlet Bluet
Canvasback		
Lesser Scaup		

Threats Affecting GCN Species in Coastal Plain Ponds (Habitat 9f)

- Insufficient scientific knowledge regarding wildlife and freshwater, diadromous, and marine fish species and their habitats (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species (e.g., fanwort, milfoil, yellow bullhead).

- Loss of habitat value due to hydrologic impacts from development, new roads, impervious surfaces, and culverts.

- Degradation, alteration, and loss of habitat due to stream channel modifications, channelization, filling, dredging, development, vegetation control, and shoreline modification.

- Fragmentation of populations and loss of access to upstream and spawning habitat due to impediments to fish movements, such as dams, barriers, culverts, and tide gates.

- Impacts of point and non-point source pollution.

- Impacts to fish habitats due to ineffective or insufficient land use regulations among towns.

- Adverse impacts to fish from lake manipulations (e.g., excessive vegetation control, water level manipulation, dredging).

- Loss of oxygenated hypo- and meta-limnetic zone due to excessive nutrient run-off or vegetation control.

Priority Research/ Survey/ Monitoring Needs for Coastal Plain Ponds (Habitat 9f)

- Determine fidelity of GCN fish to individual sites. *Measure:* number of areas surveyed; number of species or populations located; number of GIS data layers produced; number of life history measures established.

- Identify and quantify threats to the survival of GCN species. *Measure:* number of threats identified; number of life history measures established.

- Perform genetic analysis of selected trout populations to identify successful wild and hatchery strains and to determine if native strains still exist. *Measure:* number of sites surveyed; number of species or populations sampled; number of wild and hatchery strains identified; number of native strains identified.

- Enhance inventory and conservation efforts for freshwater mussels. *Measure*: number of areas surveyed; number of new survey sites; number of species or populations located.

- Enhance inventory and conservation efforts for Odonate species. *Measure*: number of new monitoring sites or species protocols established.

- Monitor GCN freshwater and coastal wetland birds in coordination with Partners In Flight and Colonial Bird Monitoring protocols. *Measure*: number of sites monitored in Connecticut.

- Determine the distribution, abundance, and breeding success of American black ducks and assess winter habitat use. *Measure*: quantify and map breeding population and winter habitats of American black ducks; and produce and update conservation plans.

Priority Conservation Actions for Coastal Plain Ponds (Habitat 9f)

- Remove dams and barriers where appropriate. *Measure:* number of dams and barriers removed; number of stream miles restored.

- Build fishways or refine methods for providing upstream passage where appropriate. *Measure:* number of fishways designed, funded, or constructed.

- Assess the effectiveness of existing facilities to pass fish. *Measure:* number of sites surveyed; number of species or populations located; number of facilities identified as effective or ineffective for fish passage.

- Reestablish native fish populations in areas where they have been extirpated. *Measure:* number of fish captured and relocated to appropriate areas.

- Mitigate impacts of drawdowns and chemical vegetation control. *Measure:* number of media and outreach products developed; number of regulations developed and implemented; number of research projects designed, funded, or conducted; number of habitats enhanced or restored.

- Develop appropriate management strategies for lake watersheds to reduce eutrophication, including stormwater management. *Measure:* literature review conducted; number of media and outreach products developed; number of lake watersheds with strategies developed.

- Develop, promote, and enforce effective drawdown management. *Measure:* number of applied management recommendations identified from research results; number of media and outreach products developed; number of recommendations enforced through permits.

- Implement plan to prioritize and address problems caused by invasive aquatic nuisance species. *Measure:* number of media and outreach products, enforcement actions, monitoring efforts, rapid response, and control measures undertaken.

- Promote public awareness of the vulnerability of box turtle populations and the negative impacts of removing turtles from the wild. *Measure*: number of media and outreach products developed; number of presentations given.

- Conserve and increase breeding populations of GCN freshwater wetland birds. *Measure*: number of breeding pairs identified statewide.

Undefined sub-habitats
The following important invertebrate species have been assigned to habitat 9 but not to a specific sub-habitat. Insufficient information is known about these species to do so.

Bembidion planum (ground beetle)
Bembidion tetracolum (ground beetle)
Boreal Turret Snail (snail)
Brachinus patruelis (ground beetle)
Leptophlebia bradleyi (mayfly)
Paraleptophlebia assimilis (mayfly)
Precious Underwing (moth)
Spongillafly (lacewing)
Whiteriver Crayfish (crustacean)

Estuarine Aquatic – Habitat 10

Estuarine Aquatic

Description, Location, and Condition of Estuarine Aquatic Habitat

Estuarine Aquatic habitats of Connecticut include coastal and tidal waters of varying salinity and substrates that are associated with Long Island Sound. All transitional zones from the Sound to upstream areas influenced by tides and with intermediate salinity levels (at least 0.5 ppt) are included. Estuaries are migration corridors for diadromous fish, as well as nursery areas for many diadromous, estuarine, and marine fish. Indicator communities include all resident estuarine and marine species, such as striped bass,

bluefish, winter flounder, sea robins, killifish, tomcod, and hogchokers, and diadromous migrators, such as American shad, herring, sea lamprey, and smelt. This key habitat classification includes seven sub-habitats determined to be important to wildlife: **(a) Coastal Rivers, Coves and Embayments, (b) Vegetation Beds, (c) Hard Bottoms, (d) Sponge Beds, (e) Shellfish Reefs and Beds, (f) Sedimentary Bottoms,** and **(g) Open Water**.

All freshwater aquatic habitats were addressed a sub-habitats of Habitat 10, as a matter of convenience. When considering comparative ecological units, each of these aquatic sub-habitats is analogous to the previously mentioned terrestrial habitats (i.e. Habitats 1 through 8).

Long Island Sound forms approximately 253 miles of coastline along Connecticut's southern border. The Estuarine Aquatic habitats extend from the pelagic (open water) areas of the Sound, to the various submerged substrates, to the intertidal coves and embayments, to the heads-of-tide that reach up to the major rivers flowing into the Sound. Examples include Mumford Cove (Groton), Little Narragansett Bay (Stonington), and the lower Connecticut River.

Hypoxia, or low oxygen content, has been identified as a major impairment of Long Island Sound. The condition is caused by excessive growth of phytoplankton, stimulated by nitrogen loading. When large amounts of phytoplankton eventually die and sink to the bottom, their decomposition uses up available oxygen. The extent of hypoxia varies from year to year, depending on weather conditions that promote stratification or layering of the Sound's waters. Under warm and relatively calm conditions, warmer lighter waters form a layer over cooler denser waters. Hypoxia occurs in the bottom waters during the summer when stratification seals off these lower layers, preventing them from mixing with and being re-oxygenated by surface waters. This is particularly acute in the western part of the Sound. The stronger and longer the period of stratification, generally the worse the hypoxia in terms of area impacted and minimum levels of oxygen observed. Potential sources of impairment are summarized in Table 4.5

Table 4.5 Summary of Potential Sources Impairing Estuaries, 2004 (Source: CT DEP 2004a)

Source Category	Square Miles
Industrial Point Sources	78.1
Municipal Point Sources	343.4
Combined Sewer Overflow	172.8
Collection System Failure	2.4
Agriculture	1.5
Urban Runoff/Storm Sewers	382.3
Dredge Mining	0.5
Land Disposal	109.8
Landfills	16.7

Onsite Wastewater Systems (Septic Tanks)	93.1
Marinas	192.5
Atmospheric Deposition	232.7
Waste Storage/Storage Tank Leaks	4.2
Spills	0.4
Contaminated Sediments	13.2
Natural Sources	0.4
Waterfowl	176.2
Source Unknown	18.5
Sources outside State Jurisdiction and Borders	1.1

Other potential impairments include a variety of cable, pipeline, and other underwater construction activities that may adversely affect seabed habitats.

(a) Coastal Rivers, Coves, and Embayments are those underwater areas contained within semi-enclosed areas. Their salinities range from full strength seawater (30-35 ppt) to slightly brackish (0.5 ppt). Connecticut contains a wide variety of Coastal Bays, Coves, and Embayments throughout the state. Most of these habitats have been negatively impacted by shoreline construction, alteration, barriers to fish passage, and pollution that have resulted from the settlement and industrialization of the region by humans. A general degradation in environmental quality in coves, rivers and embayments, from less impact to greater impact, exists from the eastern towards the western Sound.

(b) Vegetation Beds include submerged aquatic beds on various substrates and in various salinities with significant cover of macrophytes, such as eel grass, horned pondweed, and widgeongrass.

Vegetation Beds are highly productive estuarine communities that provide critical habitat for a diversity of estuarine organisms at some stage of their life cycle. The beds are important nursery and refuge grounds for juvenile fish. The condition of Vegetation Beds varies markedly throughout the state, although it is generally agreed that vegetation beds are greatly reduced from historical abundance throughout Connecticut. Submerged aquatic beds enhance sediment stability with their grass-like leaves and extensive root and rhizome systems. These submerged rooted aquatic beds change dominant species with changing salinities closer to the Sound. In brackish water along the lower Connecticut River, monospecific beds of horned pondweed are found in coves and creeks with silt bottoms. As the salinity increases to ranges between 16.5 to 31 ppt, monospecific beds of widgeon grass form. A good example may be found at Bluff Point State Park (Groton). In full saline water, eelgrass meadows form. These are host to epiphytic algae and other marine organisms, such as young bay scallops. Eelgrass is highly sensitive to pollution. Historically, eelgrass was common along Connecticut's

coast in bays and in the lower reaches of tidal rivers and creeks. In the 1930's, eelgrass wasting disease caused a massive die-off of most beds. Recovery since then has been very slow and is compounded by poor water quality. A good example of eelgrass beds may be found at Mumford Cove (Groton). Some beds (e.g., sea lettuce) are at nuisance levels as a result of nutrient loading. In Long Island Sound, kelp beds tend to be restricted to the eastern end of the Sound, roughly from Niantic east.

(c) Hard Bottoms are underwater marine substrates ranging from cobble to boulders to bedrock. They may or may not have significant relief and provide a substrate for epifauna and infauna.

Long Island Sound has a limited amount of Hard Bottoms. Most of this habitat can be found along the Connecticut shoreline and on ridges that transect the Sound. The conditions of these habitats are generally thought to be good, except for those areas degraded by sedimentation and poor water quality. Despite comprising a small percentage of available habitat, Hard Bottoms are likely to be disproportionately important in the production and recruitment of fishes and invertebrates.

(d) Sponge Beds are underwater marine communities exhibiting significant three-dimensional relief. They include well-developed communities of sponge, such as *Cliona spp*.

The condition and location of Sponge Beds is generally unknown. Sponge Beds are associated with a high diversity of vertebrates and invertebrates. Existing areas are likely to be very small and patchy. It is impossible to characterize the extent of these habitats prior to the last several hundred years because of heavy disturbance and degradation in Long Island Sound. Specific examples of Sponge Beds still exist around Falkner Island, Kimberly Reef, and in the far western Sound.

(e) Shellfish Reefs and Beds are underwater concentrations of shellfish. These reefs or beds may include, but are not limited to, the eastern oyster and various mussels.

Connecticut contains both natural and man-made or maintained Shellfish Reefs and Beds. Artificial beds are leased from state or municipal governments and are prevalent west of New Haven and east of the Thames River, although some maintained beds are found throughout the Sound. The condition and location of natural beds are less well known and mapped, although well known natural beds exist in the eastern end of the Sound and in the lower Housatonic River.

(f) Sedimentary Bottoms include three major subdivisions (sand, transition, mud), based on substrate grain size, ranging from coarse sands to silt/clay. Sandy bottoms are characterized with less than 5% silt/clay, transition bottoms have 5% to 50% silt/clay composition, while mud bottoms have greater than 50% silt/clay sediment composition. All of these sedimentary bottoms are influenced by environmental factors, such as currents, and the sediment characterization will have a major influence on benthic community composition.

Many of the nearshore Sedimentary Bottoms (particularly within harbors) have been severely impacted by human activity, but many of the offshore areas are in relatively less degraded condition. A general decline in quality is evident from east to west within the Sound. Mud bottoms comprise about 50% of the total, transition bottom types comprise approximately 30%, and sand bottoms only about 20% of the sedimentary bottoms in Long Island Sound.

(g) Open Water includes all the deep water areas of the Long Island Sound estuary. This habitat is directly connected to and influenced by the open Atlantic Ocean water through Block Island Sound and New York Harbor. The Open Water habitat provides critical habitat to marine fish, mollusks, and crustacean species. As with benthic habitats, the quality of Open Water habitat tends to improve on a gradient from west to east, influenced by major urbanized areas along the coast. The Open Water community refers solely to Long Island Sound, which has been the focus of many research projects and conservation efforts.

Estuarine Aquatic (Habitat 10)
GCN Species by Taxon

Mammal
Very Important
  Harbor Porpoise
Important
  Harbor Seal

Bird
Most Important
  Great Egret
  Least Tern
  Pied-billed Grebe
  Roseate Tern
Very Important
  American Black Duck
  American Oystercatcher
  Clapper Rail
  Common Loon
  Common Tern
  Greater Scaup
  Hooded Merganser
  Long-tailed Duck
Important
  Black Scoter
  Black Skimmer
  Canvasback
  Great Blue Heron
  Great Cormorant
  Horned Grebe
  Lesser Scaup
  Osprey
  Red-necked Grebe
  Red-throated Loon
  Ruddy Turnstone
  Surf Scoter
  White-winged Scoter

Reptile/Amphibian
Most Important
  Kemp's Ridley Seaturtle
  Leatherback Seaturtle
Very Important
  Green Seaturtle
  Loggerhead Seaturtle
Important
  Diamond-backed Terrapin

Fish
Most Important
  Alewife
  American Eel
  Atlantic Sturgeon
  Atlantic Tomcod
  Blueback Herring
  Cunner
  Longhorn Sculpin
  Northern Puffer
  Rainbow Smelt
  Sea Raven
  Shortnose Sturgeon
  Tautog
  Windowpane Flounder
  Winter Flounder
Very Important
  American Shad
  Atlantic Mackerel
  Atlantic Salmon
  Clearnose Skate
  Fourspine Stickleback
  Hickory Shad
  Lumpfish
  Menhaden
  Mummichog
  Northern Searobin
  Ocean Pout
  Red Hake
  Sand Lance
  Sea Lamprey
  Silver Hake
  Smooth Dogfish
  Spiny Dogfish
  Spotfin Killifish
  Weakfish
  Winter Skate

Fish (cont.)
Important
  Atlantic Herring
  Atlantic Silversides
  Bay Anchovy
  Butterfish
  Fourspot Flounder
  Hogchoker
  Lined Seahorse
  Little Skate
  Oyster Toadfish
  Pipefish
  Roughtail Stingray
  Sandbar Shark
  Sheepshead Minnow
  Striped Bass
  Striped Searobin

Invertebrate
Most Important
  American Lobster
  Bay Scallop
  Eastern Oyster
  Horseshoe Crab
Very Important
  Blue Crab
  Blue Mussel
  Channeled Whelk
  Green Crab
  Knobbed Whelk
  Lady Crab
  Long-finned Squid
  Mantis Shrimp
  Rock Crab
  Soft Shell Clam
Important
  Cicindela marginata
  Coastal Mud Shrimp
  Common Razor Clam
  Fiddler Crabs
  Flat Claw Hermit Crab
  Ghost Shrimp
  Grass Shrimp
  Jonah Crab
  Mud Crabs
  Sand Shrimp
  Shore Shrimp
  Spider Crab
  Starfish spp.

Threats Affecting GCN Species in Estuarine Aquatic Habitat

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Disturbance, destruction, alteration, or loss of critical habitat structure or function.

- Loss of habitat value due to hydrologic impacts from development, new roads, impervious surfaces, and culverts.

- Degradation of habitats by non-native invasive plants and wildlife.

- Adverse impacts from temperature shifts, including widespread long-term (e.g., global warming) and local short-term impacts (temporary power plant shutdowns).

- Effects of residual levels of pollution in sediments, water contamination, nutrients, and pesticides.

- Impacts from human disturbance.

- Predation, competition, displacement from habitat, or disease transmission especially from non-native species.

- Unintentional damage, injury, or mortality due to fishing (e.g., incidental catch, injuries from fishing gear).

- Fragmentation of populations and loss of access to upstream spawning habitat due to impediments to fish movements, such as dams, barriers, culverts, and tide gates.

- Impacts of point and non-point source pollution.

- Disruption of fish migrations due to dredging and development.

- Adverse effects from hypoxia and other water quality impairments, and habitat alteration in Long Island Sound.

Priority Research/ Survey/ Monitoring Needs for Estuarine Aquatic Habitat

- Research effects of drawdowns, dredging, and other vegetation control activities. *Measure:* number of before-and-after or correlation studies designed, funded, and conducted; and number of BMPs developed and implemented.

- Identify and map estuarine habitats, particularly spawning and nursery habitats, and quantify their use by estuarine species. *Measure:* number of GIS data layers produced; number of use assessments conducted.

- Determine value of marine habitats to resident fish and invertebrate populations. *Measure:* number of marine habitats evaluated.

- Examine egg and larval mortality within discrete areas in Long Island Sound, particularly for tautog. Also determine fecundity and local egg deposition rates. *Measure:* number of sites sampled; number of sites for which fecundity and egg deposition rates are determined.

- Determine fidelity of fish (e.g., tautog) to individual sites through telemetry and tagging. *Measure:* number of sites sampled; number of species tagged or tracked.

- Determine and monitor the distribution, abundance, habitat use, and condition of GCN marine invertebrate species. *Measure:* number of GIS data layers produced; number of areas surveyed; number of species or populations located; compilation of new data collected.

- Determine the extent and importance of seasonal use of the estuary and Long Island Sound by sturgeon populations. *Measure:* number of surveys or studies conducted; number of sturgeon documented.

- Determine if contaminants are impacting spawning success, particularly for sturgeon. *Measure:* number of sites monitored; number of species sampled for contaminants.

- Examine food habits of dominant predators. *Measure*: number of predator stomachs analyzed; number and taxa of prey species examined.

Priority Conservation Actions for Estuarine Aquatic Habitat

- Work with the DEP's Environmental Quality Branch, Department of Agriculture's Bureau of Aquaculture, and municipalities to protect water quality and minimize impacts to GCN species and the seabed due to dredging and sediment removal and replacement. *Measure:* number of management plans adopted; number of habitat or environmental recovery plans adopted.

- Work with the DEP Environmental Quality Branch to mitigate the effects of residual levels of sediment pollution, water contamination, nutrients, and pesticides. *Measure:* number of mitigation strategies developed and implemented.

- Minimize disturbance of spawning habitat of horseshoe crabs. *Measure:* number of technical assistance and outreach products developed and distributed; number of spawning areas protected.

- Identify, protect, and manage diamond-backed terrapin populations. *Measure:* number of nesting sites identified and protected.

- Protect habitat in coastal coves and embayments which historically supported bay scallop populations. *Measure:* number of impact assessments conducted; number of habitat protection plans developed and implemented.

- Protect and increase breeding populations of GCN colonial and beach nesting birds. *Measure:* number of breeding pairs statewide based on regional triennial survey; number of breeding sites protected.

- Minimize or eliminate unintentional injury or mortality to resources due to fishing. *Measure:* number of gear studies conducted; number of management actions adopted.

- When pesticides must be used, encourage the use of those that have minimal effect on non-target species and the environment. *Measure:* number of technical assistance and outreach products developed and distributed; number of presentations given; number of meetings attended.

Unique and Man-made Habitats – Habitat 11

Traprock Ridges

Offshore Islands

Coastal Bluffs and Headlands

Caves and Other Subterranean Habitats

Urban Habitat

Unique and Man-made Habitats

Description, Location, and Condition of Unique and Man-made Habitats

Unique and Man-made habitats not discussed in the previous 10 habitats, includes six sub-habitats determined to be important to wildlife: **(a) Traprock Ridges, (b) Offshore Islands, (c) Coastal Bluffs and Headlands, (d) Caves and Other Subterranean Habitats,** and **(e) Urban Habitat.** These often share elements with one or more of the habitats described in detail above, but they have some unique landform characteristic that requires them to be considered separately for evaluation of condition and conservation planning.

Description, Location, and Condition of Traprock Ridges (Habitat 11a)

(a) Traprock Ridges include a variety of habitats, ranging from dense forest to open rocky summits, cliff faces, consolidated rock, boulders, gravel, talus, or unconsolidated materials. Plants are scattered or absent, covering less than 26% of the substrate if present. Of most significance are large contiguous areas of forest, rich, moist lower slopes, and the rocky summit-cliff-talus complex. Traprock ridges contain many of the habitats of conservation significance that are described in this document, but the extensive, uninterrupted and undeveloped nature of these ridges and the abundance of GCN species that occur there, warrants consideration of these areas as a separate sub-habitat. Traprock Ridges are generally in good condition. Examples can be found at West Rock Ridge State Park (Hamden) and in the Connecticut River valley.

Traprock Ridges (Habitat 11a)
GCN Species by Taxon

Mammal	Reptile/Amphibian	Invertebrate
Very Important	**Most Important**	**Most Important**
Bobcat	Timber Rattlesnake	Columbine Duskywing
Meadow Jumping Mouse	**Very Important**	Northern Metalmark
	Common Five-lined Skink	Silvery Checkerspot
Bird	Eastern Box Turtle	**Very Important**
Very Important	Eastern Hog-nosed Snake	Herodias Underwing
Common Raven	Eastern Ribbonsnake	**Important**
Peregrine Falcon	Jefferson Salamander	Mottled Duskywing
Important	Northern Leopard Frog	New Jersey Tea Inchworm
Black-throated Green Warbler	Spotted Turtle	
Cape May Warbler	Wood Turtle	
Cliff Swallow	**Important**	
Yellow-rumped Warbler	Copperhead	
	Eastern Newt	
	Eastern Racer	
	Fowler's Toad	
	Gray Treefrog	
	Marbled Salamander	
	Northern Dusky Salamander	
	Spotted Salamander	
	Wood Frog	

Threats Affecting GCN Species in Traprock Ridges (Habitat 11a)

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species.

- Impacts from human disturbance.

- Impacts to micro-climate from habitat alterations (e.g., tree cutting).

Priority Research/ Survey/ Monitoring Needs for Traprock Ridges (Habitat 11a)

- Assess invertebrate populations occurring in coastal sand, trap rock ridges, and high elevation bald habitats. *Measure:* number of GIS data layers produced; number of areas surveyed; number of species or populations located; compilation of new data collected.

- Determine the status and distribution of GCN ground beetle populations. *Measure:* number of GIS data layers produced; number of areas surveyed; number of species or populations located.

- Enhance inventory and conservation efforts for butterfly species. *Measure:* number of new monitoring sites or species protocols established.

Priority Conservation Actions for Traprock Ridges (Habitat 11a)

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of moth species for which data has been collected and incorporated into a database.

Description, Location, and Condition of Offshore Islands (Habitat 11b)

(b) Offshore Islands, although they are unique landscape features, they share many of the same characteristics and face the same threats as the coastal and estuarine aquatic habitats discussed previously. Islands provide an important refuge for colonial-nesting herons and beach and island ground-nesting birds from predators that feed on nestlings and eggs (e.g., raccoons, foxes, and domestic cats). Falkner Island hosts common tern and roseate tern colonies of national significance.

The Offshore Islands include Falkner Island, Menunketesuck Island, Charles Island, Great Captain's Island, Cockenoe Island , the Norwalk Islands, and more. They are one of the 13 most imperiled communities in Connecticut (Metzler and Wagner 1998) as they are being subject to development pressures and the potentially damaging effects of heavy recreational use. Offshore Islands are critically important for the breeding success of many shorebirds and provide valuable haul-out sites for marine mammals and important stopover sites for migratory species. Offshore Islands are limited geographically and are potentially vulnerable to rising sea levels and other geological phenomena.

Offshore Islands (Habitat 11b)
GCN Species by Taxon

Mammal	Bird (cont.)	Reptile/Amphibian
Important	*Important*	*Most Important*
Harbor Seal	Belted Kingfisher	Kemp's Ridley Seaturtle
	Black Scoter	Leatherback Seaturtle
Bird	Black-crowned Night-heron	*Very Important*
Most Important	Great Cormorant	Green Seaturtle
Great Egret	Great Horned Owl	Loggerhead Seaturtle
Little Blue Heron	Horned Grebe	*Important*
Pied-billed Grebe	Lesser Scaup	Diamond-backed Terrapin
Roseate Tern	Red-necked Grebe	
Very Important	Red-throated Loon	**Invertebrate**
American Oystercatcher	Snowy Owl	*Very Important*
Common Loon	Surf Scoter	Coastal Heathland Cutworm
Common Tern	White-winged Scoter	*Important*
Glossy Ibis	Willet	*Cicindela purpurea*
Greater Scaup		Spotted Dart
Long-tailed Duck		
Snowy Egret		

Threats Affecting GCN Species in Offshore Island Habitats

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species.

- Impacts from human disturbance.

Priority Conservation Actions for Offshore Island Habitats

- Conserve and increase breeding populations of GCN colonial or beach nesting birds. *Measure:* number of known breeding pairs statewide based on regional triennial surveys.

Description, Location, and Condition of Coastal Bluffs and Headlands (Habitat 11c)

(c) Coastal Bluffs and Headlands include cliffs and escarpments that border Long Island Sound. They can be composed of either consolidated rock (headlands) or unconsolidated sediments (bluffs and escarpments), such as glacial till, with the slope and rate of erosion dependent on the substrate and exposure to wave action. Although many of these areas have been altered by human disturbance, some natural areas exist. The vegetation can be variable, including coastal woodlands of oak and pitch pine; shrublands of bayberry, huckleberry, arrowwood, and red cedar; or grasslands maintained by mowing.

Coastal Bluffs and Headlands (Habitat 11c) GCN Species by Taxon		
Bird *Most Important* Barn Owl	**Reptile/Amphibian** *Important* Diamond-backed Terrapin Fowler's Toad Smooth Greensnake	**Invertebrate** *Important* *Cucullia speyeri*

Threats Affecting GCN Species in Coastal Bluff and Headland Habitats

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species.

- Impacts from human disturbance.

**Priority Research/ Survey/ Monitoring Needs for
Coastal Bluff and Headland Habitats**

- Determine the status and distribution of GCN ground beeetle populations. *Measure:* number of GIS data layers produced; number of areas surveyed; number of species or populations located.

- Enhance inventory and conseration efforts for butterfly species. *Measure:* number of new monitoring sites or species protocols established.

Priority Conservation Actions for Coastal Bluffs and Headlands

- Conserve and increase breeding populations of GCN colonial or beach nesting birds. *Measure:* number of breeding pairs statewide based on regional triennial survey.

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of moth species for which data has been collected and incorporated into a database.

**Description, Location, and Condition of
Caves and other Subterranean Habitats (Habitat 11d)**

(d) Caves and other Subterranean Habitats are found throughout Connecticut. They include natural limestone caves found in the western marble valley and man-made habitats, such as aqueducts, abandoned mines, and transportation tunnels.

Caves, whether natural or man-made, can have more than one entrance type and many different microhabitat zones. Water movement into and through these subterranean habitats has a major influence on the microhabitat of caves. Chambers, domes, or tunnel branches can influence cave temperatures. Crevices, ceiling pockets, fault lines, blast holes, and woody or rocky debris introduce important habitat variables influencing temperature and humidity conditions.

Cave habitat is limited in Connecticut. The condition of many of the natural limestone caves has been degraded to various extents by human activity. Their quality is directly linked to human access. In contrast, a number of man-made "caves" occur in protected areas with restricted access or gated entryways. They serve as relatively high-quality cave environments.

Caves and Other Subterranean Habitats (Habitat 11d) GCN Species by Taxon	
Mammal *Most Important* Eastern Small-footed Bat Indiana Bat *Important* Eastern Pipistrelle Northern Long-eared Bat Little Brown Bat	**Reptile/Amphibian** *Very Important* Northern Spring Salamander

Threats Affecting GCN Species in Caves and other Subterranean Habitats (Habitat 11d)

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species.

- Impacts from human disturbance.

- Impacts to micro-climate from habitat alterations.

Priority Research/ Survey/ Monitoring Needs for Caves and other Subterranean Habitats (Habitat 11d)

- Determine the life history, abundance, distribution and habitat requirements for GCN bat species, especially the Indiana bat. *Measure:* number of GIS data layers produce; number of life history measures established.

Priority Conservation Actions for Caves and other Subterranean Habitats (Habitat 11d)

- Restore caves and mines not currently used by GCN bat species to provide suitable habitat conditions. *Measure:* number of sites restored; number of GIS data layers produced of cave and mine locations.

Description, Location, and Condition of Urban Habitat (Habitat 11e)

(e) Urban Habitats are those areas in and around towns and cities with a high degree of impervious surfaces. City parks are included in this habitat. Building complexes also are included because various species of wildlife have adapted to use these habitats.

In a small, rapidly urbanizing state, there is no shortage of urban habitat; however their value as wildlife habitat varies widely. Many large cities have key features, such as

parks, greenways, river corridors, or coastal marshes that attract wildlife. An example of good urban habitat is the City of Hartford. The Connecticut River funnels many migratory species through the city and some, such as the peregrine falcon, make use of the urban landscape of skyscrapers and their ledges to nest. Keney Park, a 695 acre greenspace within the city, is just one of many parks that provides wildlife habitat.

The quality of urban habitat for some species has declined. The redesign of building roof-tops and the replacement of gravel with alternative roofing materials has decreased nesting habitat for common nighthawks. Likewise, the capping and lining of chimneys has decreased roosting and nesting habitat for chimney swifts.

The present and future condition of urban habitats is directly related to the amount of awareness and information about wildlife and their habitats.

Urban Habitat (Habitat 11e) GCN Species by Taxon		
Mammal	**Bird**	**Invertebrate**
Most Important	*Most Important*	*Important*
Indiana Bat	Barn Owl	*Harpalus caliginosus*
Important	Common Nighthawk	
Little Brown Bat	Red-headed Woodpecker	
Northern Long-eared bat	*Very Important*	
	Chimney Swift	

Threats Affecting GCN Species in Urban Habitats (Habitat 11e)

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species.

- Impacts from human disturbance.

Priority Research/ Survey/ Monitoring Needs for Urban Habitats (Habitat 11e)

- Determine the population status and distribution of breeding populations of common nighthawks. *Measure:* number of GIS data layers produced of all known sites; development of effective monitoring protocols.

- Determine the population status and distribution of chimney swifts and establish effective monitoring protocols. *Measure:* number of GIS data layers produced of all known sites; development of effective monitoring protocols.

- Determine the life history, abundance, distribution and habitat requirements for GCN bat species, especially the Indiana bat. *Measure:* number of GIS data layers produced; number of life history measures established.

Priority Conservation Actions for Urban Habitats (Habitat 11e)

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN moth species for which data is collected and incorporated into a database.

Intensively Managed – Habitat 12

Intensively Managed

Description, Location, and Condition of Intensively Managed Habitat

Intensively Managed habitats have various vegetative cover and hydrology. Their common characteristic is the need for substantial human maintenance through activities such as clearing, grazing, burning, or mowing. Without this maintenance, they would succeed to another habitat type. This succession, however, often favors invasive species. This key habitat includes three sub-habitats determined to be important to wildlife: **(a) Early Successional Shrublands and Forests, (b) Cool Season Grasslands,** and **(c) Wet Meadows**.

(a) Early Successional Shrublands and Forests generally include shrubs less than 0.5m tall with individuals or clumps overlapping but not touching. This forms less than 25% canopy coverage. Tree cover also is less than 25%. Early Successional Forest stands contain trees less than 4.9 inches dbh and are generally dominated by regenerating stands of late seral stage species (i.e., oaks, maples, hickories, beech). Early Successional

Shrublands and Forests may be either seasonally flooded or non-flooded. Shrub dominated wetlands, however, provide habitat for unique assemblages of GCN species, and these communities are described separately as Shrub Inland Wetland (Habitat 5).

This Intensively Managed habitat is comprised primarily of shrubs, such as alder and dogwood species, as well as seedling to young sapling forest stands. Early Successional Shrublands and Forests generally occur when mature forest canopy is disrupted, allowing sunlight to reach the ground, and thus promoting growth of herbaceous and woody vegetation. Good examples of this habitat often result from the succession of vegetation following a forestry clearcutting operation. These habitats are distributed statewide and include abandoned fields, powerline right-of-ways, abandoned beaver flowages, and where timber harvests or other habitat management activities maintain the vegetative growth stages. In areas with active management, the condition of early successional shrublands and forests is excellent. Habitat condition declines as management activity decreases or as natural succession progresses. Two examples of good early successional shrublands and forests are the shrubland of Hunters Mountain Block (Naugatuck) of Naugatuck State Forest and a regenerating clearcut of Woodville Block (Warren) of Wyantenock State Forest.

 (b) Cool Season Grasslands include hayfields and other managed grasslands consisting primarily of naturalized European species, such as timothy, red clover, and red fescue, as well as other herbaceous or broad-leaved plants and flowers. These habitats are routinely mowed or burned prior to or after the conclusion of the avian breeding season.

Cool Season Grasslands require active management to remain in an open, grassy state. They can be found statewide in areas of active agriculture. This type of habitat tends to be most common in Litchfield, Windham, and northern Hartford, and Tolland Counties. Two examples of Cool Season Grassland habitat include Topsmead State Forest (Litchfield) and the northern fields of Goshen Wildlife Management Area (Goshen).

(c) Wet Meadows include a variety of temporarily flooded grasslands. The flooding may be controlled as part of a management plan for the habitat. Vegetation typically includes a variety of herbaceous vegetation, including forbs, grasses, flowers, sedges, and rushes (i.e., reed canarygrass, common reed, big bluestem, bluebell bellflower, bluejoint, tussock sedge).

Wet meadow habitat is created in grass-dominated areas where water seasonally pools or floods, or where the water table is close to the surface. This habitat is often maintained by periodic mowing or haying. Many of these areas have limited agricultural value, but provide excellent wildlife habitat. The location and condition of wet meadow habitat varies statewide. As agricultural pressure has increased, many sites have been altered through channelization of water, ditching, or creation of berms. Three good examples of wet meadow habitat are Durham Meadows Wildlife Management Area (Durham and Middlefield), the southern fields of Goshen Wildlife Management Area (Goshen), and the Route 7 fields of Robbins Swamp Wildlife Management Area (Canaan).

Intensively Managed (Habitat 12)
GCN Species by Taxon

Mammal

Most Important
Eastern Small-footed Bat
Hoary Bat
Indiana Bat
New England Cottontail
Red Bat
Silver-haired Bat
Southern Bog Lemming
Very Important
Meadow Jumping Mouse
Important
Black Bear
Eastern Pipistrelle
Little Brown Bat
Northern Long-eared Bat

Bird

Most Important
Barn Owl
Common Nighthawk
Golden-winged Warbler
Horned Lark
Northern Harrier
Red-headed Woodpecker
Sedge Wren
Vesper Sparrow
Yellow-breasted Chat

Bird (cont.)

Very Important
American Black Duck
American Kestrel
American Woodcock
Blue-winged Teal
Blue-winged Warbler
Bobolink
Brown Thrasher
Chestnut-sided Warbler
Eastern Meadowlark
Eastern Towhee
Field Sparrow
Glossy Ibis
Great Crested Flycatcher
Indigo Bunting
Long-eared Owl
Northern Bobwhite
Prairie Warbler
Ruffed Grouse
Savannah Sparrow
Short-eared Owl
Whip-poor-will
Yellow-billed Cuckoo
Important
American Redstart
Eastern Kingbird
Eastern Screech-owl
Eastern Wood-pewee
Gray Catbird
Great Horned Owl
Hooded Warbler
Magnolia Warbler
Orchard Oriole
Rough-legged Hawk
Ruby-throated Hummingbird
Snowy Owl
Warbling Vireo
White-eyed Vireo
Willow Flycatcher

Reptile/Amphibian

Very Important
Eastern Hog-nosed Snake
Eastern Ribbonsnake
Spotted Turtle
Wood Turtle
Important
Copperhead
Eastern Racer
Smooth Greensnake

Invertebrate

Very Important
Harris's Checkerspot
Important
Bronze Copper
Cicindela purpurea
Cucullia speyeri
Culvers Root Borer
Harpalus caliginosus
Hop Vine Borer Moth
Hops-stalk Borer
Panagaeus fasciatus
Regal Fritillary

Threats Affecting GCN Species in Intensively Managed Habitat

- Insufficient scientific knowledge regarding wildlife species (distribution, abundance, and condition).

- Loss, degradation, or fragmentation of habitats from development or changes in land use.

- Degradation of habitats by non-native invasive species.

- Impacts from human disturbance.

- Lack of fire needed to maintain certain habitats.

- Loss of early successional habitats through natural succession.

- Degradation of habitat from overbrowsing by deer.

Priority Research/ Survey/ Monitoring Needs for Intensively Managed Habitat

- Determine the population status and distribution of breeding populations of common nighthawks. *Measure:* number of GIS data layers produced of all known sites; development of effective monitoring protocols.

- Determine the population status and distribution of yellow-billed and black-billed cuckoos. *Measure:* number of GIS data layers produced of all known sites; development of effective monitoring protocols.

- Determine the population status, distribution, and breeding success of the American woodcock. *Measure:* quantify and map the breeding population of American woodcock; and produce and update conservation plans.

- Determine the distribution, abundance, and breeding success of American black ducks and assess winter habitat use. *Measure:* quantify and map breeding population and winter habitats of American black ducks; produce and update conservation plans.

- Monitoring population trends of grassland birds within Connecticut and as part regional efforts among other Northeastern states. *Measure:* report annual trend of grassland birds at Connecticut sites surveyed.

- Determine the population status and distribution of ruffed grouse. *Measure:* number of GIS data layers produced of all known sites; development of effective monitoring protocols.

- Enhance inventory and conservation efforts for butterfly species. *Measure:* Number of new monitoring sites or species protocols established.

- Determine distribution, abundance, habitat requirements, and demography of southern bog lemmings. *Measure:* number of GIS data layers produced; number of areas surveyed; number of populations located; compilation of new data collected.

- Determine the status and distribution of GCN ground beetle populations. *Measure:* number of GIS data layers produced; number of areas surveyed; number of species or populations located.

- Determine the life history, abundance, distribution, and habitat requirements for GCN bat species, especially the Indiana bat. *Measure:* number of GIS data layers produced; number of life history measures established.

Priority Conservation Actions for Intensively Managed Habitat

- Develop a statewide database for GCN moth species that includes occurrence and seasonal activity information to enhance inventory and conservation efforts. *Measure:* percentage of GCN moth species for which data is collected and incorporated into a database.

- Conserve and increase breeding populations of GCN early successional birds especially yellow-breasted chat. *Measure:* number of known breeding pairs statewide.

- Conserve and increase breeding populations of GCN grassland birds, especially the upland sandpiper. *Measure:* number of breeding pairs.

- Conserve and increase New England cottontails and their habitats. *Measure:* Number of habitat areas restored; number of populations located.

- Identify and protect key grassland areas. *Measure:* number of sites identified in each of 169 towns; percentage of these sites protected.

- Implement management techniques (e.g., burning) needed to maintain or create early successional habitats. *Measure:* number of projects implemented; number of acres managed.

Undefined Habitats

The following important invertebrate species have not been assigned to a key habitat or sub-habitat due to the lack of information on their natural histories.

Badister transversus (ground beetle)
Scaphinotus elevatus (ground beetle)
Scaphinotus viduus (ground beetle)
Stonemyia isabellina (tabanid fly)
Tetragonoderus fasciatus (ground beetle)