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DEPARTMENT OF
ENVIRONMENTAL PROTECTION

STATE OF CONNECTICUT

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Connecticut's Comprehensive Wildlife Conservation Strategy

"Creating a vision for the future of wildlife conservation"

Current Status

Connecticut's Comprehensive Wildlife Conservation Strategy (CWCS) has been completed and was approved by the U.S. Fish & Wildlife Service in January 2006. The CWCS is available for download in two ways. You may download the entire **CWCS in one large zip file** (8,286k 11 files) or you may download individual sections. If you choose to download and save the CWCS files on your computer, you should save all of the files in the same folder. By saving all of the files in the same folder, the bookmarks in each file are preserved and you will be able to easily navigate among the different sections.

Introduction (*PDF* 253k 25pp): Contains the the Title Page, Table of Contents, Acknowledgements, an Executive Summary, a Guide to the Elements used in developing the CWCS and the Introduction.
Chapter 1 (*PDF* 1,120k 26pp): Information on the distribution and abundance of Connecticut's wildlife and the process used to select species of greatest conservation need (GCN species).
Chapter 2 (*PDF* 1,582k 18pp): An overview of Connecticut's landscapes and waterscapes and the process used to select 12 key habitats of greatest conservation need.
Chapter 3 (*PDF* 254k 6pp): Describes threats affecting GCN species or their habitats.
Chapter 4 (*PDF* 2,283k 89pp): Describes the status of the 12 key habitats, the GCN species that use these habitats, threats, conservation actions and research needs.
Chapter 5 (*PDF* 39k 4pp): Describes the biological monitoring efforts for GCN species and key habitats, how the effectiveness of conservation actions will be measured, and how the strategy will incorporate adaptive management.
Chapter 6 (*PDF* 22k 1p): Describes the process that Connecticut will use to revise and update the CWCS.
Chapter 7 (*PDF* 31k 3pp): Describes how DEP coordinated the development of the CWCS with federal, state, local, and tribal partners.
Chapter 8 (*PDF* 37k 4pp): Describes efforts to seek stakeholder and public participation in the development of the CWCS.
Literature Cited (*PDF* 183k 32pp): List of publications and references used in the development of the CWCS.
Appendices (*PDF* 3,078k 473pp): Appendices for each chapter (except chapters 5 and 6) that provide supporting and supplemental information regarding each of the required elements.

How the CWCS was developed.
The DEP completed an inventory and compilation of all the available data on the state's fish and wildlife resources, including existing conservation programs and management plans. Experts throughout the Department compiled available data to identify the species of greatest conservation need in Connecticut and their habitats. Over 100 existing conservation plans were identified, reviewed and compiled to summarize previously determined priority species and habitats.

These plans are local, regional and national in scope and include strategic plans prepared by various Connecticut state agencies, The Nature Conservancy's ecoregional plans, Partners In Flight and U.S. Fish and Wildlife Service Bird Conservation and Management Plans, federally-listed species' recovery plans, open space protection plans, fisheries management plans, non-governmental organization strategic plans, species management plans, and much more. Input from cooperating conservation partners was solicited and scientific advisory committees established as part of Connecticut's Endangered Species Act (CT-ESA) were convened to refine the species and habitat review process.

How species were selected.
Starting with over 1,000 species of wildlife found in the Connecticut Natural Diversity Data Base, species were divided by taxonomic group into five categories: Birds, Fishes, Herpetofauna (Reptiles and Amphibians), Invertebrates, and Mammals. A draft list of the species of greatest conservation need in each taxonomic group was then compiled by the Department. The species list went through a series of reviews and revisions by the CT-ESA scientific advisory committees. before a final draft list was prepared.

How habitats were selected.
A draft list of 12 habitat types, based on the existing Vegetation Classification for Connecticut, was compiled. Descriptions of broad habitat types and a review of their relative conditions were also completed. Many of these habitat types contain ecological communities which are associated with unique suites of wildlife species. These habitat types and associated ecological communities were then reviewed by species experts and the CT-ESA scientific advisory committees.

Assessing threats and identifying research needs.
Existing data on threats to Connecticut's species in greatest conservation need and their associated habitats were collated through the compilation of all available management and conservation plans. Research and survey efforts that are summarized in some of these plans and reports, and those that have been identified as priorities by experts, were compiled for review by the CWCS planning team. Recommendations from key stakeholders (e.g., The Nature Conservancy, Audubon Connecticut, Connecticut Ornithological Association, U.S. Fish and Wildlife Service, scientific experts) have been included as well.
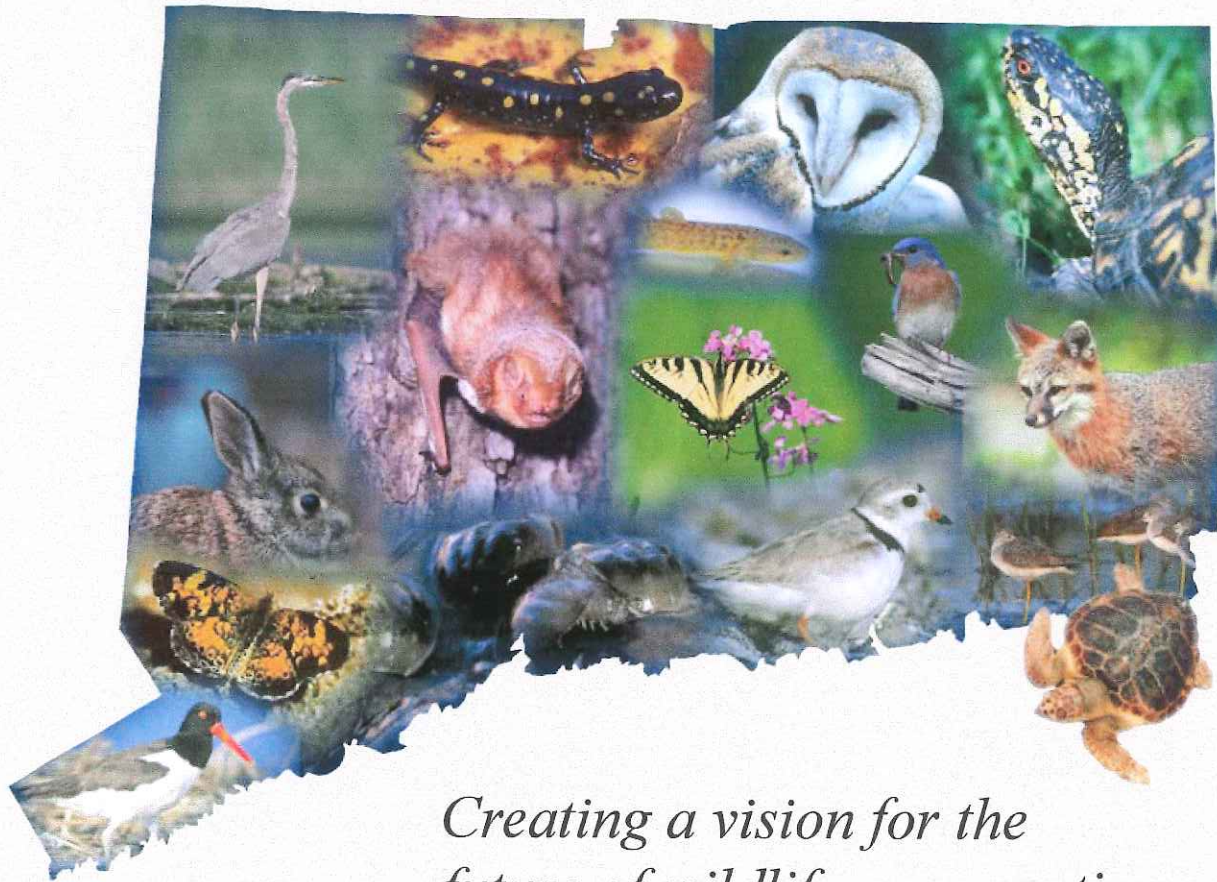
Development of conservation actions.
Existing management, strategic and conservation plans were compiled for review. The conservation recommendations contained within these reports were evaluated in conjunction with relevant actions selected for consideration by the CWCS planning team. These actions have been organized into categories based on the five taxonomic groups and by action type. The Wildlife Division conducted a facilitated workshop to review/rank these conservation actions, and these conservation actions are being reviewed, revised and ranked by the CT-ESA scientific advisory committees.

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CONNECTICUT'S COMPREHENSIVE WILDLIFE CONSERVATION STRATEGY

Creating a vision for the future of wildlife conservation.

State of Connecticut
Department of Environmental Protection
Bureau of Natural Resources

CONNECTICUT'S

Comprehensive
Wildlife Conservation
Strategy

Gina McCarthy, Commissioner
David K. Leff, Deputy Commissioner
Edward C. Parker, Chief, Bureau of Natural Resources

Developed by the
Connecticut Department of Environmental Protection
Bureau of Natural Resources
in consultation with
Terwilliger Consulting, Inc.

October 1, 2005

Connecticut's DEP Bureau of Natural Resources Mission: To conserve, improve, and protect the natural resources and environment of the State of Connecticut and to do this in a way that encourages the social and economic development of Connecticut while preserving the natural environment and life forms it supports in a delicate, interrelated and complex balance to the end that the state may fulfill its responsibility to the environment for present and future generations.

Introduction

The Department of Environmental Protection, through its Bureau of Natural Resources has a long and successful record in wildlife management. This is credited to a dedicated professional staff, and the science-based wildlife management that has been implemented with the help of many conservation partners. Most of the success, to date, has involved the restoration of game species including birds, fish and mammals, such as the wild turkey, the striped bass and the fisher. These and other efforts were made possible by the revenue derived from both the sale of fishing and hunting licenses, and the payment, by anglers and hunters, of federal excise taxes on fishing and hunting equipment as required pursuant to the public laws known today as Pittman-Robertson and Dingell-Johnson. These laws were enacted many decades ago because congress recognized that a stable, long-term funding mechanism was needed to reverse the decline in the populations of many of these species across the nation. In keeping with the Department's commitment to wildlife management, this document lays out a comprehensive strategy for wildlife conservation for the next decade.

Prior to 2000, funding for non-game wildlife programs has been minimal in most states and at the federal level. Notwithstanding limited resources, there have been several success stories in Connecticut including the recovery of the osprey and bald eagle. However, much work needs to be undertaken to address the broader array of wildlife that historically has received little or no attention, in particular, reptiles, amphibians and invertebrates. In the context of this strategy wildlife includes amphibians, birds, fish (freshwater, anadromous and marine), invertebrates (principally insects, mollusks and crustaceans), mammals, and reptiles.

Recognizing the need to conserve all of America's wildlife, Congress approved annual appropriations beginning in 2001 under Public Act 106-553, the Wildlife Conservation and Restoration Program, and subsequently, under Public Laws 107-063, 108-447, and 109-54, otherwise known as the State Wildlife Grant Program. The approval of funding under these laws was the culmination of over a decade of effort made by all the states working through the International Association of Fish and Wildlife Agencies (IAFWA), and with thousands of governmental, non-governmental and corporate conservation partners, to demonstrate the need for additional funding. With the approval of funding came the mandate that all states, territories and the District of Columbia shall prepare and submit by October 1, 2005 a Comprehensive Wildlife Conservation Strategy (CWCS) to the U.S. Fish and Wildlife Service for review and approval.

The CWCS must address the following eight criteria identified by Congress:
1) abundance and distribution of wildlife species
2) location and relative condition of key habitats
3) threats that may adversely affect species
4) conservation actions and priorities for implementing such actions

5) monitoring plans for species and habitats to measure the effectiveness of conservation actions

6) review procedures to develop the next strategy

7) plans for coordinating the development, implementation, review, and revision of the strategy with federal, state, and local agencies, as well as Indian tribes, and

8) public participation

Connecticut's strategy presents the best available and most current information on the distribution and abundance of wildlife. With the advent of a stable funding source, resources are available to develop a conservation program to address all species. This CWCS focuses on the species of greatest conservation need (GCN) and the key habitats essential to their survival. The strategy identifies the threats to these species and key habitats, as well as the conservation actions designed to address these threats. In addition, monitoring, review, and adaptive management protocols have been incorporated into the strategy, as have the efforts made to coordinate with other agencies, Indian tribes and the public. A tremendous effort over the past two years was devoted to the preparation of this document, which included input form a diverse group of public, private, governmental and non-governmental conservation stakeholders, and many agency staff members. Guidance materials developed by IAFWA's Teaming with Wildlife Committee and the U.S. Fish and Wildlife Service's National Advisory Acceptance Team were instrumental in organizing this report and ensuring that all the required elements were satisfactorily addressed.

At the heart of this strategy are conservation actions. Implementing these actions over the next decade will improve the quality of life for the citizens of Connecticut by conserving the diversity of ecosystems and wildlife in the state. Additionally, the likelihood of new species being listed as endangered or threatened will be minimized, helping to keep today's common species common in the future.

As the Department moves forward with implementation, we will continue to use the best scientific information available, while communicating and collaborating with conservation partners and constituents. New information on species distribution and abundance derived from implementing this strategy will help our partners make informed decisions on issues that affect wildlife and their habitats in Connecticut.

At a time when Connecticut's wildlife species and their habitats face formidable threats, the Department looks forward to working with its partners over the next decade, providing both the vision and the leadership necessary to conserve Connecticut's wildlife.

Chapter 1: Connecticut's Wildlife Distribution and Abundance: Determination of Species of Greatest Conservation Need (GCN)

Wildlife in Connecticut includes all species of mammals, birds, reptiles, amphibians, fish, and invertebrates that are "ferae naturae," or wild by nature. Connecticut's wildlife is remarkably diverse for a state with a geographic size of only 5,090 square miles (third smallest state in the nation). This diversity is due to the state's range of landscapes, waterscapes, and habitat diversity, from the coastal plain and Long Island Sound in the south to the mountain ranges in the northwest (Dowhan and Craig 1976, Kulik et al. 1984, Klemens 1993, Finch and Stangel 1993, Metzler and Wagner 1998). The state's physiographic gradient and associated regional climatic differences provide a complex ecological framework that supports 84 species of mammals, 335 species of birds, 49 species of reptiles and amphibians, 168 species of fish and an estimated 20,000 species of invertebrates (CT NDDB 2004, Wagner pers. comm., 2004).
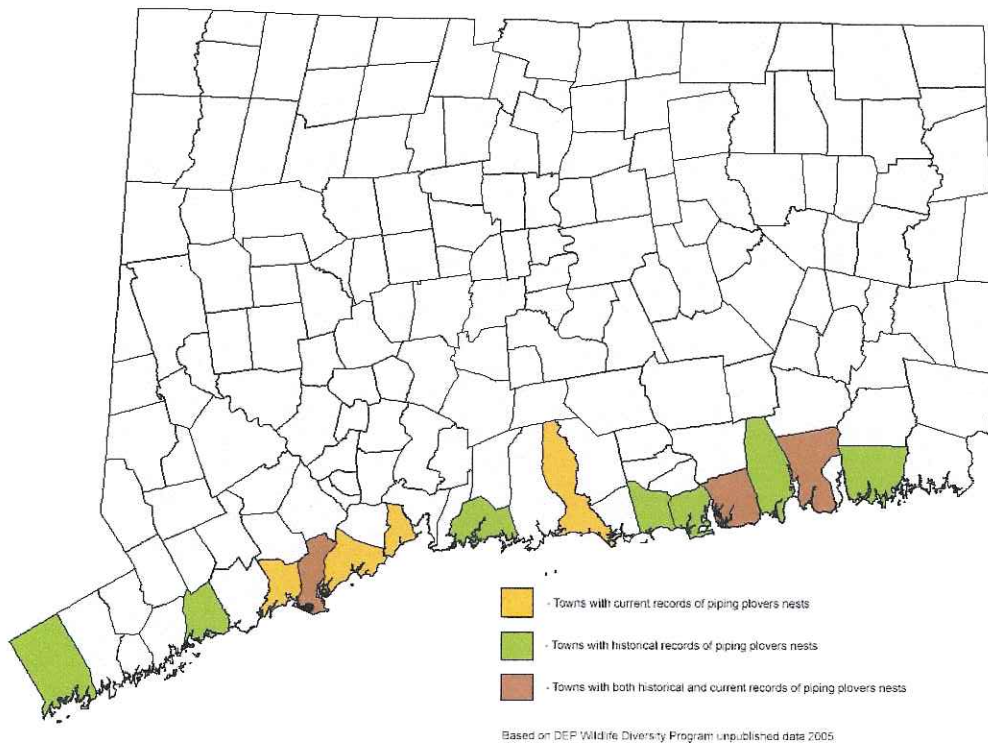
In terms of regional significance, Connecticut supports several species at the northern or southern limit of their ranges. The southeast corner of the state falls within the northern distribution limit of Atlantic and Gulf Coastal Plain species, like the king rail, while coastal Connecticut includes the northern distribution limit for southern Piedmont species, like the least shrew. The northeast and northwest upland areas of Connecticut fall within the southern distribution limit for some northern species, like the northern saw-whet owl and yellow-rumped warbler (Dowhan and Craig 1976, Kulik et al. 1984, Klemens 1993, Finch 1996, Metzler and Wagner 1998, Beers and Davison 1999, Barbour et al. 2003, Hammerson 2004, US EPA LISO 2004). Long Island Sound is near the southern extent of the inshore range of boreal species, such as the longhorn sculpin, rainbow smelt, and American lobster, and near the northern limit for temperate zone species, such as the weakfish and spot.

The state, federal, and global listings and abundance ranks for Connecticut's species are summarized in Table 1.1 by taxon. Each taxonomic group is discussed further in this chapter. A complete list of the best available summary information of wildlife species populations, abundance status, and distribution is provided in Appendix 1b.

**Table 1.1 Status of Wildlife Diversity in Connecticut**

Taxa	Species Found in CT	State-Listed	Federally Listed	Imperiled Range-wide
Mammals	84	11	3	1
Birds	335	50	4	0
Reptiles and Amphibians	49	18	5	2
Fish	168	7	1	0
Invertebrates	20,000 estimate	170	4	5
Total	**>20,636**	**256**	**17**	**8**

The following sections provide background information including distribution and abundance for Connecticut's wildlife broken out by taxa or species groups. The quality of information on distribution and abundance varies greatly. For some species, substantial data exist on distribution and are published in references cited in the text. For example, breeding bird atlas data are presented in Bevier (1994) and occurrence and distribution maps for amphibians and reptiles in Connecticut appear in Klemens (1991, 1993, 2000). Other species have benefited from focused research efforts and have well documented distributions. Two examples include the piping plover and the New England cottontail illustrated below.

- Towns with current records of piping plovers nests
- Towns with historical records of piping plovers nests
- Towns with both historical and current records of piping plovers nests

Based on DEP Wildlife Diversity Program unpublished data 2005

Piping plovers are confined to coastal habitats and the distribution and abundance of breeding birds has been monitored for several years. Until recently few data existed on New england cottontails. Since 2000 the Wildlife Division has documented the species in several towns as part of ongoing research to determine its distribution statewide.

Towns with New England cottontail
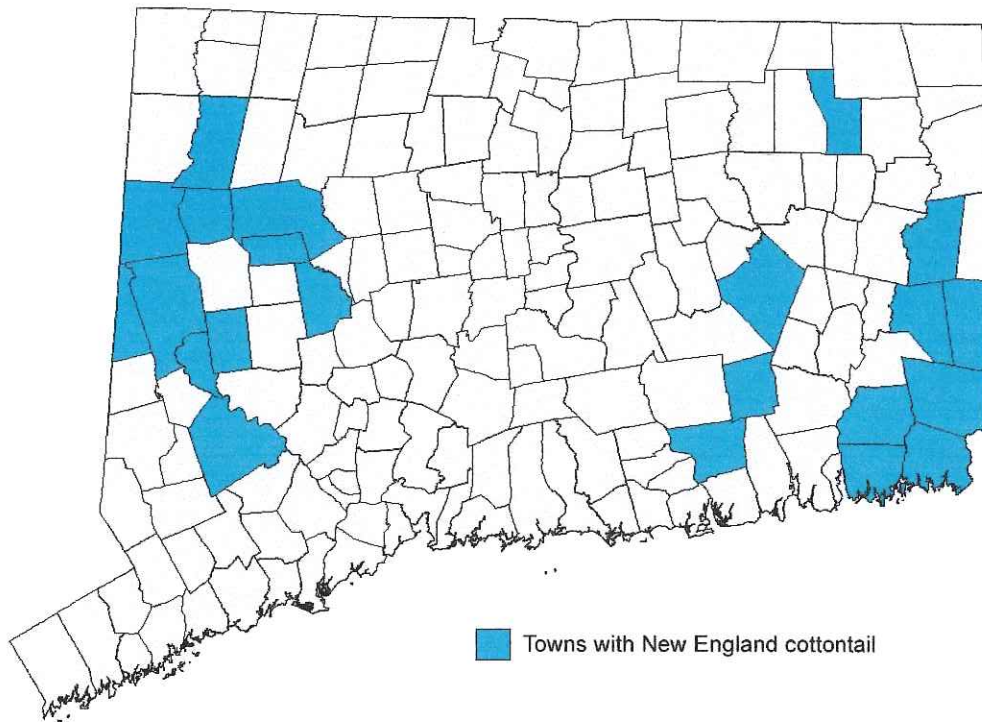
For many species, however, data on distribution and abundance are sparse or non-existent (e.g., some birds, small mammals, invertebrates). In these cases, efforts needed to fill these data gaps are identified as priority research/survey needs or conservation actions in Chapter 4.

Mammals

Sources of information for mammals are listed in this section and summarized in Appendix 1a. Appendix 1b lists all mammals and the full array of wildlife known to be present in Connecticut, along with status rank and information on abundance and distribution. All scientific names are listed in Appendix 1b.

Connecticut is home to 84 mammal species, including black bear, deer, eight bat species, and marine mammals along the coast. Linsley (1842), Adams (1896), Goodwin (1935), and Wetzel (1974) provide valuable historical catalogues of the mammalian species of Connecticut. Southern New England Gap Analysis Program (SNE-GAP, Zuckerberg et al., 2004) provides a map of predicted distribution of mammal diversity in southern New England (Figure 1.1, page 1-4). In Connecticut, eleven mammal species are state-listed, three are federally-listed, and one, the Indiana bat, is globally rare. Based upon the evaluation of all available scientific information and expert opinion, seven mammal species are in decline (Table 1.2, page 1-4).
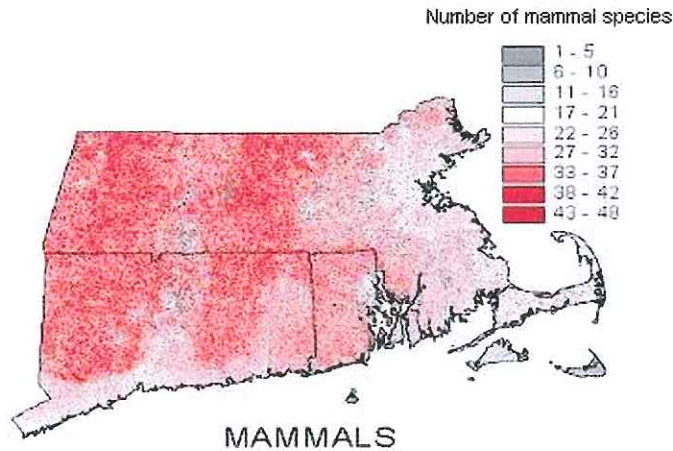
Number of mammal species

1 - 5
6 - 10
11 - 16
17 - 21
22 - 26
27 - 32
33 - 37
38 - 42
43 - 48

MAMMALS

Figure 1.1 Mammal Species Richness and Distribution in Southern New England (Source: SNE-GAP, Zuckerberg et al., 2004)

Table 1.2 Status of Mammals by Subgroup

Subgroup	Federally Listed	State-Listed	G1, G2 Rank	S1-3	NE Rank	Declining population
Bats	1	5	1	2	4	unknown
Furbearers^	2	2	0	3	0	2
Small Mammals^	0	3	0	5	2	3
Marine Mammals	0	1	0	0	1	2
Ungulates^	0	0	0	0	0	0
Total*	**3**	**11**	**1**	**10**	**7**	**7**

*84 mammal species are known to occur in Connecticut; 46 are considered secure. Note: species can have multiple status designations, thus totals are not cumulative. ^ Furbearers are species that were historically or are currently harvested for fur; ungulates are deer and moose; small mammals includes all other species.

Key to above table (and following tables for other taxa):
Global ranks (G ranks; G1, G2) are used by Natural Heritage Program (NHP) programs (in Connecticut DEP Natural Diversity Database [NDDB]), NatureServe, The Nature Conservancy (TNC) and other conservation groups to indicate the global status of a species. G1 and G2 species are listed to identify the number of globally rare species that exist in Connecticut. State ranks (S ranks) follow the same designation, but apply only within a given state.

G1 = Critically imperiled across its entire range

G2 = Imperiled across its entire range

S1 = Critically imperiled in Connecticut because of extreme rarity (5 or fewer occurrences)

S2 = Imperiled in Connecticut because of rarity (20 or fewer occurrences; steep

population declines; or other factors)

S3 = Uncommon in Connecticut (100 or fewer occurrences; limited range or

distribution; or other factors)

State-listed = includes endangered, threatened, and special concern species

Federally listed = includes endangered and threatened species

NE Rank = Identified by the Endangered Species and Wildlife Diversity Technical

Committee of the Northeastern Association of Fish and Wildlife Agencies as a

species with a declining population, species with a high risk of disappearing

from the Northeast, species lacking sufficient data to assess risk, or global

responsibility species

Declining population = Scientific information and expert opinion indicate that

these species are in decline

The federally endangered eastern cougar and gray wolf, both extirpated in Connecticut over 100 years ago, are addressed in existing recovery plans (USFWS 1982, 1987) which describe status and conservation actions throughout their range.

Bats

In Connecticut, and regionally, populations of bat species, especially tree roosting bats, have declined from historical levels in eastern woodlands (BCI 2001). National outreach efforts since the 1980s have increased public interest in bat conservation, but low reproductive rates and a variety of anthropogenic threats continue to place bats among the most likely to decline toward extinction (North American Bat Conservation Partnership 2004).

The DEP's Wildlife Division conducts research and management on bats in Connecticut. DEP information includes bat mist-netting data (1997-1999, 2001), hibernacula survey data (1997, 1999, 2001, 2003, 2005), and rabies data (1995-2005) (DEP Wildlife Division, unpub. data). The majority of bat species in Connecticut have been identified as rare or of unknown population status (Table 1.2, page 1-4). The Indiana bat, a federally endangered species, has a formal recovery plan that addresses its conservation (USFWS 1999).

Coordinated conservation practices and management guidelines can help stabilize or even increase numbers of many bat species. Ongoing research and implementation of conservation strategies to protect roosting and foraging areas and hibernacula are expected to continually benefit Connecticut's bat populations. Ecosystem-level management practices that maintain forest openings, corridors, and riparian habitats can increase bat abundance and diversity, as well as other wildlife (BCI 2001). The North American Bat Conservation Partnership (2004) recently developed a North American Bat

Conservation Partnership State Planning Guide for Bats that describes priority research, monitoring, survey, and management recommendations nationally.

Furbearers and Other Harvested Mammal Species

By the early 1800s, approximately 75% of Connecticut's landscape had been cleared for agriculture. This drastically affected the historic distribution and abundance of forest-dependent mammals, such as black bear, elk, cougar, white-tailed deer, and wolves. In addition, the unregulated harvest of trees and these mammals also greatly reduced or resulted in the extirpation of other furbearing species, such as beavers and otters (Wharton et al. 2004).

Connecticut's DEP Wildlife Division has several programs that monitor the current status of harvested mammal species, including deer, small game, and furbearers. The Deer Management Program monitors the abundance and distribution of deer and moose in the state and regulates hunting seasons to maintain healthy deer populations within biological and cultural carrying capacity. The Small Game Program monitors abundance and distribution of small game species, such as cottontail rabbits and gray squirrels. The Furbearer Program conducts research and monitors several mammal species, including bears, coyotes, beavers, fishers and raccoons. A few species of furbearers have spotty distribution or declining population trends. Associated management and outreach activities include resolving human-wildlife conflicts that occur frequently in this densely populated state.

Small Mammals

Much of the information on the distribution and abundance of Connecticut's small mammals is historical (Linsley, 1842; Adams, 1896; Goodwin, 1935; Wetzel, 1974). Little current information exists on the majority of these species. Several small mammal species are rare, declining regionally, or of unknown population status. Available information and some expert opinion on the New England cottontail suggest that this species may be in decline; however, additional information is needed to better understand its status.

Marine Mammals

Limited, non-breeding use of Connecticut's near-shore habitats by several species of endangered marine mammals necessitates cooperative efforts among National Oceanic and Atmospheric Administration-National Marine Fisheries Service (NOAA-NMFS), Sea Grant Programs, the U.S. Fish and Wildlife Service (USFWS), and DEP.

The observation of cetaceans in Connecticut's waters is a rare event. Visitors include the beluga, humpback, blue, sei, fin, and sperm whales; the harbor porpoise; the Atlantic white-sided dolphin; and the common dolphin. The harbor porpoise is a state-listed species of special concern and a northeast species of conservation concern (NE ranked). There has been only one known stranding of a harbor porpoise in Connecticut between 1994-2001 (in 1996; NOAA 2003). Another individual washed ashore dead with what appeared to be propeller injuries in early 2005. More research is needed to better understand and map the habitat use of this species along the coast of Connecticut.

A number of pinnipeds also occur commonly in the Sound, including gray and harbor seals, harp seals (winter only), and, rarely, the hooded seal. The harbor seal population is increasing in Connecticut. This species is now common in winter, spring, and fall, but is essentially absent from Connecticut waters during summer. Each of the above mentioned marine mammals has a NOAA stock assessment report. Details on the status, abundance, and distribution of these species are available online at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm182/. Management of marine mammals in Connecticut's waters is addressed through existing NOAA-NMFS and USFWS recovery and management plans, in cooperation with DEP Programs and private institutions and organizations, such as Mystic Marine Life Aquarium and the Maritime Aquarium of Norwalk.

Birds

Sources of information for birds are listed in this section and summarized in Appendix 1a. Appendix 1b lists all birds and the full array of wildlife known to be present in Connecticut, along with ranks. All scientific names are listed in Appendix 1b. Appendix 1d lists threats and conservation actions for priority bird species categorized by habitat. Some of the conservation actions in Appendix 1d are species-specific; however, habitat-specific conservation actions will often benefit a suite of species.

There are 335 bird species that occur regularly in Connecticut (COA 2004). Species richness and distribution in Connecticut are shown in Figure 1.2. Species richness for common bird habitat guilds is depicted in Figure 1.3 (page 1-10).
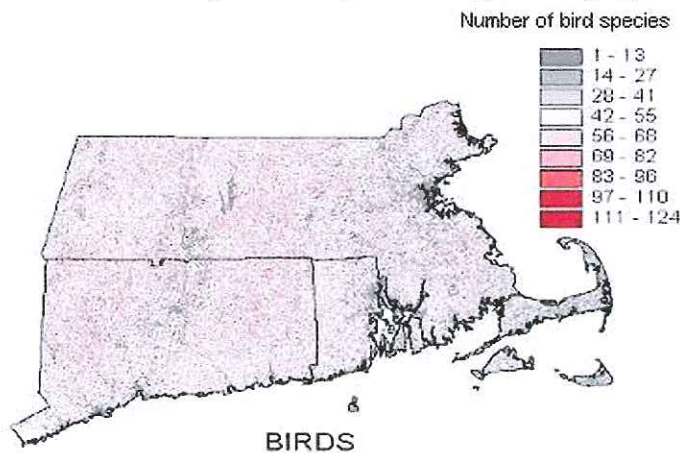

Figure 1.2 Bird Species Richness and Distribution in Southern New England (Source: SNE-GAP, Zuckerberg et al., 2004)

The Atlas of Breeding Birds of Connecticut identified 173 species and two hybrid species that were nesting in the state, with an additional 14 species that exhibited breeding behavior during the 1982-1986 surveys (Bevier 1994). The most current checklist of Connecticut birds, updated annually by the Connecticut Ornithological Association (COA), includes 408 species of birds. This checklist includes species that occur in

Connecticut during migration or the overwintering period, extirpated species, and "accidentals" that occur infrequently. Thus, the total number of species (408) is greater than the 335 species that regularly occur in Connecticut (Table 1.1, page 1-1). Merriam (1877), Sage et al. (1913), and Bevier (1994) have summarized the avian diversity of Connecticut. The Atlas of Breeding Birds of Connecticut provides distribution maps for each of Connecticut's breeding bird species. Each species account includes information about its migratory or non-migratory status, comparative abundance in the state as a breeder, and wintering areas in the state (Bevier 1994). Though dated, the Atlas is the best source of information on the distribution and abundance of breeding birds in Connecticut.

The status of birds is shown in Table 1.3, organized by American Ornithologists Union (AOU) family groups. To facilitate discussion in this document, birds were grouped into broad categories as follows: grassland birds, migratory landbirds, waterbirds, and upland gamebirds (COA 2004).

Table 1.3 Status of Birds by Family

Family	Federally Listed	State-Listed	G1, G2	S1-S3	NE Rank	Declining
Swans, Geese & Ducks		1		5	1	8
Grouse, Turkeys & Quails						2
Loons		1		1		
Grebes		1		1	1	1
Storm-Petrels						
Gannets						
Pelicans						
Cormorants & Darters				1		
Frigatebirds						
Bitterns & Herons		6		10	1	3
Ibises		1		1		
American Vultures						
Kites, Eagles & Hawks	1	3		6	2	4
Falcons		2		2		1
Rails, Gallinules & Coots		3		6		
Cranes						
Plovers	1	1		1		1
Oystercatchers		1		1		
Stilts & Avocets						
Sandpipers & Phalaropes	1	2		2	2	5
Skuas, Gulls, Terns & Skimmers	1	3		3	3	4
Auks, Murres & Puffins						
Pigeons & Doves						
Cuckoos						2
Owls		4		4	2	4
Goatsuckers		2		2	1	2
Swifts						1
Hummingbirds						

Family	Federally Listed	State-Listed	G1, G2	S1-S3	NE Rank	Declining
Kingfishers						1
Woodpeckers		1		1		1
Tyrant Flycatchers		1		1		4
Shrikes					1	1
Vireos						
Jays & Crows		1		1		
Larks		1		1		1
Swallows		1		2		
Chickadees & Titmice						
Nuthatches						
Creepers						1
Wrens		1		2	2	3
Thrushes & their Allies				1	1	3
Mimids		1				1
Pipits						
Waxwings						
Wood-Warblers		3		5	4	11
Tanagers						1
Towhees, Sparrows & Longspurs		7		6	2	8
Cardinals, Grosbeaks & Buntings				1		2
Blackbirds & Orioles		2				4
Finches						1
Total*	4	50	0	67	23	81

*335 avian species are known to occur in Connecticut; 260 are considered secure or not of conservation concern in Connecticut. Note: species can have multiple status designations, thus totals are not cumulative. For families where all rows are blank, all species are considered secure.

Grassland Birds

The status of Connecticut's grassland birds has recently been described in a report prepared by Comins et al. (2003). This report incorporated information collected by the DEP on distribution, abundance, and habitat use by these species statewide. DEP Wildlife Division monitors current status of grassland birds with the use of staff and volunteers statewide. Information about grassland bird abundance and distribution has been obtained annually since 1998 through grassland bird surveys (DEP Wildlife Division, unpub. data). Partners In Flight (PIF) Physiographic Plans (Dettmers and Rosenberg 2000; Rosenberg 2004), USFWS North American Landbird Conservation Plan (NALCP) (Rich et. al 2004), and Region 5 Avian Conservation Summary for Connecticut (USFWS R5 2004) provide detailed status, abundance, and distribution information for grassland birds. These plans also provide population goals, objectives, and threats for grassland birds. Appendix 1d summarizes and integrates all international, national, and regional plans and provides detailed information specific to actions for Connecticut.
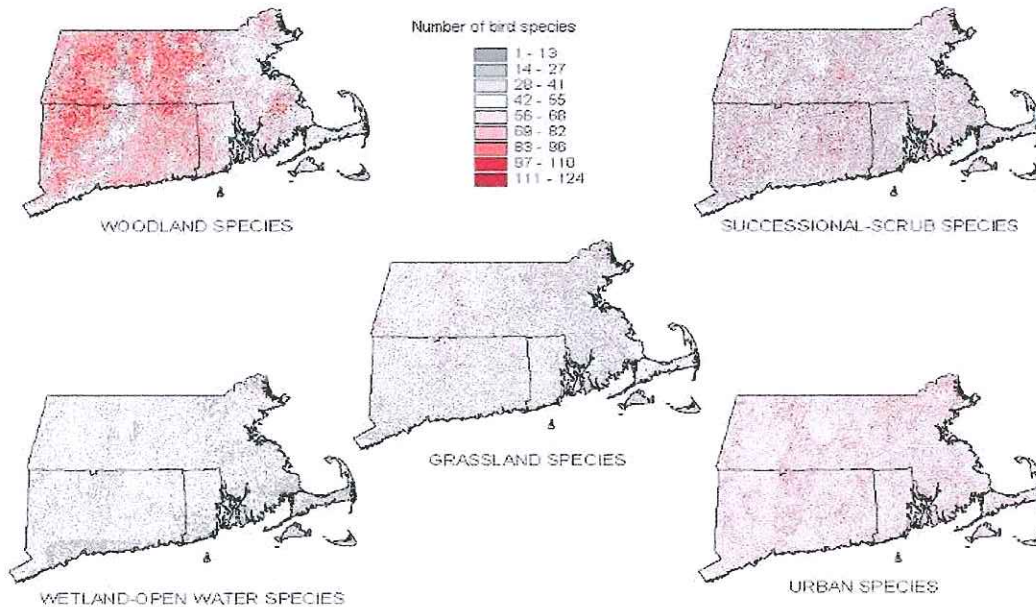
Figure 1.3 Species Richness for Common Bird Habitat Guilds (Source: SNE-GAP, Zuckerberg et al., 2004)

Migratory Landbirds

The decline in abundance and distribution for many migratory landbirds is well documented regionally and globally (Rich et al. 2004). The Northern Forest Avifaunal Biome contains 44 species of continental importance, 29 of which occur in Connecticut. The Eastern Avifaunal Biome contains 38 species of continental importance, of which 30 occur in Connecticut (Rich et al. 2004). Connecticut falls within three PIF Bird Conservation Regions (BCRs): the New England and Mid-Atlantic Coast (#30), the Atlantic Northern Forest (#14), and the Appalachian Mountains (#28) (Figure 2.11, page 2-13). The Physiographic Area 9, Southern New England, and Physiographic Area 27, Northern New England, conservation plans identify conservation issues and opportunities at the planning unit and habitat level. Conservation plans for the three BCRs and two physiographic regions examine the regional status of migratory landbirds. Rosenberg has identified state-level conservation actions from these plans for Connecticut's birds (Hodgman and Rosenberg 2000; Dettmers and Rosenberg 2000). PIF (Rosenberg 2000, 2004), USFWS NALCP (Rich et al. 2004) and Region 5 Avian Conservation Summary for Connecticut (USFWS R5 2004) provide detailed status, abundance, and distribution information, along with population goals, objectives, and threats for priority migratory landbird species. DeGraaf (1979) describes habitat associations for birds in the northeast and provides management recommendations. Appendix 1c describes abundance status, including low and declining populations, and distribution characteristics. Appendix 1d summarizes all international, national, and regional bird plans and provides detailed information specific to actions for Connecticut. It also provides detailed status, rank, and population goals and objectives for migratory landbirds (it can be found at www.rmbo.org/pif/pifdb.html).

The DEP Wildlife Division monitors current populations of certain migratory landbirds. Information about migratory landbird abundance and distribution is collected via:
- Golden-winged warbler surveys (2000-present),
- Migratory bird stopover habitat project (2002-2004),
- Annual midwinter eagle survey (1979-present),
- Bluebird nest box program (1980-present) (DEP Wildlife Division, unpub. data).

Upland Gamebirds

The American woodcock, eastern wild turkey, and ruffed grouse are upland gamebirds for which there are regulated hunting seasons. Information about gamebird abundance and distribution is maintained in several databases (DEP Wildlife Division, unpub. data), including:
- Woodcock surveys (1991-present),
- Turkey harvest surveys,
- Small game harvest surveys
- Ruffed grouse drumming surveys (2005-present).

Waterbirds

There are a variety of plans and partnerships focused on waterbird conservation. PIF (Rosenberg 2000, 2004), USFWS NALCP (Rich et al. 2004), and Region 5 Avian Conservation Summary for Connecticut (USFWS R5 2004) provide detailed status, abundance, and distribution information, along with population goals, objectives, and threats for priority waterbird species.

Connecticut has participated in the development of a variety of regional, national, and international programs and plans, including:
- North American Waterbird Conservation Plan (NAWCP),
- U.S. Shorebird Conservation Plan (USSCP),
- North American Colonial Waterbird Plan (NACWP),
- Waterbird Monitoring Partnership (WMP),
- South Atlantic Migratory Bird Initiative (SAMBI),
- Mid-Atlantic/New England/Maritimes Regional Working Group (MANEM),
- North American Waterfowl Management Plan (NAWMP),
- Atlantic Coast Joint Venture (ACJV), and
- Black Duck Joint Venture (BDJV).

These programs share the best available species abundance and distribution data at regional and state levels, as summarized in Appendix 1d. The ACJV has identified areas of particular importance to migratory waterbirds (Figure 1.4, page 1-12). The MANEM provides distribution maps in Connecticut for various guilds of waterbirds (Figure 1.5, page 1-13).

DEP Wildlife Division monitors current status of waterbirds through various surveys (DEP Wildlife Division, unpub. data):

- Midwinter waterfowl survey (1955-present),
- Waterfowl harvest surveys(1955-present),
- Waterfowl breeding survey (1989-present),
- Banding and recovery data (1955-present),
- Wood duck box productivity (1985-present),
- Wetland callback survey (1993-present),
- Colonial waterbird survey (1979-present) and
- Piping plover and least tern survey (1979-present).

The status and distribution of colonial nesting waterbirds is monitored by the DEP Wildlife Division, USFWS, and other cooperators, such as Connecticut Audubon, every three years. The conservation of the federally threatened piping plover and federally endangered roseate tern are addressed by existing recovery plans (USFWS 1996, 1998).
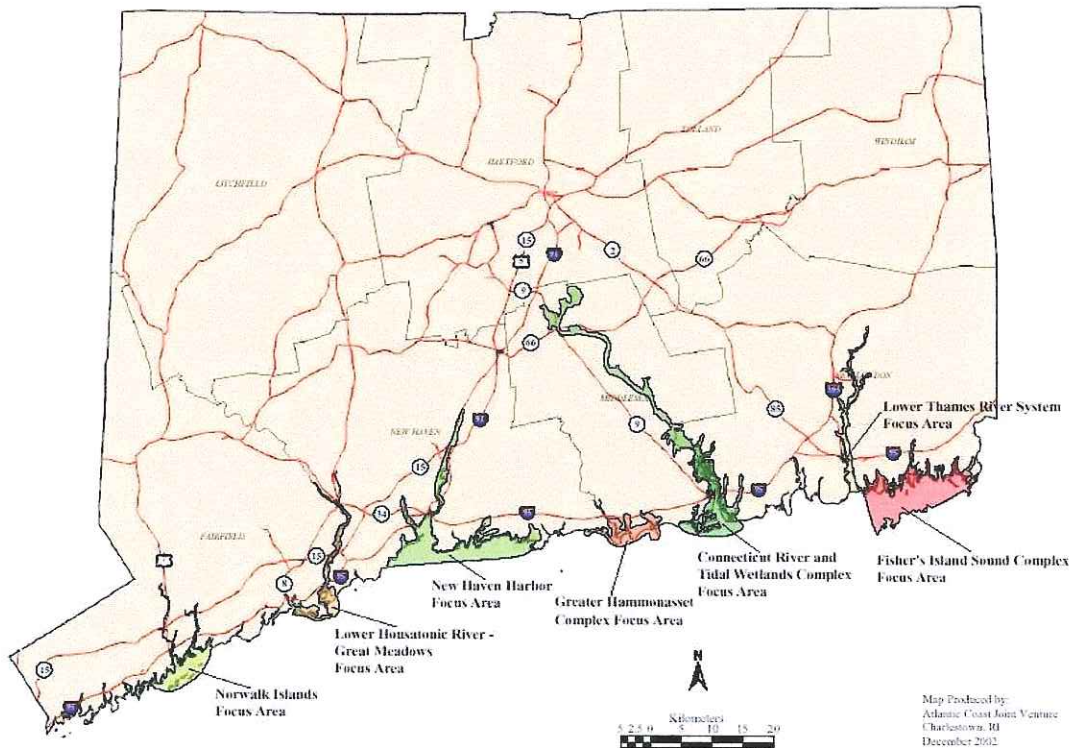

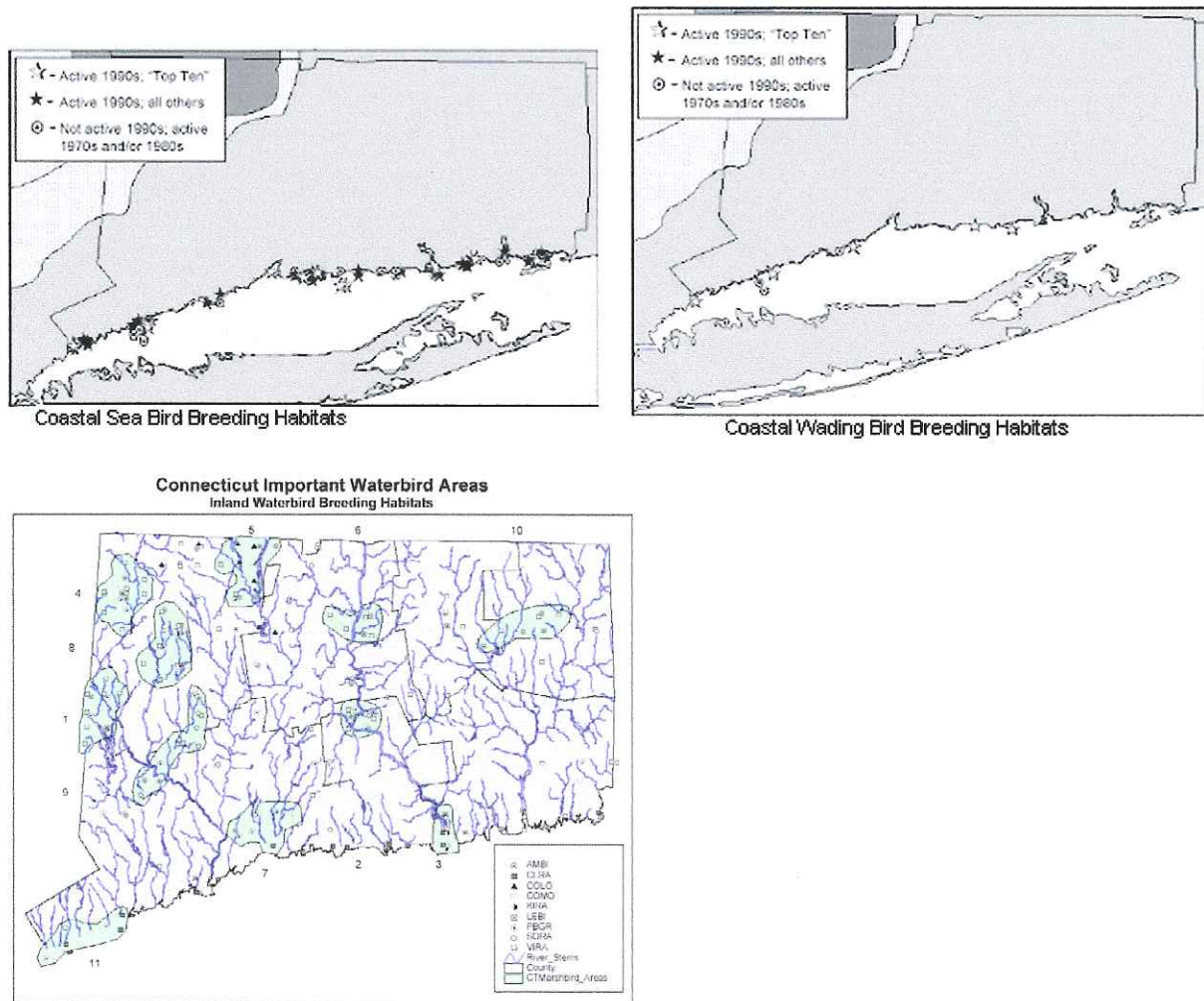**Figure 1.4 ACJV Waterfowl Focus Area Maps (Source: ACJV Plan 2004)**

Coastal Sea Bird Breeding Habitats

Coastal Wading Bird Breeding Habitats

Connecticut Important Waterbird Areas
Inland Waterbird Breeding Habitats

Figure 1.5 MANEM Important Waterbird Areas (Inland Waterbirds, Sea Birds, Wading Birds) (Source: MANEM 2004)

Important Bird Areas

The National Audubon Society initiated the Important Bird Area (IBA) program in the United States in 1995. IBAs are areas of essential habitat for one or more species of birds. They are usually discrete sites that stand out from the surrounding landscape due to their unique characteristics. In recognition of Connecticut's importance for birds, 15 IBAs have been designated, 13 sites have status pending, 11 sites are currently under review, and 81 additional sites have been identified as potential IBAs (Figure 1.6, page 1-14) (Audubon Connecticut 2004).
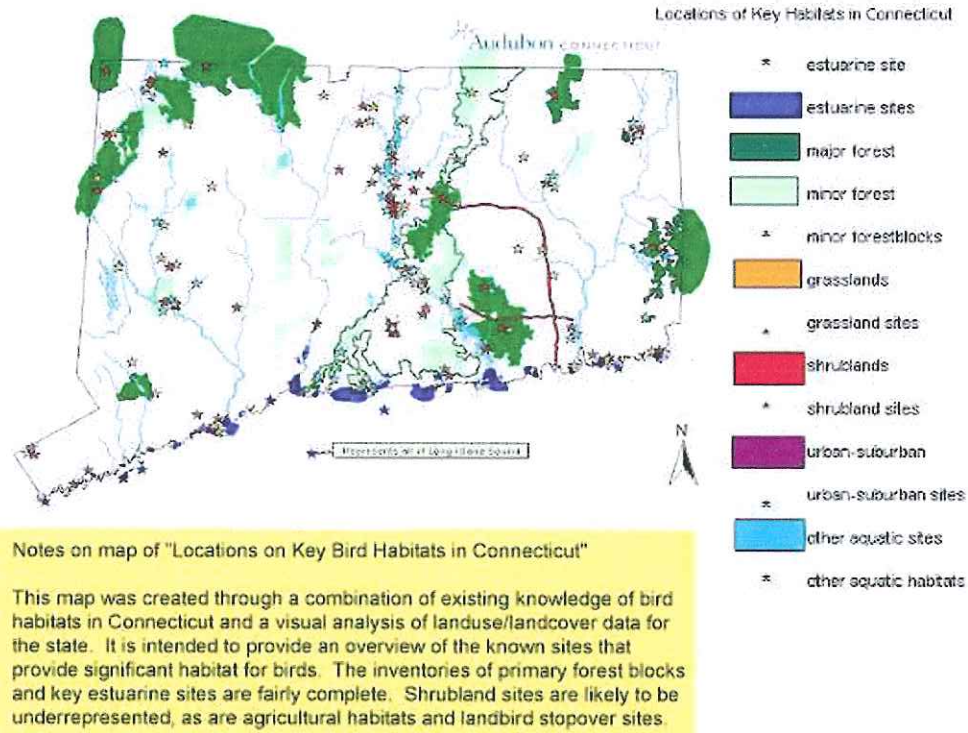
Notes on map of "Locations on Key Bird Habitats in Connecticut"

This map was created through a combination of existing knowledge of bird habitats in Connecticut and a visual analysis of landuse/landcover data for the state. It is intended to provide an overview of the known sites that provide significant habitat for birds. The inventories of primary forest blocks and key estuarine sites are fairly complete. Shrubland sites are likely to be underrepresented, as are agricultural habitats and landbird stopover sites.

Figure 1.6 Audubon Key Bird Habitats in Connecticut (Source: Audubon Connecticut)

Reptiles and Amphibians (Herpetofauna)

Sources of information for herpetofauna are listed in this section and summarized in Appendix 1a. Appendix 1b lists all herpetofauna, as well as the full array of wildlife currently known to be present in Connecticut, along with status rank and information on abundance and distribution, including low and declining populations. All scientific names are listed in Appendix 1b.

The herpetofauna of Connecticut are diverse and have been thoroughly described by Lamson (1935), Babbitt (1937), Peterson (1970), and Klemens (1991, 1993, and 2000). SNE-GAP analysis provides maps of predicted amphibian and reptile distribution (Figs 1.7, page 1-16 and 1.8, page 1-17). Klemens (1993) provides regional and state occurrence and distribution maps for Connecticut's amphibian and reptile species. He concludes that the biodiversity of Connecticut's reptiles and amphibians is declining and local extirpations are increasing. Gruner and Victoria (2000) provide an overview of the conservation status of Connecticut's amphibians and reptiles. Appendix 1b details population abundance and distribution information according to the most recent literature and expert opinion. Forty-nine reptile and amphibian species are found in Connecticut. Of the 49, 18 are listed by the state as endangered, threatened, or species of special concern . Specific listings of GCN herpetofauna species by subgroup and order are shown in Table 1.4, page 1-15. Global evidence also indicates widespread declines in

reptiles and amphibians. According to all available scientific information and expert opinion, 24 of the 49 herpetofauna species in Connecticut are in decline (Table 1.4).

In general, little quantitative information is currently available to identify the specific problems affecting populations of this taxonomic group (Gibbons et al. 2000), although many experts believe that habitat loss and fragmentation, and road mortality are problems for some species. There is a recognized national and regional need for advocacy focused on conservation of amphibians and reptiles and the use of an ecosystem approach to incorporate herpetofauna species protection into existing management plans (PARC 1999). Additional efforts will be focused on data collection to assess population abundance and distribution and to identify threats so that conservation actions can be developed and implemented.

Table 1.4 Status of Herpetofauna by Subgroup

Subgroup	Federally Listed	State-Listed	G1, G2 Rank	S1-S3	NE Rank	Declining
Salamanders[1]	0	5*	0	5*	2	8
Frogs	0	1	0	1	1	2
Toads	0	1	0	1	1	1
Snakes	0	3	0	5	3	3
Lizards	0	1	0	1	0	1
Turtles	5	7	2	3	4	9
Total*	**5**	**18**	**2**	**16**	**11**	**24**

[1] Includes both diploid and hybrid complex populations of blue-spotted salamander.
*49 herpetofaunal species are known to occur in Connecticut; 20 are considered secure or not of conservation concern in Connecticut. Note: species can have multiple status designations, thus totals are not cumulative.

The dispersal ability of many amphibians and reptiles is limited compared to other terrestrial vertebrate taxa. As a result, past fragmentation of habitats likely has resulted in some herpetofaunal populations becoming isolated. This factor continues to affect distribution in the state, as apparently suitable habitat may not be used by species with limited ability to colonize restricted or fragmented habitats (Klemens 1993, 2000).

Amphibians

Amphibians in Connecticut include 12 salamanders and 10 frogs and toads. The predicted distribution of amphibians in Connecticut is shown in Figure 1.7, page 1-16. Many species require both wetland and terrestrial habitats to complete their various life stages. For this reason, juxtaposition and connectivity of habitats are important. Guidelines on habitat conservation of upland buffers around wetlands, including vernal pools, have been developed for a number of species (PARC and NE PARC 2004). Guidelines have been developed for forestry habitat management practices to conserve vernal pools (Calhoun and deMaynadier 2004). Best Development Practices also have been developed for the northeast to conserve pool-breeding amphibians in commercial and residential developments (Calhoun and Klemens 2002). Connecticut's Amphibian Monitoring

Program (CAMP) is a statewide monitoring effort to investigate correlations between amphibian communities and land use. Several amphibian species in Connecticut have been identified as rare, declining, or of unknown population status (Table 1.4, page 1-15).
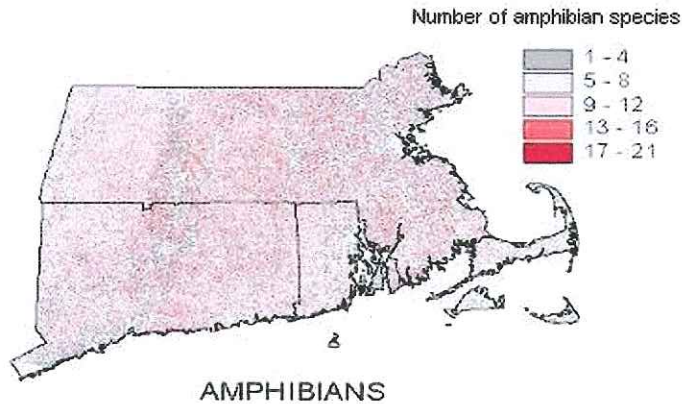

Figure 1.7 Predicted Distribution of Amphibians in Southern New England. (Source: SNE-GAP, Zuckerberg et al., 2004)

Reptiles

Reptiles in Connecticut include 14 snakes (2 that are venomous), 12 turtles (including 4 sea turtles), and 1 lizard. The predicted distribution of reptiles is shown in Figure 1.8 (page 1-17). One venomous snake, the timber rattlesnake, is listed as state endangered. Unfortunately, due to lack of understanding about snakes, human perception of these species is skewed, often resulting in unnecessary killing. Poaching of rattlesnakes also is a concern. The eastern ribbon snake and eastern hog-nosed snake are listed as state species of special concern due to their low population numbers. Habitat loss and urban sprawl are considered the main factors for the decline of these two snake species. Turtle populations are at high risk in developing landscapes due to their extremely low reproductive rates. Several reptile species in Connecticut have been identified as rare, declining, or of unknown population status (Table 1.4, page 1-15). Proportionally, reptiles have the highest number of specially ranked species compared to all other taxonomic groups.
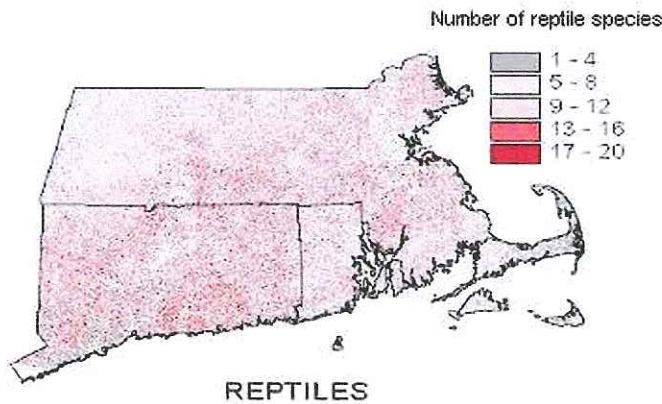
Figure 1.8 Predicted Distribution of Reptiles in Southern New England. (Source: SNE-GAP, Zuckerberg et al., 2004)

Four of the federally and state-listed reptiles are sea turtles. Three of these sea turtles, the Kemp's ridley, green, and loggerhead, are common visitors to Long Island Sound and its estuaries between May and October. The occurrence of the fourth sea turtle, the leatherback, is an uncommon event. More information about distribution, abundance, migratory movements, and population characteristics is needed for the loggerhead. Conservation of all sea turtles is addressed in federal recovery plans (NMFS and USFWS, 1991, 1992, and 1993). The bog turtle also is federally and state-listed and its recovery plan includes specific actions focused on areas of the Hudson and Housatonic Rivers (USFWS 2001).

Fish

Sources of information for fish are listed in this section and summarized in Appendix 1a. Appendix 1b lists all species of fish and the full array of wildlife presently described in Connecticut, along with rank, abundance, and distribution information. All scientific names are listed in Appendix 1b. A total of 168 species of fish (63 freshwater and diadromous; 105 saltwater) are found in Connecticut's aquatic habitats, including seven fish species that are state-listed and one that is federally listed. Table 1.5 breaks down these fish species by subgroup.

Table 1.5 Fish Species by Subgroup

Subgroup	Federally Listed	State-Listed	G1, G2 Rank	S1-3	NE Rank	Declining population
Diadromous	1	3	0	7	1	6
Freshwater	0	4	0	8	3	5
Marine	0	0	0	15	0	15
Total*	**1**	**7**	**0**	**30**	**4**	**26**

*168 fish species are known to occur in Connecticut; 119 are considered secure or not of conservation concern in Connecticut. Note: species can have multiple status designations, thus totals are not cumulative.

Diadromous Fish

Diadromous fish species are found in both freshwater and estuarine waters where sufficient freshwater habitat exists below the first barrier (e.g., dam, falls) upstream from Long Island Sound. Diadromous fish migrate between saltwater and freshwater to spawn. Of the nine diadromous species that occur in Connecticut, eight are anadromous (migrate from saltwater to freshwater to spawn) and one, the American eel, is catadromous (migrates from freshwater to saltwater to spawn) (Whitworth 1996).

The presence of dams on Connecticut rivers and streams has substantially reduced the historic range of several fish species, particularly the anadromous species that migrate into freshwater for spawning. As a result, all nine diadromous species are considered to be in need of conservation and several have been identified as declining (Table 1.5 page 1-17). Restoration of migratory routes is underway in many locations through dam removal and the construction of fish ladders. The abundance and distribution of several species, such as American shad and shortnose sturgeon, are being monitored. The DEP Inland and Marine Fisheries Divisions work cooperatively with USFWS, NMFS, ASMFC, Connecticut River Atlantic Salmon Commission, and non-government organizations (NGOs), like the Connecticut River Watershed Council, to manage diadromous fish species and assess the status of their populations (CT DEP 2002).

Freshwater Fish

The abundance and distribution of freshwater fish of Connecticut have been described by Thorpe et al. (1968), and Whitworth (1996). There are 26 (three species are extirpated) naturally-occurring freshwater fish species. Observations indicate that more than 50 non-native freshwater species have been released into Connecticut waters or imported into the state. At least half do not have viable, reproductive populations (Whitworth 1996). The results of the 1988-1994 DEP Fisheries Stream Survey provides considerable data on the abundance, status, and distribution of stream fish species (Figure 1.9, page 1-19). Of the 26 naturally-occurring species, 13 are considered to be in need of conservation, four are state-listed, eight are state-ranked, three are regionally ranked, and, according to all available scientific information and expert opinion, at least five, such as the slimy sculpin, are in decline (Table 1.5, page 1-17).

The Rivers Alliance of Connecticut conducted a statewide assessment of rivers and evaluated the diversity of fish and aquatic species and the quality of Connecticut's riverine habitat (CT Rivers Alliance 1993). Studies of several watersheds, such as the Farmington, Eightmile, Pawcatuck, and Quinebaug-Shetucket, provide additional natural resource assessments of wildlife and habitat within these watersheds (Appendix 1a).
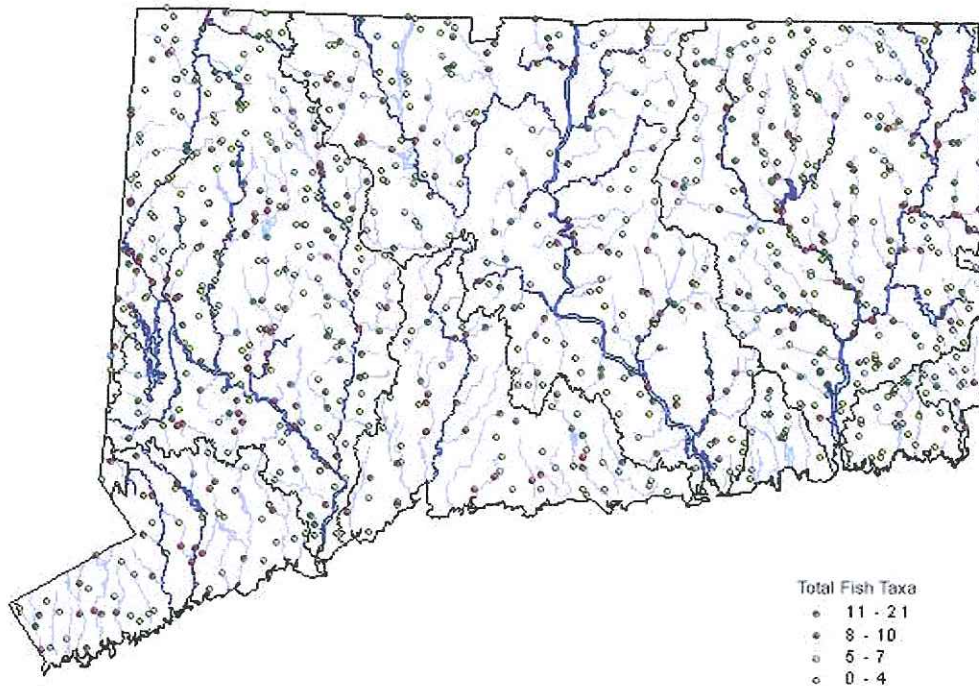
Figure 1.9 Total Number of Fish Species per Site (Source: CT DEP Stream Survey 1988-94)

Marine Fish

The distribution and abundance of saltwater fish in Connecticut have been described by Whitworth (1996) and Thomson et al. (1971). They identified 105 saltwater fish species that occur regularly in Connecticut waters. Of these, 42 are considered to be in need of conservation, 15 are state-ranked, and, according to all available scientific information and expert opinion, 15 marine species are in decline (Table 1.5, page 1-17). At least 50 marine fish species spawn in Long Island Sound and 120 species, including about 20 tropical species, enter the Sound seasonally (US EPA LIS 2004). Blake and Smith (1984) outlined the existing Marine Resources Management Plan for marine fisheries in Connecticut. The DEP Marine Fisheries Division annually conducts the Long Island Sound trawl survey to measure the abundance and distribution of important finfish. This survey is independent of harvest data collected by the Division. These data are used to evaluate fish stock health to guide effective management strategies (CT DEP 2004b). NMFS implements fishery management plans developed by the New England Fishery Management Council, of which Connecticut is a participating state. The Atlantic States Marine Fisheries Commission (ASMFC) develops fishery management plans for commercially and recreationally important migratory or shared fishery species occurring in the state waters (ASMFC 1997, 1998a-c, 2001, 2002a-d; MAFMC 1977, 1983, 1984, 1988; NEFMC 1999, 2003a-h). Connecticut is a statutorily-authorized member state of the commission. A list of these plans can be found in Appendix 1a.

Invertebrates

Information sources for invertebrates are identified in this section and summarized in Appendix 1a. Appendix 1b lists all invertebrate species for which information is available and the full array of wildlife presently described in Connecticut, including status rank, abundance, and distribution information. All scientific names are listed in Appendix 1b.

The invertebrate fauna of Connecticut is incredibly diverse. Taxon include freshwater mussels, gastropods and crustaceans; dragonflies and damselflies; butterflies and moths; benthic marine mollusks and crustaceans; and numerous others. Many of these fauna are rare. One hundred and seventy species are state-listed as endangered, threatened, or species of special concern. In addition, the DEP Marine Fisheries Division has identified 26 marine invertebrates as GCN species. It is estimated that there are at least an additional 20,000 species of invertebrates for which there exists little to no information on abundance or distribution (Wagner, University of Connecticut, pers. comm., 2004). The status of invertebrates is listed in Table 1.6.

Table 1.6 Invertebrates by Subgroup

Subgroup	Federally Listed	State-Listed	G1, G2	S1-3	NE Rank	Declining population
Burying Beetle	1	1	1	0	0	0
Butterfly	0	14	0	9	0	5
Crustacean	0	5	0	2	0	1
Damselfly	0	5	0	5	0	1
Dragonfly	0	13	0	12	0	0
Freshwater Mussel	1	6	1	4	4	1
Ground Beetle	0	32	0	2	0	6
Horseshoe Crab	0	0	0	1	0	1
Lacewings and Others	0	2	0	0	0	0
Mayfly	0	6	0	0	0	0
Moth	1	47	0	20	0	3
Plant Bug	0	1	0	0	0	1
Rove Beetle	0	1	0	0	0	0
Shellfish	0	0	0	2	0	1
Skipper	0	8	0	5	0	4
Snail	0	8	0	7	0	2
Soldier Fly	0	1	0	0	0	0
Spider	0	1	0	0	0	0
Squid	0	0	0	0	0	0
Starfish	0	0	0	0	0	0
Syrphid Fly	0	1	0	0	0	0
Tabanid Fly	0	10	0	2	0	0
Tiger Beetle	2	8	1	5	0	0
Total*	**5**	**170**	**3**	**76**	**4**	**26**

*Over 20,000 invertebrate species are estimated to occur in Connecticut. Note: species can have multiple status designations, thus totals are not cumulative.

The paucity of invertebrate information highlights the need for additional surveys and monitoring programs to provide meaningful data to guide species-specific conservation actions (M. C. Thomas, Connecticut Agricultural Experiment Station, pers. comm., 2004).

Nationwide, invertebrates are underrepresented on lists of rare species. Therefore, many scientists support an ecosystem-level approach to provide conservation for invertebrates. Eventually, better population data would allow species-focused actions to be incorporated into management plans to protect specific species (Black et al. 2001).

Freshwater Benthic Invertebrates

Data from the Rotating Basin Survey undertaken by DEP Bureau of Water Management provide information on the distribution of riffle-dwelling benthic macroinvertebrates at the community level (Figure 1.10). The abundance and distribution of these macroinvertebrates serve as barometers of environmental health of rivers and streams. For example, the presence of three pollution sensitive orders of riffle-dwelling macroinvertebrates - Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) - indicates high water quality (CT DEP 2004a). Water Quality Index figures for Ephemeroptera-Plecoptera-Trichoptera (EPT) are detailed in Chapter 4.
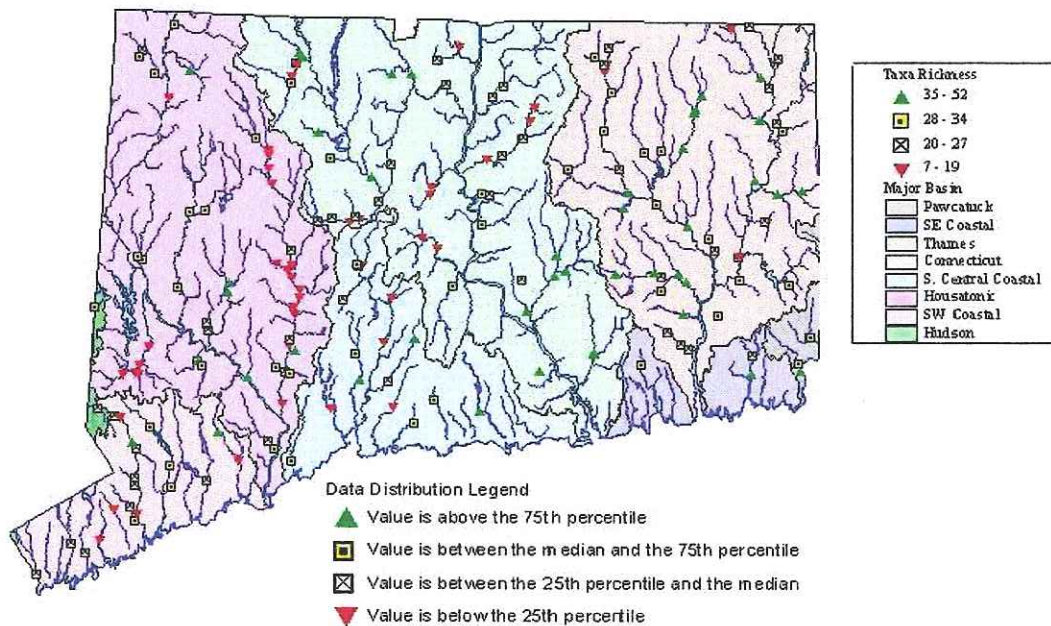

Figure 1.10. Distribution of Benthic Macroinvertebrates in Connecticut (Source: CT DEP BWM Rotating Basin Strategy)

The aquatic insects of Connecticut rely upon healthy riparian and wetland habitats throughout their life histories. Bog and calcareous wetlands of the northwest highlands are important habitats to Odonate (dragonfly and damselfly) species (M. C. Thomas,

Connecticut Agricultural Experiment Station, and D.L. Wagner, University of Connecticut, pers. com., 2004).

At least 22% of the dragonflies and damselflies of this state can be regarded as rare. Demographic surveys are needed for these species to identify both larval aquatic and adult feeding and maturation habitat requirements (M. C. Thomas, Connecticut Agricultural Experiment Station, and D.L. Wagner, University of Connecticut, pers. com., 2004).

Freshwater Shellfish

The *Field Guide to the Freshwater Mussels of Connecticut* provides state range distribution maps for each of Connecticut's mussel species. The guide includes key identification features, habitat, and conservation status (CT DEP 2003a). Figure 1.11 illustrates the known sites for state-listed freshwater mussels in Connecticut. Nationally and regionally, many freshwater mussel species are in danger of extinction (Williams et al. 1993). Half of Connecticut's 12 native freshwater mussel species are state-listed due to their rarity and one, the yellow lampmussel, is thought to be extirpated (CT DEP 2003a). Survey data and long-term monitoring research are needed to determine the distribution and abundance of these freshwater mussel species. Baseline population and life history information also are needed to determine appropriate conservation actions. The status of the state and federally endangered dwarf wedge mussel is addressed by its current recovery plan (USFWS 1993).
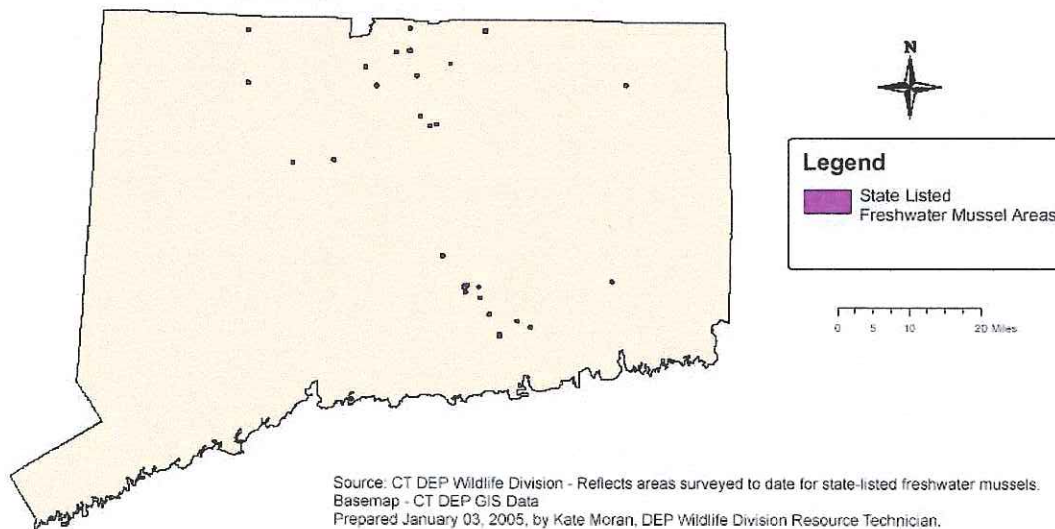

Source: CT DEP Wildlife Division - Reflects areas surveyed to date for state-listed freshwater mussels.
Basemap - CT DEP GIS Data
Prepared January 03, 2005, by Kate Moran, DEP Wildlife Division Resource Technician.

Figure 1.11 Sites for State-listed Freshwater Mussels in Connecticut (Source: CT DEP Wildlife Division, 2005 unpublished data)

Information on the status of knowledge of Connecticut's freshwater snails was reported by Jokinen (1983) but significant research is needed to accurately determine the abundance and distribution of this taxon.

Butterflies, Moths, and Bees

Efforts to map the distribution of Connecticut's 120 butterfly species are being undertaken through the Connecticut Butterfly Atlas Project (www.dep.state.ct.us/cgnhs/nddb/bfly.htm). Many of the state's butterflies have specific host plants. In general, these species are in decline as their required habitat continues to be lost or altered by development (Wagner et al. 2003; Rogers-Castro, DEP Wildlife Division, pers. comm. 2004).

Many specialized butterflies, such as northern metalmark, Harris' checkerspot, Acadian hairstreak, bronze copper, and falcate orange-tip, require very specific habitats (Rogers-Castro, DEP Wildlife Division, pers. comm. 2004). Conservation efforts focused on these specialists also will benefit generalist butterfly and moth species (Swengel 1998). Native bees, that are important pollinators, also would benefit from management efforts and native plantings targeting these focal butterfly species (Rogers-Castro, DEP Wildlife Division, pers. comm. 2004; Gall, et al, in press).

Endangered Tiger Beetles

The endangered tiger beetles are highly dependent upon specific habitats and can only be found in a few locations in the state. Recent research has identified a population of the Puritan tiger beetle along the Connecticut River in Middlesex County. Research, monitoring, and survey actions are on-going in accordance with the federal recovery plan (USFWS Puritan Tiger Beetle Recovery Plan 1993) and may reveal other sites along the Connecticut River that may be prove to be suitable for reintroduction.

Marine Invertebrates and Shellfish

Marine invertebrates of interest for commercial or recreational harvest, such as lobsters, blue crabs, and horseshoe crabs, are managed by the DEP Marine Fisheries Division. Molluscan shellfish, such as oysters and clams, and conch are managed by the Connecticut Department of Agriculture's Aquaculture Bureau. There is a need to assess abundance and distribution of other, non-harvested benthic marine macroinvertebrates. As with other invertebrate species discussed above, a broad habitat approach will be necessary to start this process, as baseline information is lacking.

Species of Greatest Conservation Need (GCN)

The process used to select species in greatest conservation need (GCN) involved the collection, compilation, and evaluation of data from a variety of sources. Data sources included numerous state, regional, and national ranking systems that prioritize or rank species for various wildlife taxa including:

- Federal (USFWS and NOAA-NMFS) Official Threatened and Endangered Species lists,
- State (DEP) Official Threatened and Endangered Species lists,
- Environmental and Geographical Information Center (EGIC) Natural History Survey,
- Natural Diversity Database (NDDB) rare and tracked species,

- Environmental Protection Agency (EPA) and DEP - Resource Protection Areas (CT DEP 1997),
- Dowhan and Craig (1976) - listing of rare species and habitats,
- Special Projects, including Farmington Valley Biodiversity Project and the Green Valley Institute (GVI),
- Connecticut Rivers Assessment (1997),
- Water Bureau - Water Quality Assessment and 305B reports (CT DEP 2004a),
- TNC - ecoregional target species,
- USFWS - Threatened and Endangered Plans (USFWS 1993 - 2001),
- PIF - bird plan priority species (Rosenberg 2004),
- USFWS - Comprehensive Conservation Plans,
- Metzler and Wagner's 13 Most Imperiled Ecosystems (1998), and
- Northeast Endangered Species & Wildlife Diversity Technical Committee Regional Species of Conservation Concern list (NEES & WDTC draft)

In addition, quantitative and qualitative input were obtained from DEP staff and stakeholders, including:
- Wildlife Division,
- Inland Fisheries Division,
- Marine Fisheries Division,
- Office of Long Island Sound Programs,
- Environmental and Geographic Information Center,
- Watershed coordinators,
- Universities,
- Nonprofit organizations,
- State and federal agency partners,
- Tribal Nations, and
- Scientific experts

Connecticut's Endangered Species Act Scientific Advisory Committees (ESSAC), (six taxon committees comprising 50 recognized wildlife experts from academia, conservation stakeholder groups, and state agencies) were asked to provide information on status, abundance, distribution, and habitat associations. Their input, along with the contributions of DEP staff and other stakeholders, was used to guide development of the database for GCN species. Appendices 7b and 8b provide additional information on Connecticut's input.

All available information from a variety of existing plans and partner programs (Appendix 1a and 1e) and a survey of expert opinion (ESSAC) were used to characterize species rank, status, abundance, and habitat information. Existing designations, including the IAFWA recommended criteria (Table 1.7, page 1-25), were used to develop an initial list of Connecticut's species of Greatest Conservation Need (GCN). Three qualitative categories (most important, very important, and important) were used to highlight the relative ranking of GCN species with "most important" species being in the most urgent need of conservation efforts. The initial GCN list was provided to experts and interested

stakeholders for refinement and confirmation. Additional input was provided at subsequent meetings. There was considerable overlap of priorities among all participants indicating significant concurrence on GCN species. DEP staff and its consultant compiled these results and prepared a final list (Table 1.8). Appendix 1c lists the GCN species for all taxa, along with the criteria used to identify GCN species in Connecticut.

Table 1.7 IAFWA Guidance Criteria for Identifying GCN Species*

- Endangered, threatened, and candidate species (federal or state)
- Imperiled species (globally rare)
- Declining species
- Endemic species
- Disjunct species
- Vulnerable species
- Species with small, localized "at-risk" populations
- Species with limited dispersal
- Species with fragmented or isolated populations
- Species of special or conservation concern
- Focal species
  - (keystone species, wide-ranging species, species with specific needs)
- Indicator species
- "Responsibility" species
  - (i.e., species that have their centers of distribution within a state)
- Concentration areas
  - (e.g. migratory stopover sites, bat roosts or maternity sites)

*A national committee of experts was established to develop guidelines to help states identify GCN species.

Table 1.8 Summary of Connecticut's GCN Species

Taxa	Most Important	Very Important	Important	Total GCN Species	Total Species in CT
Mammals	8	7	12	27	84
Birds	22	57	69	148	335
Herpetofauna	6	13	11	30	49
Fish	22	24	28	74	168
Invertebrates	21	34	141	196	>20000*
Total	**79**	**135**	**261**	**475**	**>20636**

*Invertebrates are underrepresented on lists of rare species because they are poorly studied compared to vertebrate taxa.

Transient species generally were not considered unless Connecticut was critical to their overall survival. Many other species will benefit from conservation actions aimed at GCN species and their habitats. GCN species and taxon-level data gaps have been

prioritized into species conservation actions in Chapter 4. Figure 1.12 depicts general areas of concern based on existing and historical occurrences of federally listed and state-listed species, and significant natural communities.

General Areas of Concern for State and Federally Listed Species and
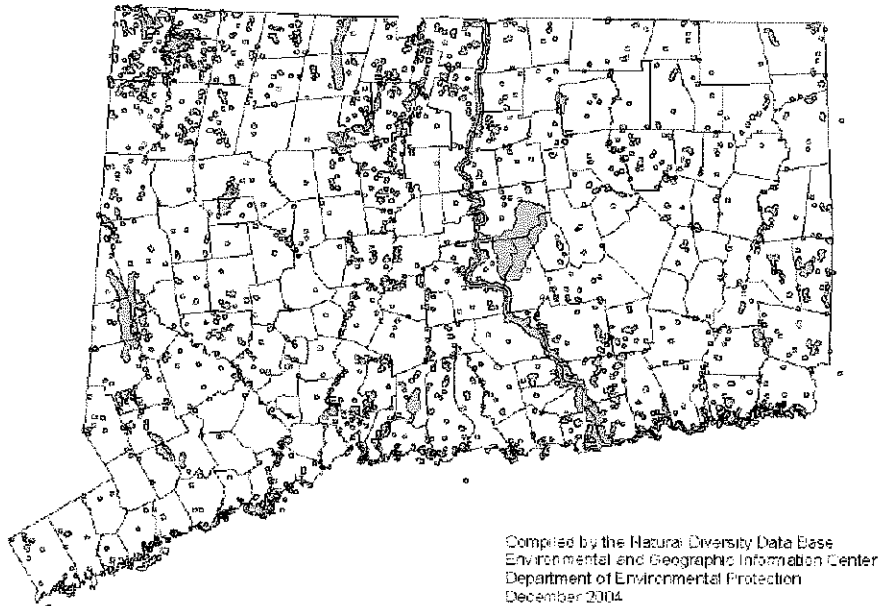Significant Natural Communities

Compiled by the Natural Diversity Data Base
Environmental and Geographic Information Center
Department of Environmental Protection
December 2004

Figure 1.12 NDDB Threatened and Endangered Species Distribution in Connecticut (Source: CT DEP NDDB 2004)
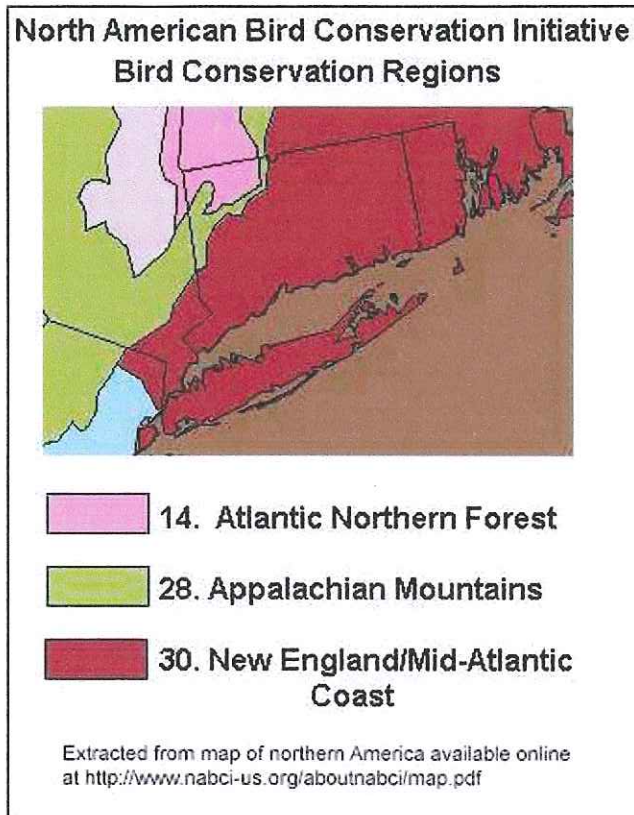
Figure 2.9 North American Bird Conservation Initiative Bird Conservation Regions (Source: NABCI website)

The most current ecoregion classification for Connecticut, which is shown in Figure 2.10 (page 2-12), corresponds with the habitat classification used in this CWCS. Metzler and Barrett (in press) modified Keys et al., "Ecological Units of the United States" (1995) to develop this ecoregion classification system. This system consists of eight classifications:

- Berkshire Vermont Uplands (BVU),
- Taconic Mountains (TM),
- Western Connecticut [Hudson Highlands] (WCT),
- Connecticut Valley [Lower Connecticut River Valley] (CT Valley),
- Eastern Connecticut [Southern New England Coastal Hills and Plains] (ECT),
- Connecticut Coast [Southern New England Coastal Lowlands] (COAST),
- Worcester/Monadnock Plateau (WM), and
- Long Island Sound (LIS).

Most of Connecticut is part of the Oak Dominated Forest of the Eastern Broadleaf Forest Province, and only the northwestern corner of the state includes areas within the Northern Hardwoods Forest of the Laurentian Mixed Forest Province (Metzler and Barrett, in press).

The combination of the above sources provides the best available information on the types, relative condition, and location of wildlife habitats in Connecticut. Because these vegetative communities have not yet been mapped at a fine scale, the collection of additional habitat information is necessary. Due to the lack of distribution and abundance information for many wildlife species, especially invertebrates, information on key habitats, sub-habitats and associated vegetative communities is used for conservation planning and research activities.

Key Habitats of Greatest Conservation Need (GCN)

As with the identification of GCN species discussed in chapter 1, the identification of key habitats essential to GCN species involved input and analysis by DEP staff, the Endangered Species Scientific Advisory Committee (ESSAC), and stakeholders. Staff from the Wildlife and Fisheries Divisions and Environmental and Geographic Information Center (EGIC) developed an initial list that was subsequently refined by the Wildlife Division's Habitat Unit and the ESSAC for plants. Using information from the existing ecoregion and vegetative classification systems, an initial list of habitats important to wildlife in Connecticut was developed and repeatedly refined by input from these groups. This list was then compared and cross-referenced with NVCS and NatureServe (Appendix 2b) for regional and national consistency. DEP staff and the ESSAC used these data to identify 12 key habitats and 43 sub-habitats (Table 2.1). Each habitat may contain more than one sub-habitat that is similar in vegetative structure and characteristics in terms of wildlife habitat. Each of these sub-habitats has been referenced, in Table 2.1, to Metzler and Barrett's eight ecoregions from Figure 2.10 (page 2-12).

Table 2.1 Key Habitat Types, their Associated Sub-habitats or Vegetative Communities, in relation to Ecoregions defined in Figure 2.10

Habitat	Sub-habitats or Vegetative Community	Ecoregion (see Figure 2.10)	
1) Upland Forest	a) Dry Oak Forests on Sand and Gravel	CT Valley (lower), ECT, Coast	
	b) Calcareous Forests	WCT (specifically Marble Valleys)	←
	c) Coniferous Forests	Throughout	
	d) Old Growth Forests	WCT, TM	←
2) Upland Woodland and Shrub	a) Red Cedar Glades	Traprock - CT Valley (lower), Limestone - WCT (Northern Marble Valley)	←
	b) Pitch Pine – Scrub Oak Woodlands	CT Valley (lower), Coast, ECT, TM	
	c) Coastal Shrublands and Heaths	Coast	
3) Upland Herbaceous	a) Coastal Dunes	Coast	
	b) Grassy Glades and Balds	WCT, TM, BVU, CT Valley (lower)	←

	c) Sandplain and other Warm Season Grasslands	CT Valley (lower), Coast, ECT
	d) Sparsely Vegetated Sand and Gravel	CT Valley (lower), Coast, ECT
4) Forested Inland Wetland	a) Atlantic White Cedar Swamps	ECT, eastern Coast
	b) Red/Black Spruce Swamps	TM, BVU, WCT
	c) Northern White Cedar Swamps	WCT (Northern Marble Valley)
	d) Floodplain Forests	Throughout
5) Shrub Inland Wetland	a) Bogs, Seeps, and Fens	Bogs - throughout except coast; Acidic Seeps - mostly throughout but poorly known; Acidic Fens - poorly known; Calcareous Fens - WCT (Northern Marble Valley); Sea level Fens – eastern Coast
6) Herbaceous Inland Wetland	a) Calcareous Spring Fens	Northern Marble Valley
	b) Freshwater Marshes	Throughout
7) Sparsely Vegetated Inland Wetland	a) Surface Springs	Unknown
	b) Vernal Pools	Throughout
8) Tidal Wetland	a) Tidal Wetlands	Coast, Major River Estuaries
	b) Intertidal Beaches and Shores	Coast
9) Freshwater Aquatic	a) Large Rivers and Streams and their Associated Riparian Zones	Throughout
	b) Unrestricted, Free-flowing Streams	Throughout
	c) Cold Water Streams	Unknown
	d) Head-of-Tide	Major Rivers
	e) Lakes and their Shorelines	Throughout
	f) Coastal Plain Ponds	CT Valley (lower), central Coast
10) Estuarine Aquatic	a) Coastal Rivers, Coves, and Embayments	Coast, LIS
	b) Vegetation Beds	Coast, LIS
	c) Hard Bottoms	Coast, LIS
	d) Sponge Beds	Coast, LIS
	e) Shellfish Reefs/Beds	Coast, LIS
	f) Sedimentary Bottoms	Coast, LIS
	g) Open Water	Coast, LIS
11) Unique or Man-Made Habitats	a) Traprock Ridges (various habitats)	CT Valley (lower) and Pomperaug outlier
	b) Offshore Islands (various habitats)	Coast, LIS
	c) Coastal Bluffs and Headlands	Coast

	d) Caves and other Subterranean Habitats	Caves - WCT (specifically Northern Marble Valley), Mines - WCT
	e) Urban Habitat	Throughout
12) Intensively Managed Habitats	a) Early Successional Shrublands and Forests	Throughout
	b) Cool Season Grasslands	Throughout
	c) Wet Meadows	Throughout

Each key habitat and its associated sub-habitats are described in greater detail in Metzler and Barrett (in press). Summary tables of associated wildlife species, by taxa, are presented for each of the 12 key habitats, and in some cases sub-habitats, in chapter 4. These tables were produced from the database developed by DEP staff, expert advisors, and stakeholders following the same process outlined in chapter 1 to identify GCN species.

The best available information and expert opinion on the location and relative ecological condition of each of the 12 key habitat types, is described in chapter 4. Representative sites and priority areas within the habitats also have been identified by DEP staff, ESSAC, and stakeholders. Primary sources of information used in developing this list of habitats were Metzler and Barrett (in press) and Metzler and Wagner (1998). In general, habitat location and relative condition of habitats are sufficient to determine what conservation action should take place for most GCN species. However, additional study and mapping of rare natural communities will provide improved baseline information for many rare species, especially invertebrates.

Chapter 3: Threats Affecting Species of Greatest Conservation Need (GCN) or their Habitats

Threats affecting GCN species or their habitats were determined based on a review of the best available information and sources. Over 120 existing conservation programs and plans were evaluated (Appendices 1a and 1e). Threats were compiled from these sources and from stakeholders and partners through surveys and workshops. An iterative consultation process was used to refine and link the threats to conservation actions. Appendix 3 identifies these threats by GCN species and taxon. Appendix 3 lists these compiled threats as they pertain to key habitats, sub-habitats, and their associated vegetative communities. Appendix 4 lists conservation actions identified by DEP staff, Endangered Species Scientific Advisory Committee (ESSAC) members, and stakeholders to address threats to GCN species.

A formal comprehensive statewide assessment of threats has never before been conducted in Connecticut for wildlife and habitat. The foundation for the process of identifying threats/problems impacting GCN species and key habitats was a comprehensive review of existing conservation programs and plans developed by the DEP, other agencies, and stakeholders organizations.

Threats identified in these plans were evaluated and prioritized by DEP staff. For example, threats to water quality were evaluated by reviewing biological monitoring data collected on Connecticut's rivers, lakes, and estuaries by the Inland Fisheries Division and the Water Bureau (CT DEP Water Bureau, Reports 305b and 303d, 2004a). In addition, The Nature Conservancy (TNC) Threats Assessment and Viability Analysis (TNC 2000) for its ecoregional target species was reviewed. A summary of threat assessments from Partners in Flight (PIF) conservation plans for the state's three Bird Conservation Regions and other related regional/international bird plans applicable to Connecticut was reviewed and integrated into this process (Rosenberg 2004, USFWS R 5) (Appendix 1d). Finally, a survey of DEP staff and a wide variety of stakeholders was conducted to capture their input on problems affecting wildlife species and key habitats (Appendix 8c).

After compiling results, additional input was sought through follow-up workshops with the ESSAC and staff from all divisions of the DEP. Threats to GCN species are shown in Table 3.1. A summary of the threats associated with the 12 key habitats is presented in Table 3.2. Some threats were specific to one habitat or applied only to closely related key habitats, whereas others were applicable to several habitats across Connecticut.

Table 3.1 Threats to Species of Greatest Conservation Need

All species:

- Insufficient scientific knowledge regarding wildlife, as well as 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., *phragmites*, purple loosestrife, mute swan)
- Lack of resources to maintain/enhance wildlife habitat
- Lack of landscape-level conservation efforts
- Public indifference toward conservation
- Delayed recovery of species with depressed populations due to limited reproductive potential, dispersal ability, or other factors

Terrestrial species:

- Loss of early successional habitats through natural succession
- Lack of wildlife conservation on most private lands
- Illegal collection/poaching of wildlife species
- Lack of data exchange (access to and submission of information) for the public and scientific community

Marine species:

- Disturbance, destruction, alteration, or loss of critical habitat structure or function
- Effects of residual contaminants in sediments and water such as, nutrients, and pesticides
- Adverse impacts from temperature shifts, including widespread long-term (e.g., global warming) and local short-term impacts (e.g., temporary power plant shutdowns)
- Predation, competition, displacement from habitat, and or disease transmission, especially from non-native species
- Unintentional damage, injury, or mortality due to fishing (e.g., incidental catch, injuries from fishing gear)

Freshwater and diadromous species:

- Degradation, alteration, and loss of habitat due to stream channel modifications, dams, channelization, filling, dredging, development, sedimentation, vegetation control, and shoreline modification
- Impacts to prey species from predation by striped bass in the Connecticut River

- 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 of excessive boat activity (wake wash, sediment suspension, propeller scarring)
- Instream flow alterations and increasing temperatures caused by consumptive withdrawals of surface or ground water and wetland loss
- Impacts of water diversions that reduce stream flows resulting in fish mortality, loss of habitat, and interference with migration
- 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-limnetic and meta-limnetic zone due to excessive nutrient run-off and vegetation control
- Disruption of fish migrations due to dredging and development
- Loss of coldwater habitat due to decreased groundwater input or increased warming (e.g., wetlands filling, impoundment, 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.

Table 3.2 Threats to Key Habitats, Sub-habitats, and their Associated Vegetative Communities

- Lack of fire needed to maintain certain habitats
- Unauthorized use of motorized vehicles, which disturb wildlife (e.g., ATVs, jet skis)
- Lack of stand age and structural diversity and understory diversity among upland forests
- Degradation of habitat from over-browsing by deer
- Degradation of habitat from insects and disease
- Loss of large forest blocks (e.g., 2,000+ acres) with unbroken canopy
- 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
- Impacts from development to upland buffers
- Impacts from development to upland migration corridors associated with vernal pools
- Impacts to and loss of riparian habitat for wildlife corridors and insufficient buffer requirements to protect streams
- Impacts from human disturbance
- Adverse effects from hypoxia and other water quality impairments, and habitat alterations in Long Island Sound
- Impacts to micro-climate caused by habitat alterations (e.g., tree cutting)

A recurring theme throughout these lists of threats is the loss and degradation of wildlife habitat in Connecticut from development and other anthropogenic impacts. Connecticut's natural landscape has been and continues to be significantly altered by human population increase and associated human activities.

Prior to European settlement, 95% of Connecticut's 3.1 million acres were forested, but by 1820, only 25% remained forested. After 1830, farm abandonment across New England resulted in the return of forests to much of Connecticut. From 1953 to 1998, the human population grew by 51% to 3.3 million, making it the fourth most densely populated state in the United States. However, Connecticut ranks 13th in percentage of forest cover. Few places on earth have so many people living as densely within an area of forest (CT DEP 2004c).

Land cover changes from 1985 through 2002 have been determined through satellite-based remote sensing images by the University of Connecticut's Center for Land Use Education And Research (CLEAR) program (Table 3.3). CLEAR data show that since 1985 the state has lost 18 acres a day to high-density development, which includes buildings, parking lots, and roads. Many of these developments are concentrated around already established cities and towns (Swift 2004). There is consensus among natural resource managers that the loss and degradation of habitats from our increasing human population and development is the primary threat to GCN species.

Table 3.3 Land Cover Changes in Connecticut 1985-2002

Class Descriptions	1985 Land Cover (sq. miles)	1985-1990 Change (sq. miles)	1990-1995 Change (sq. miles)	1995-2002 Change (sq. miles)	2002 Land Cover (sq. miles)
Developed	811	63.3	21.0	34.3	930
Turf and Grass	223	-1.8	1.3	0.1	223
Other Grasses and Agriculture	553	14.4	13.0	14.8	595
Deciduous Forest	2,483	-73.6	-36.8	-46.0	2,327
Coniferous Forest	462	-6.8	-3.7	-5.2	446
Water	164	-0.5	-4.9	-7.6	151
Non-forested Wetlands	12	6.4	2.0	3.4	23
Forested Wetlands	187	-7.9	-3.4	-1.5	174
Tidal Wetlands	23	0.1	0.1	0.3	24
Barren	35	6.6	11.4	7.5	61
Utility-right-of-way	15	-0.3	0.0	-0.1	15

Despite the high percentage of forest cover in Connecticut, fragmentation of habitat from development renders the remaining habitat functionally less valuable or unsuitable to many species of wildlife that require large blocks of contiguous forest. The CLEAR program indicates that fragmentation of forest in Connecticut continues

at a high rate. Trends in Connecticut's forest fragmentation also have been monitored by the University of Connecticut's Natural Resources Management and Engineering (NRME) Laboratory for Earth Resources Information Systems (LERIS). This program is working to develop a forest fragmentation index to better quantify the rate of forest change in Connecticut.

Impacts to forest habitats pose a difficult challenge to wildlife managers because so much of Connecticut's forests are in private ownership. More than 102,000 individuals and private enterprises own 84% of Connecticut's forestland. State, federal, and other public owners hold only 16%. Private and public water utilities own some of the largest forested tracts; however, the number of private landowners with fewer than 50 acres of forestland has increased by 68% since 1975. Three-quarters of the private forest landowners have fewer than 10 acres. These small tracts are primarily home sites (CT DEP 2004c). Thus, it is apparent that forest fragmentation poses a major threat to many GCN species and, if the CWCS is to succeed, participation by private forest landowners is critical.

For aquatic species, the loss of wildlife habitat from hydrologic impacts, such as road construction, increasing amounts of impervious surfaces, and expanded beaver activity, were identified as the primary threats affecting many habitats throughout Connecticut. Increased sedimentation and pollution from adjacent land-use changes and development also were identified as multi-habitat problems needing attention (CT DEP 2004a).

Impacts to water quality were identified as a threat to many GCN species. Declines in water quality have been well-documented, as important aquatic systems and habitats continue to degrade and become unsuitable for fish and wildlife (Figure 3.3). Trends in water quality and the aquatic life of rivers and streams have been monitored through the cooperative efforts of Inland Fisheries Division and Bureau of Water Management (CT DEP 2004a). Specifically, the Ephemeroptera, Plecoptera, Trichoptera Taxa Richness Index (EPT) and Hilsenhoff Biota Index (HBI) are commonly used methods of indicating poor quality or polluted waters that threaten the aquatic systems of Connecticut (Figure 3.4).

The Connecticut Lakes and Ponds Survey monitors and maps trends in water quality, depth and aquatic vegetation in inland lakes and ponds statewide (CT DEP 2004a; www.dep.state.ct.us/cgnhs/lakes/lakepond.htm). The Long Island Sound Program (LISP) continues to work collaboratively at the local, state, and regional levels to monitor water quality in tidal waters (US EPA OLISP 2004).

RBP III Assessments 1996-2000 (206)
ɣ Non-Impaired (49/24%)
ɣ Slightly Impaired (66/32%)
ɣ Moderately Impaired (74/36%)
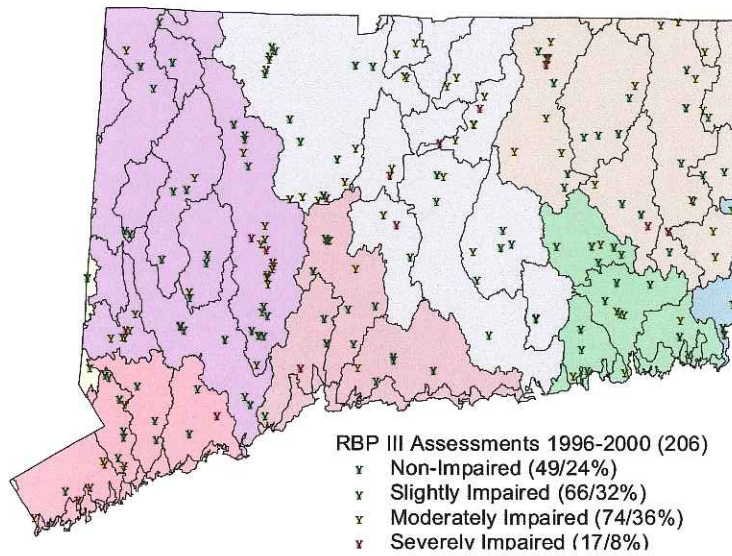ɣ Severely Impaired (17/8%)

Figure 3.1 Connecticut's Water Quality (Source: CT DEP BWM Rotating Basin Strategy, 1999)
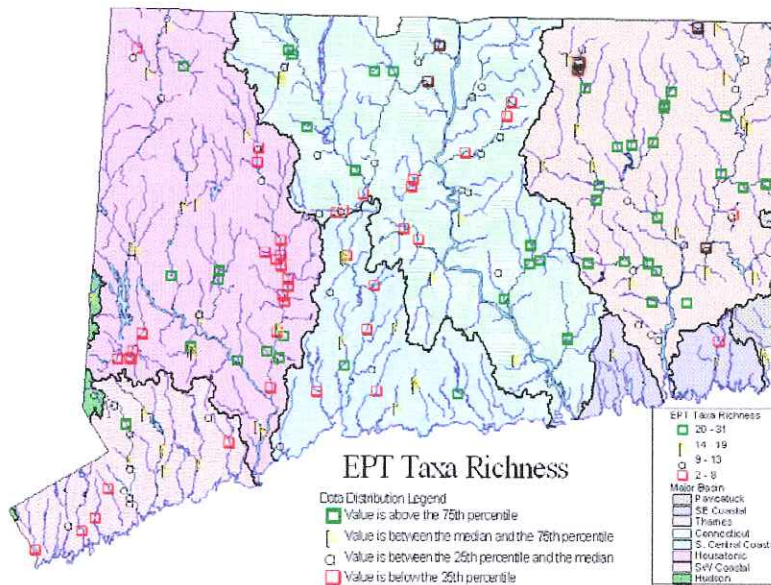

Figure 3.2 Connecticut's Water Quality EPT Indicator (Source: CT DEP BWM Rotating Basin Strategy, 1999)

The threats identified from the compilation of existing plans and programs described above were confirmed and validated iteratively by DEP staff and stakeholder input throughout the development of this CWCS. Once these threats were identified, the next step was to develop conservation actions that addressed them. The next Chapter describes how the Connecticut DEP Bureau of Natural Resources developed conservation actions to address the identified threats.

Forested Inland Wetland – Habitat 4
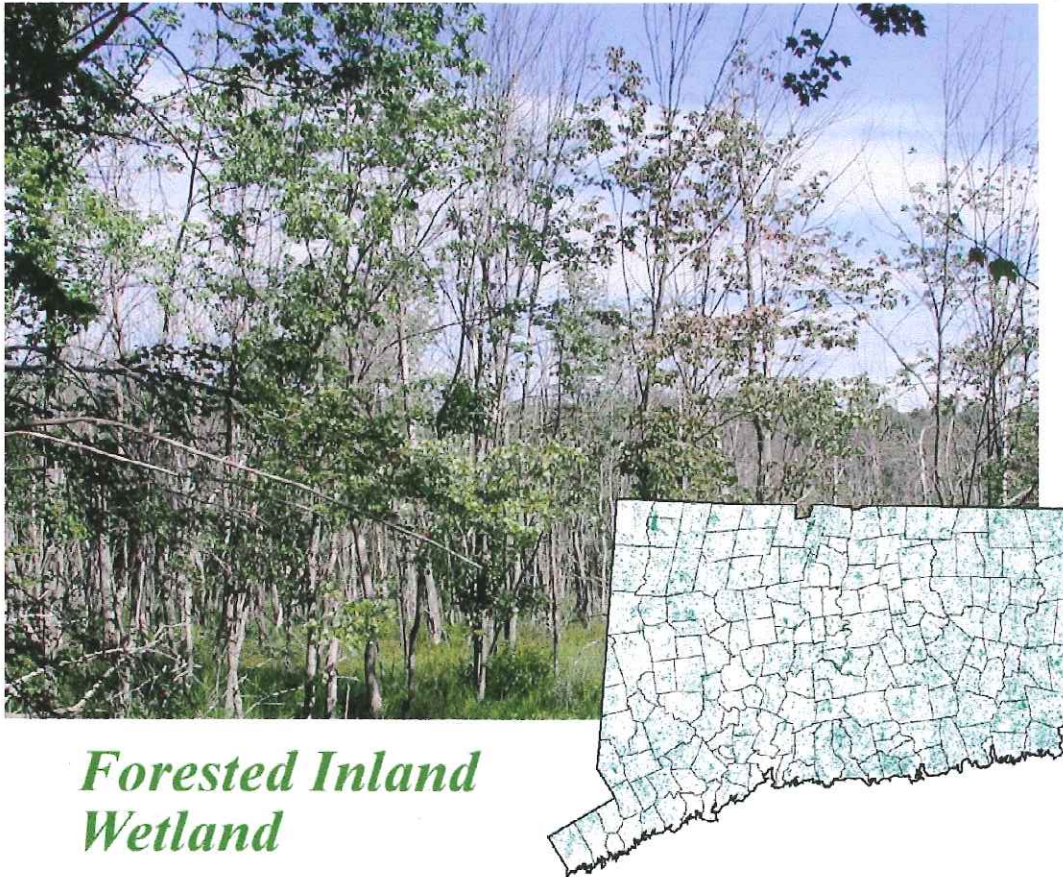
Forested Inland Wetland

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.

4-22

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	Bird (cont.)	Reptile/Amphibian
Most Important	**Important**	**Most Important**
Eastern Small-footed Bat	American Redstart	Blue-spotted salamander (diploid)
Hoary Bat	Baltimore Oriole	Eastern Spadefoot
Indiana Bat	Barred Owl	**Very Important**
Red Bat	Black-throated Green Warbler	Blue-spotted Salamander (complex)
Silver-haired Bat	Broad-winged Hawk	Eastern Box Turtle
Southern Bog Lemming	Eastern Kingbird	Eastern Ribbonsnake
Very Important	Eastern Screech-owl	Spotted Turtle
Bobcat	Gray-cheeked Thrush	Wood Turtle
Northern Water Shrew	Great Blue Heron	**Important**
Important	Louisiana Waterthrush	Eastern Newt
Black Bear	Northern Flicker	Fowler's Toad
Eastern Pipistrelle	Northern Parula	Marbled Salamander
Hairy-tailed Mole	Northern Waterthrush	Spotted Salamander
Little Brown Bat	Purple Martin	Wood Frog
Mink	Red-shouldered Hawk	
Northern Long-eared Bat	Veery	
	Winter Wren	**Invertebrate**
Bird	Yellow-throated Vireo	**Most Important**
Very Important		Hessel's Hairstreak
American Black Duck		**Very Important**
American Woodcock		Pink Streak
Black-billed Cuckoo		Two-spotted Skipper
Black-throated Blue Warbler		**Important**
Canada Warbler		Annointed Sallow Moth
Cerulean Warbler		*Bembidion semicinctum*
Chestnut-sided Warbler		*Brachinus cyanipennis*
Green Heron		*Carabus vinctus*
Hermit Thrush		Coastal Pond Amphipod
Hooded Merganser		*Goniops chrysocoma*
Least Flycatcher		Gray Comma
Northern Saw-whet Owl		*Hybomitra trepida*
Rose-breasted Grosbeak		*Hybomitra typhus*
Yellow-billed Cuckoo		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.

- 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
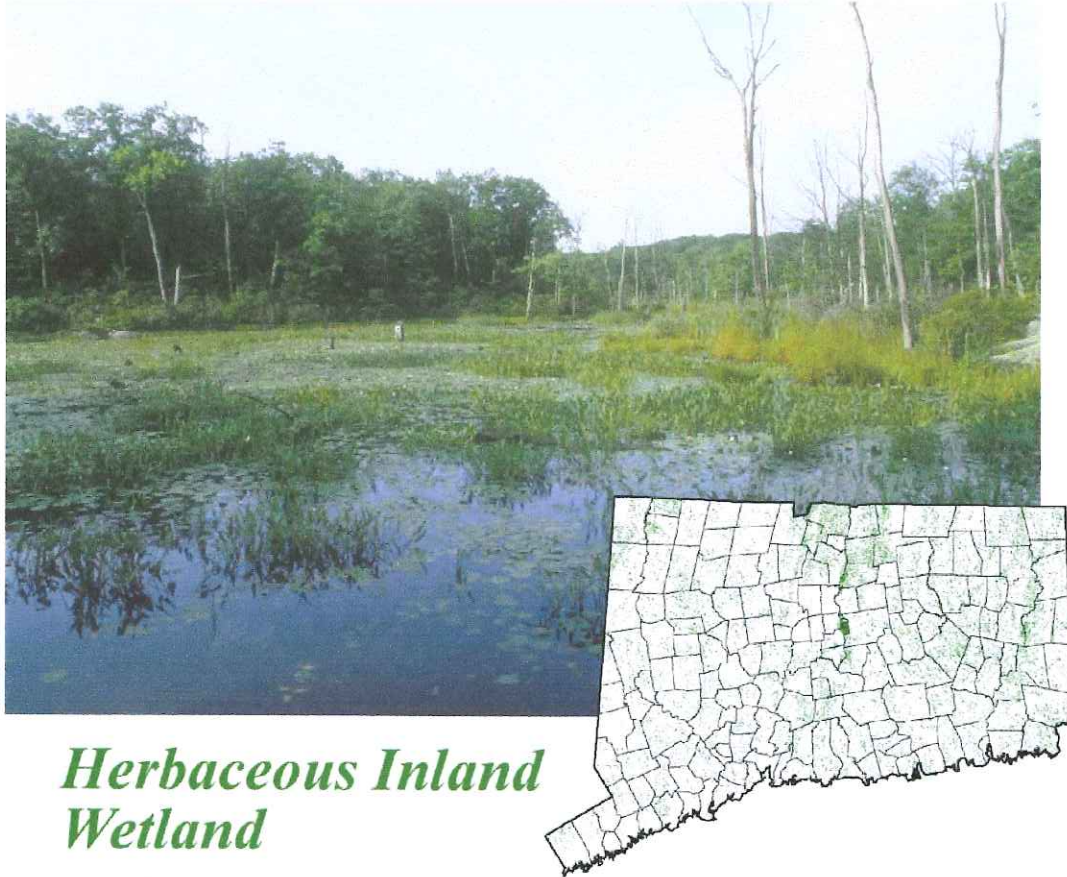
Herbaceous Inland Wetland

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.