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CHAPTER 1
FISH AND WILDLIFE OF CONSERVATION CONCERN

INTRODUCTION

This chapter addresses Element 1 by describing the full array of Connecticut's wildlife and summarizing the best available sources of information on species abundance and distribution. It then presents the greatest conservation need (GCN) species as identified by Connecticut DEEP's experts, partners, and stakeholders.

NORTHEAST REGIONAL CONTEXT

Connecticut actively participates in the regional collaboration for fish and wildlife conservation in the Northeast. The northeastern states (Virginia north to Maine) have a long history of cooperation through the Northeast Association of Fish and Wildlife Agencies (NEAFWA). These states recognize that a cooperative effort is necessary for the successful protection and management of many of our region's most endangered and threatened species.

To address this rising need, the Northeast Fish and Wildlife Diversity Technical Committee (NEFWDTC), comprised of technical experts from states' Natural Resource Agencies, evaluated a total of 1,260 species from seven major taxonomic groups (mammals, birds, reptiles, amphibians, fish, tiger beetles, and freshwater mussels). Almost 30 percent (365 species) were identified as Regional Species of Greatest Conservation Need (RSGCN) based on a species' conservation status, listing in State Wildlife Action Plans (SWAP), and the percentage of a species' range that occurs in the Northeast (see Table 1.1 for a breakdown of RSGCN by major taxonomic groups). The RSGCN process is ongoing; other species are still being evaluated for inclusion in the RSGCN list.

Analysis of the RSGCN list (excluding 11 federally listed invertebrate species omitted from the RSGCN process) shows that approximately 16 percent of RSGCN species are considered to be of both high regional responsibility and high regional concern. High regional responsibility indicates that a species is found in 50 percent or more of the northeastern states, while high regional concern is determined by population status and trends and inclusion in SWAPs. Nearly 30 percent of the RSGCN species are currently listed, or being considered for listing, under the federal Endangered Species Act (ESA). These data show that while the Northeast is rich in species, regional action is necessary to ensure that this richness endures.

TABLE 1.1: REGIONAL SPECIES OF GREATEST CONSERVATION NEED (RSGCN) SUMMARY STATISTICS

Taxonomic Group	Species in Region*	State GCN**	RSGCN***	High Regional Responsibility and Concern***	Federal Status***
Mammals	128	87	45	8	13
Birds	387	263	110	12	35
Reptiles	74	65	29	6	11
Amphibians	91	73	35	3	4
Fish	441	299	100	16	11
Tiger Beetles	28	27	11	6	2
Freshwater Mussels	111	101	23	7	4

Note: There are 11 other Federally listed invertebrates.

** From NEPARC website and the comprehensive lists of vertebrate species, tiger beetles, and freshwater mussels on the NatureServe Explorer website*

*** From Whitlock (2006) comprehensive list of SGCN for all Northeast states*

**** From most recent version of RSGCN list, produced by NEFWDTC and partners* (Sources: NatureServe and NALCC)

CONNECTICUT'S FISH AND WILDLIFE

Wildlife in Connecticut includes all species of invertebrates, fish, amphibians, reptiles, birds, and mammals which are wild by nature. Connecticut's wildlife is remarkably diverse, especially considering that it is the third smallest state in the nation. This diversity is due to the state's range of landscapes, waterscapes, and habitats, from the coastal plain and Long Island Sound in the south to the mountains in the northwest (Dowhan and Craig 1976, Kulik et al. 1984, Klemens 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, 50 species of reptiles and amphibians, 169 species of fish, and an estimated 20,000 species of invertebrates (CT DEEP 2014).

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 species like the northern saw-whet owl and yellow-rumped warbler (Dowhan and Craig 1976; Kulik et al. 1984; Klemens 1993; Metzler and Wagner 1998; Anderson et al. 2006; 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. It is also near the northern limit for temperate zone species, such as the weakfish and spot.

State, federal, and global listings and abundance ranks for Connecticut's species are summarized in Table 1.2 by taxon. Sources of information for all taxa are summarized in Appendix 1a. Appendix 1b lists the Regional Species of Greatest Conservation Need and Appendix 1c lists Connecticut's GCN species.

TABLE 1.2: WILDLIFE DIVERSITY OF CONNECTICUT - SPECIES RICHNESS BY REPRESENTATIVE TAXA

Taxonomic Group	Found in CT	State listed	Federally listed	G1 & G2 Ranked	GCN Most Important	GCN Very Important	GCN Important
Mammals	84	11	4	1	12	6	10
Birds	335	48	3	0	22	38	35
Reptiles	27	14	5	2	4	8	4
Amphibians	23	8	0	0	2	5	8
Fish	169	13	2	0	17	14	42
Vertebrate Total	**638**	**94**	**14**	**3**	**57**	**71**	**99**
Invertebrate Total*	**20,000**	**194**	**4**	**5**	**36**	**58**	**148**
Grand Total	**20,638**	**288**	**18**	**8**	**93**	**129**	**247**

** Total is only an estimate of the actual number of invertebrates found in Connecticut. Many groups remain to be fully quantified including some with high diversity such as spiders, bees, ants, and myriad soil arthropods.*

Key:
G1 Rank = Critically imperiled across its entire range (i.e., globally)
G2 Rank = Imperiled across its entire range (i.e., globally)
GCN Most Important, Very Important, Important = Greatest Conservation Need species in Connecticut classified by the urgency of needed conservation actions.

Information on the state's priority species continues to be gathered and analyzed, especially on those for which there is no baseline data. Inventory and assessment of Connecticut's priority species have been conducted continuously since the original Comprehensive Wildlife Conservation Strategy (now referenced as the 2005 WAP) in 2005. Projects are funded through the State Wildlife Grant (SWG), Endangered Species Act Section 6, and other key Federal Aid programs of the U.S. Fish and Wildlife Service (USFWS) that enable states to implement the priority conservation actions identified in their Wildlife Action Plans. This funding has allowed Connecticut to develop protocols for collecting baseline data on distribution and abundance of species, and to conduct other surveys and research for focused species information needs. SWG project updates are summarized by taxa in the following sections.

In addition to the collection of new data on GCN species , consolidation and digitization of existing data were identified as high priorities in the 2005 WAP, and this effort has increased each year since the original WAP was adopted. Through consolidation and digitization, information can be shared more readily with stakeholders, partners, and the public. Wildlife Diversity Program staff developed spatially-enabled databases that included bald eagle and peregrine falcon nesting data (since 1992), colonial waterbird survey data (since mid-1980's), and rabies test results for bats dating back to 1995 (CT DEEP Report to USFWS 2011). Bald eagle nest locations and productivity data since 1992 were contributed to a regional study coordinated by New Hampshire Audubon. This will facilitate watershed-wide mapping and analysis of eagle productivity for the entire Connecticut River basin from Long Island Sound to Quebec.

MAMMALS

Forty-five species of mammals have been designated as RSGCN in the Northeast. This designation was based on current conservation status, the percentage of their distribution contained in the region, the number of states that listed them as GCN species in their 2005 State Wildlife Action Strategies, and in response to emerging issues and threats. Eight mammal species were considered to be of regional responsibility or of "high" or "very high" regional concern, and were also listed in a majority of northeastern Wildlife Action Plans. Those

occurring in Connecticut were eastern small-footed myotis, New England cottontail, and American water shrew. These species were also considered "high" regional responsibility, as at least half of their range occurs in the Northeast.

Since the original 2005 WAP, Connecticut has been involved with state and regional projects to address conservation issues affecting mammalian species. The state has collaborated on 41 regional projects since 2005, including Regional Conservation Needs (RCN) projects, Competitive SWG, and North Atlantic Landscape Conservation Cooperative (NALCC) projects. These efforts were summarized in the Northeast Synthesis (Terwilliger Consulting, Inc. and NEFWDTC 2013) and are accessible on the www.RCNgrants.org website.

Eighty-four mammal species have been found in Connecticut, including eleven state-listed and four federally-listed species. Linsley (1842), Adams (1896), Goodwin (1935), and Wetzel (1974) provided valuable historical catalogues of the mammalian species of Connecticut.

Summaries of statewide projects managed by DEEP and by a multitude of other partner organizations are accessible on the DEEP website (www.ct.gov/deep). Some of DEEP's core projects that address mammals include: deer and furbearer management, nuisance or problem animal management, and wildlife rehabilitation. Additional information and updates on the WAP process and on projects discussed throughout this document can be found at the DEEP Wildlife Action Plan web page: www.ct.gov/deep/wildlifeactionplan.

Large Mammals and Furbearers

Almost 75 percent of the landscape in Connecticut was cleared for agriculture by the year 1820. This drastically affected the historic distribution and abundance of forest-dependent mammals such as black bear, elk, cougar, moose, white-tailed deer, and timber wolf. Timbering practices and unregulated harvest also greatly reduced other furbearing species such as beaver and river otter (Wharton et al. 2004), and resulted in the extirpation of elk, cougars and timber wolves.

P.J. Fusco

The black bear population in Connecticut has been rapidly increasing over the past few decades.

The Wildlife Division monitors the status of furbearers, bear, deer and moose. Mammals categorized as furbearers include 13 species. All furbearers with the exception of bobcats may be harvested during regulated trapping seasons. Harvest during regulated hunting seasons is also allowed for six species (raccoon, opossum, skunk, red fox, gray fox and coyote). Information about furbearer distribution and abundance is maintained in varied data sets and reported in annual federal aid performance reports.

Black Bear: Black bears are forest-dependent omnivores that ranged throughout the state prior to European settlement. Black bears were extirpated from the state by the mid-1800's, mainly as a result of deforestation and unregulated hunting. Remnant populations in western Massachusetts expanded into northwestern Connecticut beginning in the 1980's. Since then, the population in Connecticut has been rapidly increasing. Population abundance and distribution have been indexed through annual recording of sightings and records of vehicle

kills. An ongoing radio-telemetry study of female bears began in 2000. This research has provided estimates of reproduction, survival, home range sizes, and resource selection. A hair-snare mark-recapture study conducted in 2013 and 2014 provided population estimates of several hundred black bears.

White-tailed Deer: The deer management program monitors abundance and distribution in the state and regulates deer-hunting seasons to maintain healthy deer populations within biological and cultural carrying capacity. It also addresses deer management in urban areas within the state. Annual deer program summaries, which describe population dynamics, hunting regulation changes, and harvest statistics, can be found in the "Hunting & Trapping" section of DEEP's website.

Moose: It is unclear if moose are native to Connecticut. There is no archaeological evidence to suggest that moose were present and no mention of the animal in ethno-historic accounts. If moose were native to the state, they likely existed in low numbers. The first reported moose sighting in Connecticut was of a moose cow with calves, in Hartland in 2000. Between 2000 and 2007, at least 40 calves were born in the state (this number only includes reported sightings by the public). Other moose likely were born in Connecticut or migrated into the state from Massachusetts.

Raccoon, Opossum, Skunk: Raccoon, opossum and skunk are found throughout Connecticut. These species are highly adaptable and utilize human-altered habitats such as agricultural and residential areas. Distribution and abundance information is available from annual trapper surveys.

Muskrat: Muskrats are found throughout Connecticut. Harvests have been declining within the state and regionally for several decades. This is a concern for furbearer managers in the region. Still, the species is common within suitable habitat and the population is not threatened. Current distribution and population trends are obtained from trapper harvest reports and annual trapper surveys.

Beaver: Forested wetlands are preferred beaver habitat. The increase in forest habitat that began in the 1850's, combined with restoration and relocation efforts in the 1900's, have resulted in a well-established and broadly distributed beaver population. Harvests are increasing. Current distribution and population trends are obtained from trapper harvest reports and annual trapper surveys.

River Otter: The river otter population appears to be well established in Connecticut. Their numbers probably increased as a result of the growth and expansion of the beaver population. Distribution and abundance trends have been determined from trapper harvest reports. Reproductive indices were obtained from examining carcasses of harvested otters from the 1980's through 2012.

Red Fox, Gray Fox: The red fox population that exists today is made up of hybrids, a result of interbreeding between native red foxes and the European red fox, which was introduced into the eastern coastal areas of the United States in the mid-18th century. Red and gray fox populations are distributed throughout Connecticut but have probably declined from historic levels due to a corresponding decline in early successional stage habitats and competition with coyotes. These species often utilize human-altered habitats and can live in close association to humans. Abundance trends and distribution can be determined from hunter and trapper harvest reports and annual trapper surveys.

Coyote: Originally found only west of the Mississippi River, the coyote's range expanded over much of North America in the 1900's. The eastern expansion reached Connecticut in the mid-1950's. Their population increased rapidly and spread throughout the state over the ensuing decades, and the species is now common. Reproductive indices obtained from coyote carcasses examined during the 1980's and again from 1995 through 2005 showed that coyotes exhibited a high reproductive potential. Population distribution and trends have been obtained from annual hunter and trapper harvest reports and annual trapper surveys. Reports from people having conflicts with coyotes may also serve to index distribution and abundance.

Fisher: Fisher were extirpated from Connecticut and considered absent through the 1980's. Their range expanded from central Massachusetts south into eastern Connecticut in the late 1980's. Fishers were reintroduced into northwestern Connecticut in 1989 and 1990 and are now found statewide, although they appear more abundant in the eastern portions of the state. Population density and distribution have been indexed from sighting reports since the 1980's. Fisher carcasses gathered from vehicle-kills and trapper harvests have been necropsied to measure reproductive indices. Harvest reports and trapper surveys provide distribution and population trend information.

Bobcat: Bobcats occur commonly throughout Connecticut. The population abundance and distribution have been indexed via sighting reports and records of vehicle kills since the 1980's. Reported sightings have steadily increased since the 1980's when they were first recorded. Sightings and distribution have also been reported on annual trapper surveys. Carcasses of vehicle-killed bobcats have been necropsied and indices for reproduction suggest the population may be increasing.

Long-tailed and Short-tailed Weasel: Connecticut used SWG funding to conduct genetic and morphometric studies that assessed the distribution and abundance of long and short-tailed weasels. Initial results of this study indicate that long-tailed weasels are common statewide, while short-tailed weasels are found mostly in the northwestern portion of the state (CT DEP 2009).

Marine Mammals

A sighting of marine mammals 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, common dolphin, and manatee. The North Atlantic Right whale population is stable at a low level of abundance (345-400 individuals) in the Atlantic coast waters outside of Long Island Sound (McCann et al. 2010), with no known occurrences in the Sound during the last 20 years. The harbor porpoise is a state-listed species of special concern and is also listed as a species of low regional responsibility and high regional concern despite not being federally-listed. There are many historical records indicating that the harbor porpoise was once abundant in Connecticut, but those records may be suspect because they include dolphins. There have been few recent sightings of this species in Connecticut, but a total of 11 confirmed strandings (six deceased and five living animals) occurred in the state between 1990 and 2011 (Smith 2013; NOAA 2003). Smith (2013) presents GIS-based maps on marine mammal strandings in Connecticut, Rhode Island, and Fisher's Island, New York (Figure 1.1).

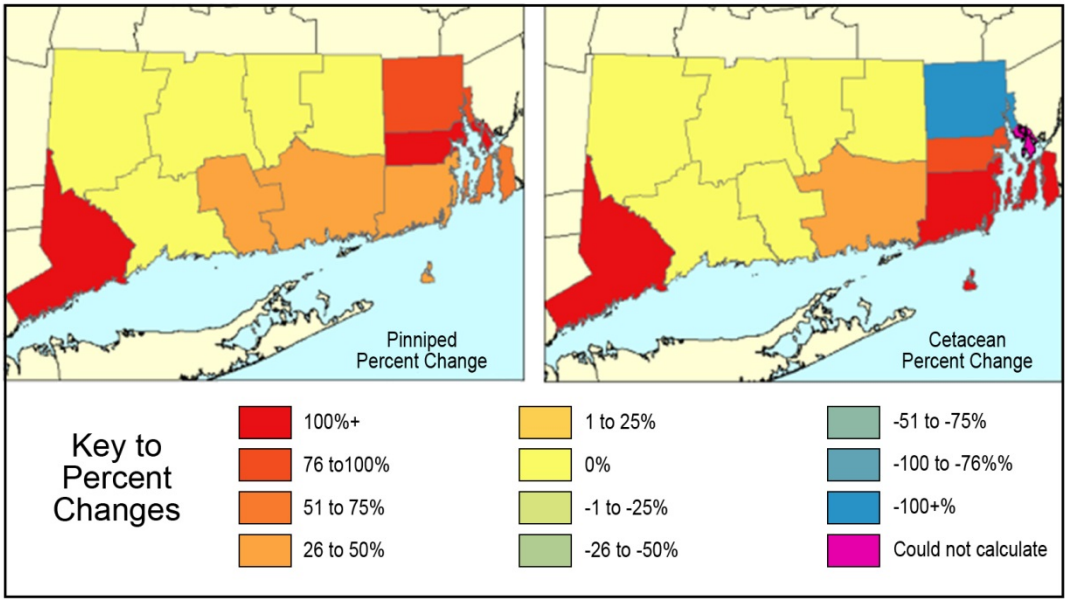

FIGURE 1.1: PERCENT CHANGE IN MARINE MAMMAL STRANDINGS BY COUNTY IN CONNECTICUT AND RHODE ISLAND, COMPARING 1990-2000 DATA AGAINST 2001-2011 DATA (SOURCE: SMITH 2013)

A number of pinnipeds also occur commonly in the Sound. These include gray and harbor seals, harp seals, and rarely, the hooded seal. The number of harbor seals is increasing in Connecticut, as part of a broader population increase to 6,100 individuals (based on a 1999 study) in southern New England (McCann et al. 2010). Harbor seals only occur in Connecticut (and south of Cape Cod) in winter months. Harp seals are reported in southern New England, including Connecticut and Rhode Island, almost solely due to strandings.

A NOAA stock assessment report has been issued for each of the above mentioned marine mammals. For more detailed information on status, abundance, and distribution of these species refer to the reports available online at http://www.nefsc.noaa.gov/nefsc/publications/tm/tm182/ (NOAA 2003).

The Mystic Aquarium Marine Mammal and Sea Turtle Stranding Department maintains a database on stranding events in southern New England. During the period 1990-2014, a total of 161 strandings were documented in Connecticut, including representing four species of pinnipeds (seals) and five species of cetaceans (whales, dolphins and porpoises) (Table 1.3). Of these, harp seal strandings have been the most common since the late 1990s (McCann et al. 2010).

TABLE 1.3: MARINE MAMMAL STRANDINGS IN CONNECTICUT, 1990-2014. (SOURCE: ADAPTED FROM SMITH 2013)

Pinnipeds	No. of strandings	Cetaceans	No. of strandings
Gray Seal	10	Atlantic White-sided Dolphin	3
Harbor Seal	33	Common Dolphin	2
Harp Seal	82	Fin Whale	1
Hooded Seal	8	Harbor Porpoise	7
Unidentified Pinniped	10	Long-finned Pilot Whale	1
		Unidentified Cetacean	4
Total Pinnipeds	**143**	**Total Cetaceans**	**18**

The two leading causes of death for marine mammals are entanglement in commercial fishing equipment and collisions with ships. To address marine mammal mortality, NOAA has developed multiple strategic and take-reduction plans to provide northeastern states with guidelines and regulations. Species-specific plans currently exist for Atlantic large whales, harbor porpoise, North Atlantic Right whale, and Bottlenose dolphin. Strategic plans have been developed for Atlantic trawl gear, mammal strandings, and more. All of NOAA's take-reduction and related plans can be found at http://www.nero.noaa.gov/Protected/mmp/ (NOAA 2015).

Small Mammals

Small mammals have been a focus of SWG-funded projects, focusing on inventory and assessment of relative abundance and distribution of GCN species and identification of key habitat associations.

P.J. Fusco

White-nose syndrome has caused a dramatic decline in Connecticut's bat populations.

Bats: In Connecticut and regionally, populations of bat species, especially tree roosting species, have declined from historical levels in eastern woodlands (USFWS 2014; BCI 2001). National education efforts since the 1980's have increased public interest in bat conservation, but low reproduction and a variety of anthropogenic threats continue to increase the likelihood of extinction of some species (Tuttle 2004).

White-nose syndrome (WNS) is an epidemic for cave roosting bat species in the United States, and has resulted in a loss of between five and six million bats in the eastern United States and Canada since its discovery in 2006 (Reeder et al. 2012). In Connecticut, dramatic losses have been documented for the northern long-eared bat, little brown bat, and tri-colored bat (Figure 1.2). While the big brown bat also experienced significant declines due to WNS, they do not approach the more than 90 percent declines experienced by these other species. Connecticut is at the epicenter of this disease, , and as a result it has both the need and an opportunity to collect and disseminate information to states that are currently less affected by WNS. To conserve species of bats and respond effectively to WNS, the U.S. Fish and Wildlife Service has issued a national plan for managing WNS (USFWS 2011). In addition, the development of laboratory and field tests for treatments to combat WNS is ongoing (Reeder 2012).

The Wildlife Division has conducted research and management on bats, collecting data from mist netting surveys, radio-telemetry studies, hibernacula surveys, and rabies tests (1995-2014) (J. Dickson, CT DEEP, pers. com., 2015). Since 2001, SWG-funded research has allowed Connecticut to continuously gather vital information through surveys for all bat species: red bat, hoary bat, silver-haired bat, little brown bat, big brown bat, northern long-eared bat, Indiana bat, small-footed bat and, especially, tri-colored bat. Hibernacula surveys have documented the dramatic decline of bat populations due to WNS (Figure 1.2). Acoustic surveys (2011-2012) found that tree roosting bats (red bat, hoary bat, silver-haired bat) made up only

20-30 percent of the bats identified. The other 70-80 percent was made up by cave roosting bats, and this percentage is skewed heavily by the big brown bat which is currently the most abundant bat species in the state, post-WNS.

The Indiana bat, a federally endangered species, has a formal recovery plan that addresses its conservation (http://www.fws.gov/midwest/Endangered/mammals/inba/inba_drftrecpln16ap07.html) (USFWS 2007). In April, 2015, the U.S. Fish and Wildlife Service listed the Northern long-eared bat as federally threatened throughout its range. The determination and accompanying 4(d) ruling can be found at: http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/FRnlebFinalListing02April2015.pdf (USFWS 2015).

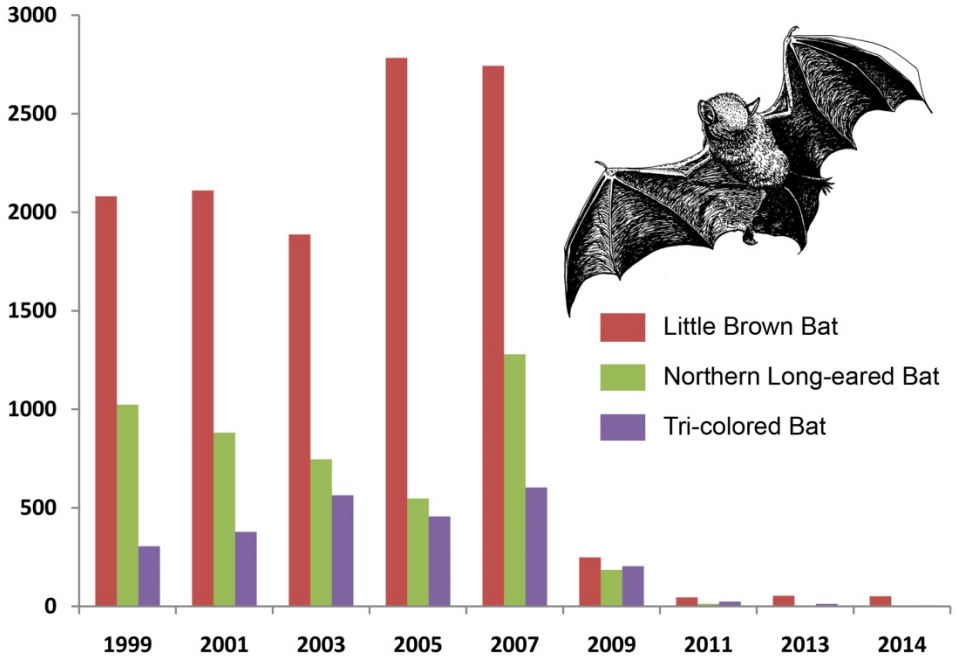

FIGURE 1.2: NUMBER OF BATS COUNTED AT THREE HIBERNATION SITES IN CONNECTICUT.

Small Rodents and Shrews: Very little data exist for these species in Connecticut. Therefore**,** in 2010, the mapping of historic and current ranges for several small rodents (southern red-backed vole, woodland vole, meadow jumping mouse, and woodland jumping mouse) was a major focus of SWG efforts (CT DEEP Report to USFWS 2010). More than 5,000 trap nights were recorded with the following captures: 16 red-backed voles, 61 woodland voles, 11 meadow jumping mice, and ten woodland jumping mice. The meadow jumping mouse has shown long-term stability in two population areas, and the woodland jumping mouse range has decreased in size. During this research period, it was also determined that the endangered least shrew requires critical management and conservation strategies to maintain its habitat.

Small Game Mammals: The Wildlife Division's small game program monitors abundance and distribution of eastern cottontail, New England cottontail, gray squirrel, woodchuck, snowshoe hare, and European hare through hunter surveys. In addition to hunter use surveys, the Wildlife

Division has conducted several studies to assess the distribution and population status of the New England cottontail.

The New England cottontail (NEC) was once common throughout New England and eastern New York, but largely due to habitat loss and competition from the introduced eastern cottontail, the range of this species has declined by 86 percent since 1960 (Figure 1.3) In 2004, the NEC was listed as a species of greatest conservation need in all the State Wildlife Action Plans in the Northeast where the species still occurred (CT, RI, MA, NH, ME and NY) and its listing continues. In 2006, the species was designated as a Candidate for Threatened or Endangered Status under the Federal Endangered Species Act. Its designation triggered a sweeping conservation effort by state and federal agencies. This regional conservation effort was formalized in 2011 with the organization of the Regional NEC Initiative. The groups involved included state and federal agencies, universities, and non-governmental organizations, all working to develop a Conservation Strategy that described habitat and population goals, funding sources, and planned actions. The Conservation Strategy for the New England Cottontail (*Sylvilagus transitionalis*) (Fuller and Tur 2012) was formally adopted in November of 2012 (http://www.newenglandcottontail.org/sites/default/files/conservation_strategy_final_12-3-12.pdf). A result of this effort was the 2015 determination that the NEC does not warrant listing under the Federal Endangered Species Act. Innovative conservation ranging from habitat restoration to captive rearing helped the NEC reach many recovery goals. Continued public-private partnerships will be required to maintain this success.

Connecticut holds the most significant remaining population of NEC and as such plays a leadership role in restoration efforts. The Wildlife Division is partnering with the Natural Resources Conservation Service (NRCS), the U.S. Fish and Wildlife Service, the Wildlife Management Institute (WMI) and the National Fish and Wildlife Foundation (NFWF) to conduct research, implement habitat management work, and provide education and outreach in order to cultivate and foster public participation in these efforts (WTNEC 2014).

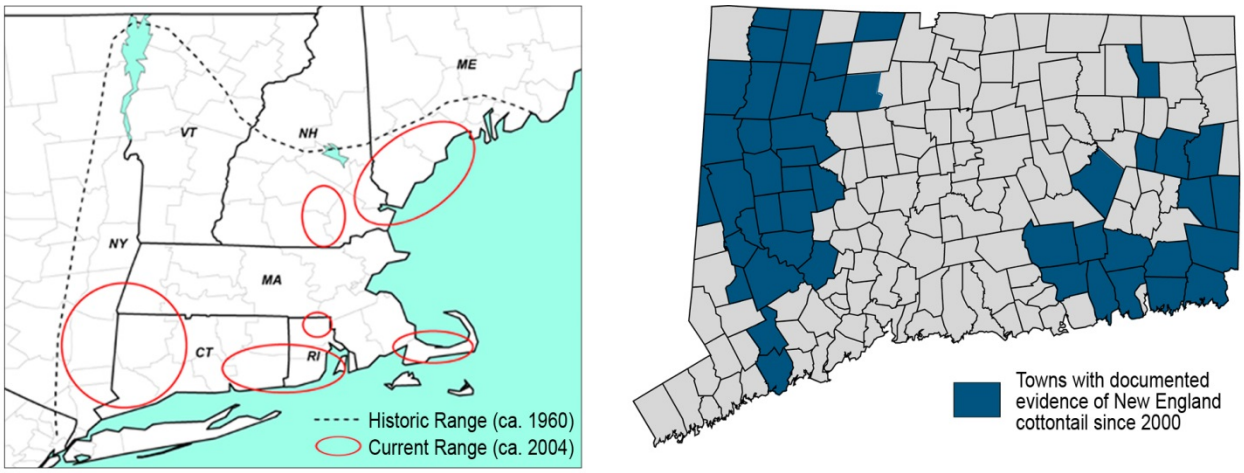

FIGURE 1.3: HISTORIC AND CURRENT DISTRIBUTION OF NEW ENGLAND COTTONTAIL IN THE NORTHEAST (SOURCE: USFWS AND CT DEEP)

The Wildlife Division initiated NEC research in 2000, beginning with the objective of locating towns where NEC were present. Species distribution was assessed using live trapping, collection of fecal pellets and roadkills, and donations from hunter harvest. Because NEC and Eastern cottontails look very similar and are difficult to distinguish in the field, DNA analysis of tissue samples and skull examinations were used for species identification. To date, 1,851 specimens have been collected and NECs have been documented in 46 of Connecticut's 169 towns (Figure 1.3).

BIRDS

One hundred ten species of birds have been identified as RSGCN in the Northeast, based on conservation status, the percentage of their range included in the region, and the number of states that listed them as GCN in their 2005 State Wildlife Action Plans. Of these birds, ten species were ranked by the NEFWDTC as "very high" concern and "high" responsibility for the Northeast, with more than 50 percent of their range occurring in this region.

P.J. Fusco

The blue-winged warbler has been identified as one of the 26 bird species listed in the "most important" tier of Connecticut GCN species.

Thirty-five of the 110 RSGCN birds occur along the Northeast region's coast, either in salt marshes, beaches, dunes, or offshore islands. For centuries, these habitats have been heavily impacted by human activities, including development, pollution, marsh filling and draining, spraying for mosquito control, and human recreational use. These activities represent formidable threats to coastal species. Of these species, the piping plover, red knot, and roseate tern have been the subject of considerable conservation attention in the Northeast due to their listing under the Endangered Species Act.

Merriam (1877), Sage et al. (1913), and Bevier (1994) have summarized the avian diversity in Connecticut. The Atlas of Breeding Birds of Connecticut (1982-1986) identified 173 species and two hybrid forms that were nesting in the state, with an additional 14 species exhibiting breeding behavior (Bevier 1994). It provided distribution maps for each of Connecticut's breeding birds as well as a narrative account for each species with information about its migratory/non-migratory status, comparative breeding population abundance, and wintering areas in the state (Zeranski and Baptist 1990, Bevier 1994, 1996, and Perkins 2001). The North American Bird Conservation Initiative's annual State of the Birds report (most recently published in 2014) also described trends, statistics, and information about bird species in North America (NABCI 2014). Estimates of the annual rates of survival, reproduction, recruitment, and population change for 150 bird species is provided by the Vital Rates of North American Landbirds (http://www.vitalratesofnorthamericanlandbirds.org/). The data are based on analyses of hundreds of thousands of bird banding and recapture records collected over a 15-year period (1992-2006) across the United States and southern Canada by the Monitoring Avian Productivity and Survivorship (MAPS) program. For decades, trends in mourning dove breeding populations in Connecticut have been monitored with call count surveys conducted by the Wildlife Division, as part of a U.S. Fish and Wildlife Service national project to provide an index to population size. The most current checklist of Connecticut birds, updated annually by the

Connecticut Ornithological Association (COA 2014), included 431 species, some of which occur infrequently while others occur only during migration or as over-wintering species.

In 2008, an implementation plan was developed for the New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30). It's goal was to promote partner-driven, science-based conservation efforts to achieve regional habitat and population goals for all birds in the region (ACJV 2008).

Connecticut has been involved with multiple regional bird-specific projects since the implementation of the 2005 WAP. One of these projects, completed in March 2009, developed avian monitoring indicators and measures for conservation action effectiveness in the Northeast (view final reports at http://rcngrants.org/content/development-avian-indicators-and-measures-monitoring-threats-and-effectiveness-conservation) (NCBMP 2007). Best management practices for the implementation of conservation actions for early successional habitat birds in the Northeast were developed in 2011 (McDowell 2011). Connecticut was involved in a regional Atlantic brant survival and habitat use study, covering the area from Connecticut to Virginia (Ladin 2010 and Ladin et al. 2011). It was also one of five states investigating regional American black duck survival and wintering habitat use (Ringelman et al. 2015).

Information for conservation of GCN bird species has been compiled since 2005. In 2011, DEEP developed a centralized avian database to provide these data to conservation partners. Partners and managers can now access information on target bird species and also input their own standardized data into the database (CT DEEP Report to USFWS 2011).

Additional SWG projects focused on collecting baseline data on the distribution and abundance of several GCN species in Connecticut by identifying key nesting habitat features and developing local resource management plans (CT DEEP reports to the USFWS 2009, 2012a;b, 2013). SWG funding has also been dedicated to establishing survey protocols for species for which information is limited; and research has been focused on acquiring baseline data needed for effective conservation and management of those species (CT DEEP Report to USFWS 2009).

In 1995, the National Audubon Society initiated the Important Bird Area (IBA) program in the United States. IBAs provide essential habitat for one or more species of birds and are usually discrete sites that stand out from the surrounding landscape. In recognition of Connecticut's importance for birds, Audubon Connecticut has identified 27 IBAs (Table 1.4) and is working to develop individual conservation plans for each site. All current IBAs and conservation plans can be found at http://ct.audubon.org/important-bird-areas-11.

TABLE 1.4: IMPORTANT BIRD AREAS (IBAS) OF CONNECTICUT AND ASSOCIATED CONSERVATION PLANS. (SOURCE: NATIONAL AUDUBON SOCIETY; CONSERVATION PLAN SOURCES: AUDUBON CONNECTICUT N.D., 2006, 2007A-B, 2008, 2009A-D, 2011, 2012A-B)

Important Bird Area	Town(s)	Plan
Audubon Center at Bent of the River	Southbury	Download Plan
Audubon Greenwich (including Quaker Ridge)	Greenwich	
Bafflin Sanctuary Complex	Pomfret	
Barn Island Wildlife Management Area*	Stonington	
Connecticut College Arboretum	Waterford, New London	
Cove Island Park	Stamford	Download Plan
East Rock Park	New Haven	
Falkner Island Unit of McKinney NWR	Guilford	Download Plan
Good Hill Farm Preserve	Woodbury, Roxbury	Download Plan
Great Captains Island	Greenwich	Download Plan
Greenwich Point Park	Greenwich	
Hammonasset Beach State Park*	Madison	
Lighthouse Point Park	New Haven	Download Plan
Mamacoke Island	Waterford	Download Plan
Menunketesuck and Duck Islands	Westbrook	
Milford Point/Wheeler Marsh	Milford	
Naugatuck State Forest	Naugatuck, Beacon Falls	Download Plan
Northwest Park	Windsor	Download Plan
Quinnipiac River Tidal Marsh	North Haven, New Haven, Hamden	
Salt Meadow Unit of McKinney NWR	Westbrook	Download Plan
Sandy Point	West Haven	
Silver Sands State Park and Charles Island	Milford	
Station 43	South Windsor	Download Plan
Stratford Great Meadows Area	Bridgeport, Stratford	Download Plan
TNC's Devil's Den	Weston, Redding	
Topsmead State Forest	Litchfield	
White Memorial Foundation	Litchfield, Morris	

**denotes a globally important bird area*

Despite substantial efforts focused on birds, several species groups remain in need of further research. For example, many of Connecticut's upland birds have received little research or management attention despite exhibiting declining population trends. Basic information on their population status is needed to guide management and monitoring protocols.

Grassland Birds

P.J. Fusco

Eastern meadowlarks are one of the 17 grassland bird species that have experienced persistent, widespread declines.

The 2014 National State of the Birds report discussed decades of population declines for grassland birds. (NABCI 2014). The 2009 State of the Bird's report also concluded that grassland birds continue to be among the fastest and most consistently declining group of birds in North America, with 55 percent of these species showing significant declines (NABCI 2009).

According to the Conservation Status Assessment (Anderson and Olivero Sheldon 2011), of the 22 bird species that preferentially breed in grasslands, fields and field edges, 17 have experienced persistent, widespread declines. These included Eastern meadowlark, field sparrow, Northern bobwhite, ring-necked pheasant, brown thrasher, song sparrow, common yellowthroat, grasshopper sparrow, red-winged blackbird, killdeer, savannah sparrow, golden-winged warbler, vesper sparrow, yellow-breasted chat, blue-winged warbler, prairie warbler, and bobolink. This trend probably reflects the historical fact that habitat for these species expanded during the period of widespread farming and pasturing and then declined following agricultural abandonment and a return of the land to forest (Anderson and Olivero Sheldon 2011). Partners in Flight (PIF) has identified upland sandpiper, grasshopper sparrow, and bobolink as priority species for these habitats in southern New England (Dettmers and Rosenberg 2000; Rosenberg 2004). These species were also included as GCN species for Connecticut.

The status of Connecticut's grassland birds, including information collected by DEEP on the distribution, abundance and habitat use by these species statewide, has been described by Comins et al. (2003). The Wildlife Division has monitored the status of grassland birds annually since 1998, through grassland bird surveys conducted by volunteers (J. Dickson, CT DEEP, pers. com., 2015). Physiographic Plans by Partners in Flight (Areas 9 – Southern New England, and 27 – Northern New England) (Rosenberg 2000, 2004), the North American Landbird Conservation Plan (NALCP) (Rich et al. 2004), and the Region 5 Avian Conservation Summary for Connecticut (USFWS R5 2004) have all provided detailed status, abundance, and distribution information for grassland birds. These plans also provided population goals, objectives, and threats for these species.

The Wildlife Division, in cooperation with the Northeast Connecticut Kestrel Project and University of Connecticut (UConn), assessed fledgling survival and dispersal for American kestrel. The Northeast Connecticut Kestrel Project is a volunteer endeavor that monitors about 50 kestrel nest boxes in eastern Connecticut. Ongoing work with the Northeast Connecticut Kestrel Project included determination of nest site fidelity rates, adult survival rates, and habitat use.

Shrubland Birds


P.J. Fusco

The eastern towhee is a shrubland bird for which Connecticut holds regional responsibility.

Breeding Bird Surveys (BBS) conducted from 1966 – 2006 indicate that more than 80 percent of shrubland bird species occurring in New England region, including Connecticut, declined across their range (Schlossberg and King 2007). In response, the Wildlife Division, in cooperation with other partners, initiated the Young Forest and Shrubland Initiative. Surveys were conducted from 2010 to 2013 to determine the abundance, distribution and habitat preference for targeted species. These surveys target shrubland species for which Connecticut holds regional responsibility, including blue-winged warbler, eastern towhee, prairie warbler, and field sparrow. For each of these species, the Wildlife Division has determined rates of occupancy, abundance, and distribution in relation to habitat, management, and landscape characteristics. By periodically repeating these surveys, the Wildlife Division can track species' population responses to shrubland habitat management and creation.

Other surveys were conducted to determine the abundance and distribution of state managed lands that were suitable for upland shrubland birds, and to estimate abundance of shrubland species on these managed properties.

Rare species such as the golden-winged warbler, brown thrasher, and yellow-breasted chat were too rare to be detected using standard survey methods, so inventories were used for these species. Golden-winged warbler surveys resulted in sightings of hybrids and one female at seven sites. Similar surveys were also conducted for brown thrasher and yellow-breasted chat. Additional research on brown thrasher resulted in a refined protocol to maximize detection and descriptions of the preferred habitat characteristics for this species.

Night Birds


P.J. Fusco

A whip-poor-will with young.

From 2005 to 2008, summer night bird surveys were used to track the population trends of whip-poor-wills, resulting in abundance and distribution maps for the species. Connecticut developed a pilot study to determine survey and monitoring protocols for owls, both state-wide and regionally (CT DEEP Report to USFWS 2009). Summer night surveys for owls has been ongoing since 2008.

Using radio-telemetry and invertebrate sampling, the Wildlife Division also conducted research into the specific foraging and nesting

requirements of whip-poor-wills in relation to forest management and land use activities. It was determined that whip-poor-wills spend the majority of their time foraging in mature forest with open understory, but are most often observed singing in early successional openings.

Migratory Landbirds

The decline in abundance and distribution of many migratory landbirds is well documented globally and regionally (Rich et al. 2004; Rosenberg 2004). Partners in Flight (Rosenberg 2000, 2004), NALCP (Rich et al. 2004), and the 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 in need of conservation.

The Wildlife Division has monitored the status of migratory landbirds using various surveys, including the Migratory Bird Stopover Habitat Project (2002-2004), the Bluebird Nestbox Program (1980-present), and forest interior bird surveys (2010-2014) (J. Dickson, CT DEEP, pers. com., 2015). Connecticut cooperated with other Northeast states to identify important migratory landbird stopover sites throughout the region (http://www.northatlanticlcc.org/projects/bird-radar-group/migratory-landbird-stopover-sites-in-the-northeast) (Buler 2014).

A Purple Martin Working Group (PMWG) was created in 2008 to establish priorities for long-term research projects. The work in Connecticut has been focused on summarizing the current information on population status and available nesting structures and determining the criteria for selecting nesting sites.

Chimney swifts have one of the highest rates of decline among passerines in the Northeast, at approximately 7 percent range-wide since 2002, placing them on Birdlife International's Red List. The Wildlife Division took the lead in developing the Northeast Coordinated Bird Monitoring working group for urban aerial insectivores, to more effectively address the needs and coordinate conservation efforts of high priority urban birds. This working group developed "Chimney Watch," which included a standardized inventory protocol to assess local areas for their capacity to support chimney swift populations as well as quantify the occupancy rates of each area. From this effort, the Wildlife Division has determined that if chimney capping continues at current rates, it could mean a loss of suitable nesting habitat for swifts in the northeast . Through other statewide inventory and monitoring efforts, the Wildlife Division in coordination with UConn has made progress towards understanding the factors implicated in chimney swift decline.

P.J. Fusco / Mount Vernon Songbird Sanctuary

Chimney swifts have among the highest rate of population decline among northeastern passerines.

Raptors

Bald Eagles: Prior to the 1990's, the last documented bald eagle nesting in Connecticut occurred on the Connecticut River in Middlesex County in the 1950's. The number of bald eagle nests has risen steadily from one nest in 1992 to 32 nests fledging 58 young in 2014. The Bald Eagle Study Group of Connecticut, a volunteer organization, contributed significantly to this effort by tracking and monitoring bald eagle nests.

P.J. Fusco

The number of bald eagle nests has risen steadily from 8 nests fledging 14 young in 2005 to 32 nests fledging 58 young in 2014.

Since 1979, the Wildlife Division has coordinated the Connecticut Midwinter Bald Eagle Survey every January. A record of 146 bald eagle sightings was recorded during the 2015 survey. Additional information can be found online for Midwinter Bald Eagle Surveys at a national scale (http://ocid.nacse.org/nbii/eagles/).

Ospreys: Osprey numbers in Connecticut plummeted in the 1970's, partly from the effects of DDT. In the 1980's, the remnant core population at the mouth of the Connecticut River began to recover and expand, and since that time ospreys have spread west along the coast and inland. By 1999, the population had reached the westernmost town in the state (Greenwich), and three inland pairs were reported. In the first decade of the 21st century, the osprey population grew by 72 pairs (44.4%) to 234, with a substantial inland nesting population (19 towns occupied). Even though DEEP stopped conducting annual counts in 2001, statewide counts will continue once every decade to monitor this species. The last statewide count, in 2009, documented 234 active nests, 202 successful nests, and 345 young fledged. In partnership with Connecticut Audubon Society, the Wildlife Division launched an Osprey Nation program in 2014. The program uses citizen-science volunteers to monitor osprey nests and fledging success statewide.

Woodland Raptors: From 2005 to 2008, the Wildlife Division conducted a research project to improve the monitoring protocols and determine the population status and distribution for six species of woodland raptors (Red-tailed Hawk, Red-shouldered Hawk, Broad-winged Hawk, Sharp-shinned Hawk, Cooper's Hawk, and Northern Goshawk). As a result of survey efforts, the Wildlife Division created preliminary abundance and distribution estimates for these species and established monitoring protocols and recommendations for future monitoring of diurnal woodland raptors in Connecticut.

Upland Gamebirds

The eastern wild turkey, ruffed grouse, northern bobwhite quail, and American woodcock are upland gamebirds for which there are regulated hunting seasons. Information about gamebird abundance and distribution is maintained in several databases (H. Kilpatrick, CT DEEP, pers. com., 2015).

Eastern Wild Turkey: Based upon harvest trends and survey data, wild turkeys have been on a gradual decline during the past ten years. Probable causes include poor spring weather conditions and, secondarily changes in habitat. Spring harvest has declined from a high of 2,367 birds in 2003 to the most recent harvest of 1,232 birds (2015). Since brood surveys began in

2007, the index (young per adult hen) has ranged from a low of 1.7 to a high of 3.6 with an average of 2.5. The literature suggests that an index of 3.0 indicates a productive population.

DEEP monitors wild turkey status and population trends through harvest information and surveys: Spring Harvest (1981-present); Fall Firearms Harvest (1990-present); Fall Archery Harvest (1983-present); Spring Turkey Hunter Survey (1981-present); and Turkey Brood Survey (2007-present).

Ruffed Grouse: Due to long-term changes in forest composition (currently less than 5% young forest) ruffed grouse have been declining statewide. In 2005, the Wildlife Division implemented baseline grouse research to obtain statewide distribution information, population trends, and identify the age and sex composition of the population.

P.J. Fusco

A radio telemetry project was started in 2012 to better understand the factors affecting shrinking ruffed grouse populations.

The majority of observations and harvest have been in the northern portion of the state, principally in the northwest corner. A statewide population index was derived from querying spring turkey hunters about their grouse encounters and then determining average number of encounters per 100 hunters.

The Wildlife Division collects population, distribution, and status for grouse through Public Grouse Observations (1999-present); Grouse Drumming Surveys (2006-present); Grouse Population Index (2005-present); Permit-Required Area Hunter Survey (1985-present); and Small Game Hunter Survey (2012-present).

A radio telemetry project was launched in 2012 to improve understanding of the factors affecting shrinking ruffed grouse populations. Preliminary findings show an apparent correlation between the lack of habitat and population decline. .

Northern Bobwhite Quail: No formalized surveys have been conducted for quail since the mid to late 1980's. In 2009, an inquiry was made to the birding community to solicit information regarding extant quail populations in Connecticut. Suitable bobwhite habitat is limited and disjunct statewide, and the conclusion of the inquiry was that Connecticut likely has no naturally reproducing bobwhite populations. Existing bobwhites are likely derived from pen-raised and released birds. Genetic assessment and stable isotope analyses would definitively determine if 'wild' birds still occur in Connecticut.

American woodcock: The population status of the American woodcock is assessed annually by the U.S. Fish and Wildlife Service (see Cooper and Rau 2014). Both the Eastern and Central Management Regions for American woodcock have a long-term (1966-2014) declining trend (-0.1 in the Eastern Region and -0.9 in the Central Region). Recruitment in both management regions continues to decline. Long-term declines in the Eastern Region are 2.3 percent lower than the average of 1.63 juveniles per adult.

In response to concerns about woodcock status in the state, the Wildlife Division created a statewide woodcock management plan (2012) based on various national and regional plans (WMI 2008, 2010). The objective of the plan was to increase the number of woodcock by 50

percent on state-owned lands and within designated focus areas. From 2003-06, the Division conducted a comprehensive study to assess woodcock population status, survival, and habitat use across the state (Huang and Kubik 2007). Ten additional survey routes were added to determine a population index for the state, as the sampling resolution of the U.S. Fish and Wildlife Service routes was not sufficient at the state level. Over the three-year period, it was found that habitat quality and quantity are the major factors governing survival rates of male woodcock in Connecticut.

Forest Interior Birds

According to the Conservation Assessment of Fish, Wildlife, and Natural Habitats in the Northeast Landscape (Anderson and Olivero Sheldon 2011), there have been substantial changes--increases as well as declines-- in forest bird abundances over the past 40 years. Changes in species abundance have been correlated with degree of habitat fragmentation, with the road-riddled oak-pine forests showing declines in 11 species and increases in ten species.

P.J. Fusco

The wood thrush is one of the 18 bird species that Partners in Flight has identified as a priority species in southern New England.

In fragmented landscapes and/or small habitat patches, direct threats such as predation and brown-headed cowbird brood parasitism are higher, often making such habitats ecological sinks. Emerging threats include changes in forest composition that may result from invasive species, diseases, and climate change. It is also important to note that forest birds have varying habitat requirements with some requiring older or younger seral stages, or different levels of structural diversity. Eighty-four percent of eastern forests are privately owned. This means that timber companies and other private forest owners can provide immense benefits to forest birds by maintaining large forest blocks and participating in sustainable forestry initiatives (NABCI 2014).

Bird Conservation Research, Inc., a non-profit research group, has conducted forest bird surveys in eastern Connecticut and western Rhode Island, and in 2011 produced a land-planning atlas that has been distributed to every town conservation commission within the research area (Craig et al. 2003).

In 2010, the Wildlife Division designed a statewide forest interior bird monitoring program that used improved and standardized sampling protocols to assist with tracking bird populations in Connecticut. Four target species (cerulean warbler, black-throated blue warbler, black-throated green warbler, and worm-eating warbler) were selected to serve as indicators of overall forest patch suitability for breeding populations of forest interior bird species. Surveys were conducted from 2010 to 2014 (J. Dickson, CT DEEP, pers. com., 2015).

Waterbirds

A variety of plans and partnerships focus on waterbird conservation. PIF (Rosenberg 2000, 2004), 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.

P.J. Fusco

The American black duck has been identified as a "very important" GCN species in Connecticut.

In 2012, the North American Waterfowl Management Plan Revision (NAWMP 2012a) and its companion Action Plan (NAWMP 2012b) were published. These two reports identified and discussed various conservation recommendations and actions which were then used to guide waterfowl management throughout the United States, including in Connecticut.

In addition, Connecticut has participated in the development of many regional, national and international programs and plans involving waterbirds, including:

- North American Waterbird Conservation Plan (NAWCP),
- United States 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),
- Atlantic Coast Joint Venture (ACJV), and
- Black Duck Joint Venture (BDJV).

These programs provide the best available species abundance and distribution data at the regional and state levels. The Wildlife Division and ACJV identified areas of particular importance to waterfowl in the state (Figure 1.4). These focus and planning areas served to direct conservation actions for waterfowl and other wetland dependent birds. The MANEM provided distribution maps of Connecticut for various guilds of waterbirds (Figures 1.5, 1.6, 1.7).

The Wildlife Division has monitored the status of waterbirds through various surveys (M. Huang, CT DEEP, pers. com., 2015), including waterfowl mid-winter inventory (1955-present), waterfowl harvest (1955-present), breeding waterfowl plot surveys (1989-present), waterfowl banding and recovery data (1955-present), wood duck box productivity (1985-present), wetland call-back survey (1993-present), and colonial waterbird survey (1977-present). The status and distribution of colonial nesting waterbirds is monitored by the Wildlife Division, the U.S. Fish and Wildlife Service, Connecticut Audubon Society, and others every three years. Additional data about three colonial waterbird species (snowy egret, great egret, black-crowned night heron) can be found at:
http://longislandsoundstudy.net/category/status-and-trends/living-marine-resources/coastal-bird/

The status and conservation of the federally threatened piping plover and federally endangered roseate tern are addressed by existing recovery plans (USFWS 1996, 2009; USFWS 1998, 2010).

Since 2004, the banding of migrant shorebirds to assess long-term habitat use, site fidelity, and survival rate continues along the Connecticut coast. Data indicate high site fidelity from year to year but that movement within a given year does occur. This work demonstrates the importance of how critical our few remaining shorebird beaches are to staging shorebirds.

A statewide partnership between Audubon Connecticut and the Connecticut Audubon Society recently established the Audubon Alliance for Coastal Waterbirds, which uses volunteers and state and federal agency staff to monitor nesting habits of coastal birds, and to educate the public about Long Island Sound bird species (Audubon Connecticut 2013). DEEP also received SWG funding to conduct wintering surveys in the Long Island Sound from 2004-2008. The goal was to better understand the importance of the Sound to staging and wintering birds. Sixty-eight species were identified, proving Connecticut to be a valuable wintering site for many migratory species. The work also identified areas of concentration that were critical for conservation planning and mitigation of impacts such as oil spills.

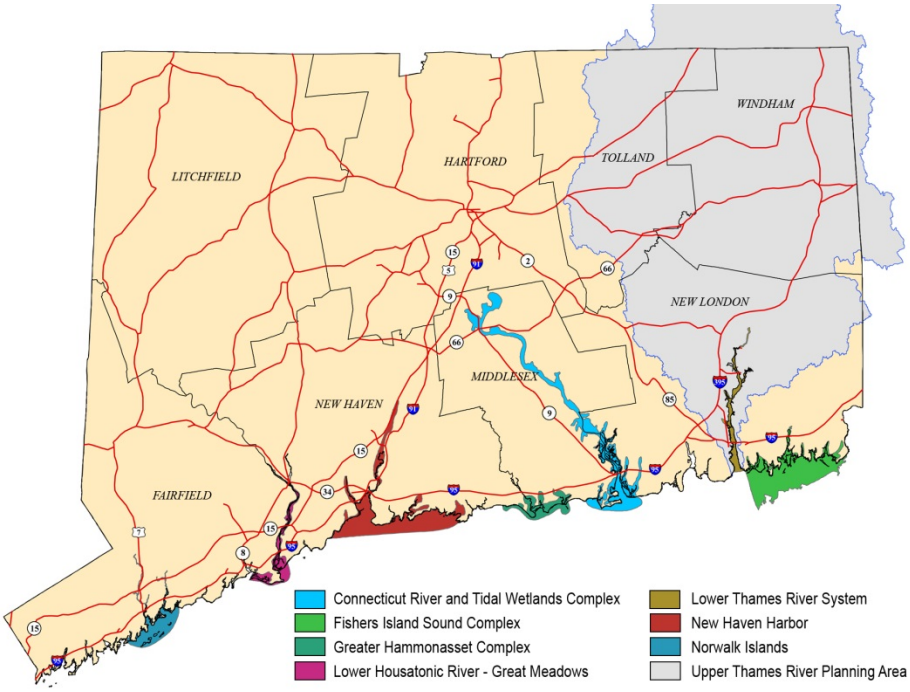

FIGURE 1.4: ATLANTIC COAST JOINT VENTURE WATERFOWL FOCUS AREAS FOR CONNECTICUT. (Source: ACJV 2005)

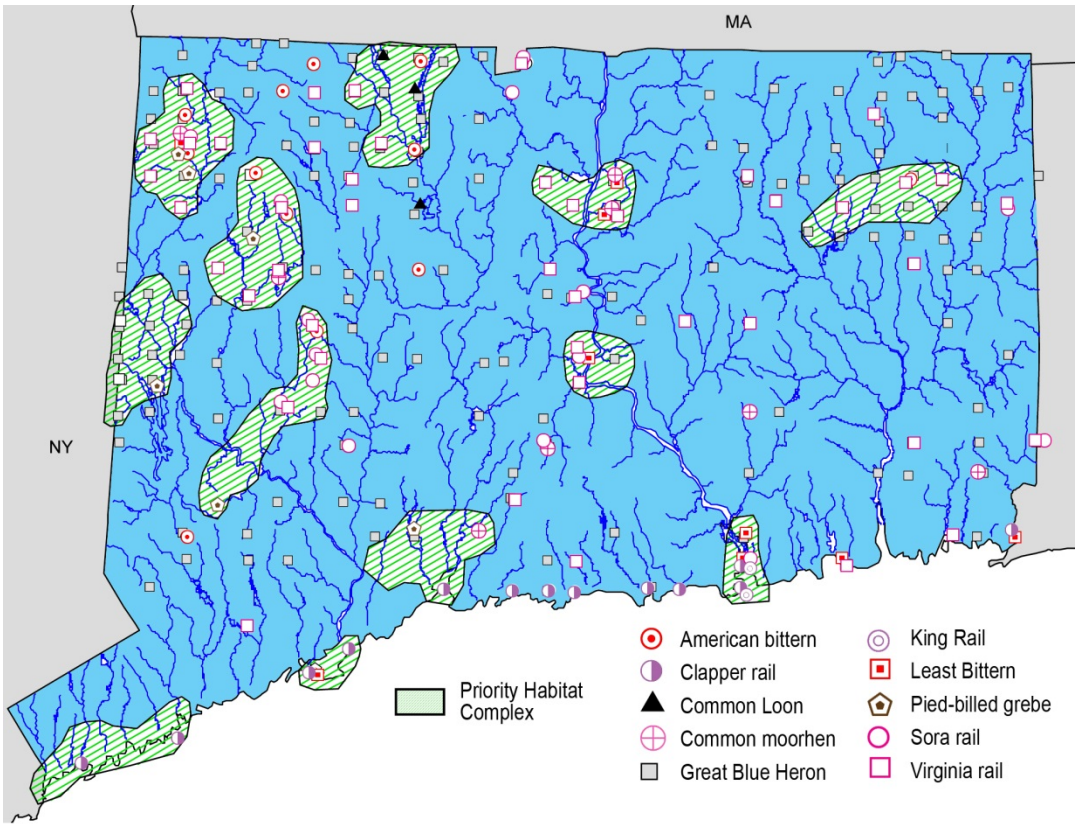

FIGURE 1.5: CONNECTICUT PRIORITY INLAND WATERBIRD HABITATS. (SOURCE: MANEM 2010)

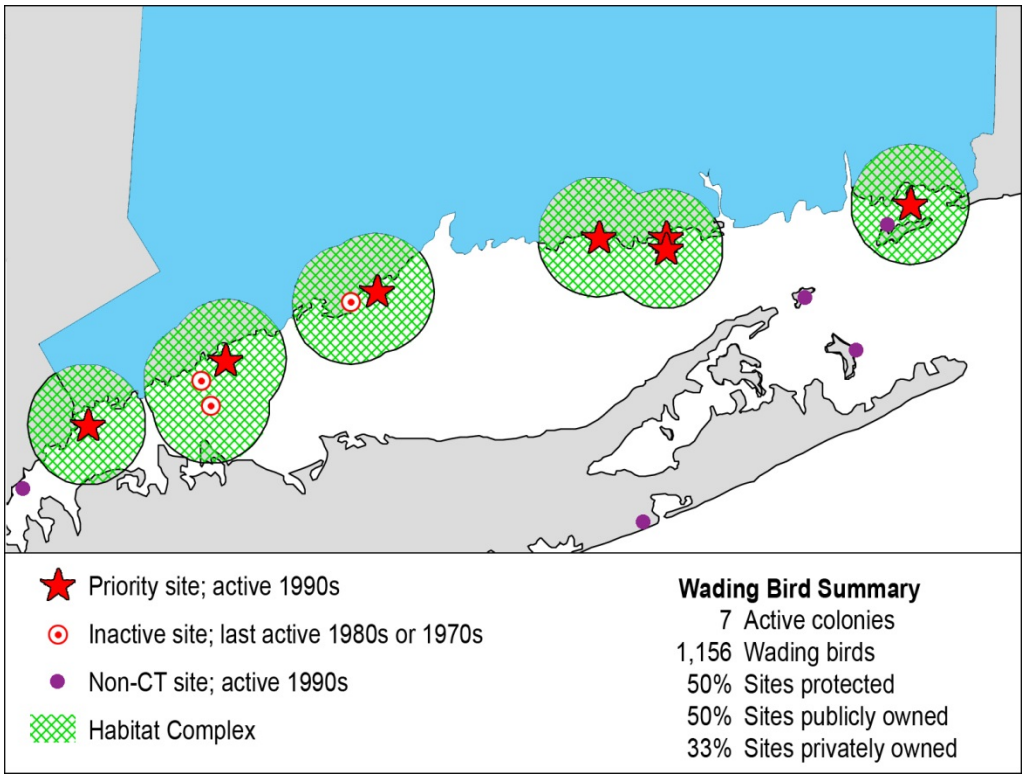

FIGURE 1.6: CONNECTICUT PRIORITY COASTAL WADING BIRD HABITATS. (SOURCE: MANEM 2010)

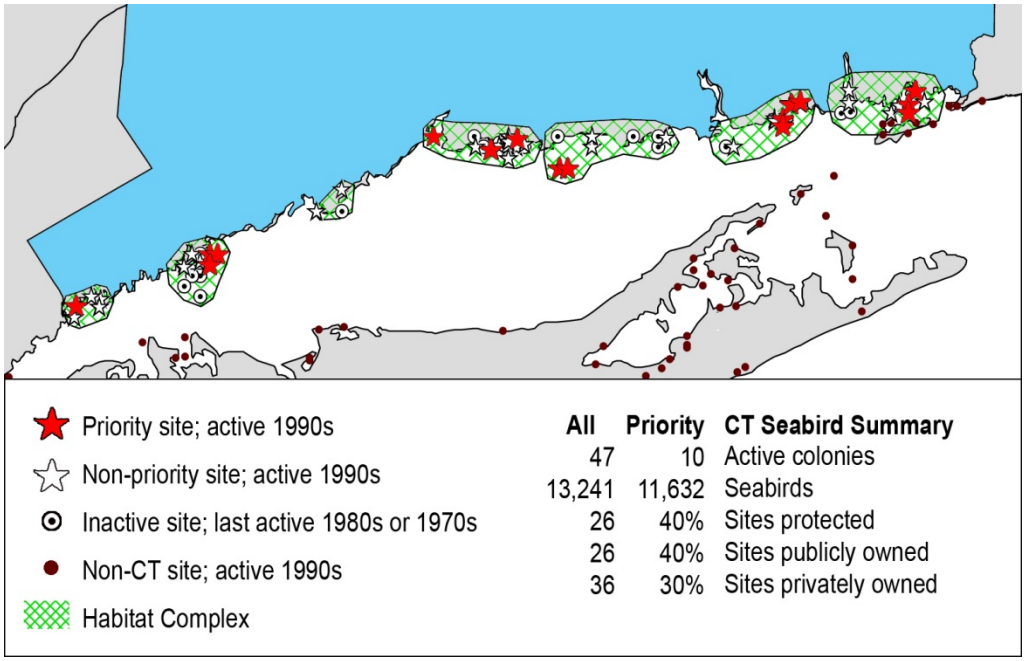

FIGURE 1.7: CONNECTICUT PRIORITY COASTAL SEABIRD HABITATS. (SOURCE: MANEM 2010)

Marsh Birds

Marshes are considered to be among the most important wildlife habitats in North America. PIF has identified maritime marshes as the habitat harboring the largest number of high priority species in southern New England.

Sea-level rise associated with climate change is expected to become a major threat to the Northeast's extensive marsh systems, many of which are already heavily degraded through past ditching, filling, and associated coastal development. The saltmarsh sparrow is considered by PIF to be the species of highest conservation priority in this region because a significant proportion of the world's population of this species breeds in the coastal marshes of southern New England (Dettmers and Rosenberg 2000).

In 2002, UConn began a series of studies on saltmarsh sparrows and other saltmarsh specialist species. Studies focused on distribution, abundance, nesting success, productivity, habitat use, and survival (Bayard and Elphick 2011; Gjerdrum et al. 2008). Preliminary analyses suggest that there have been declines in the abundance of saltmarsh sparrow and other specialist saltmarsh birds during the past two decades, and that there have been substantial changes in their habitat that are consistent with the marsh becoming wetter.

The Saltmarsh Habitat and Avian Research Program (SHARP), comprised of academic, governmental, and non-governmental collaborators, is a landscape-scale project that provides critical information for the conservation of tidal marsh birds. The project will determine each state's responsibility for the conservation of tidal marsh bird species thus providing a platform for long-term monitoring of the tidal marsh bird community along the Atlantic coastline. Detailed population and demographic data are collected for bird species using tidal marsh habitat in New England/Mid-Atlantic Coast Bird Conservation Region (BCR 30) to assess the importance of tidal marshes at state and regional scales (Shriver 2014). The SHARP project provides critical information on population trends, breeding success, and distribution of

saltmarsh obligate birds from Maine to Virginia. The Connecticut portion of the work is also the catalyst for several other saltmarsh monitoring projects that will greatly inform the management of saltmarshes in the face of climate change. For more information on SHARP and the importance of tidal marsh bird conservation, visit www.tidalmarshbirds.org.

A regional Black Rail Conservation Assessment (Wilson 2014), which studied abundance and distribution of the imperiled eastern Black Rail along the Atlantic Coast, found that dramatic declines for this species indicate that habitats are no longer suitable to support healthy populations. There were a number of other factors affecting this population decline, including nest predators and nest flooding, both of which were major threats to the breeding success of this species. In the Northeast, there are an estimated 270-400 breeding pairs. The study also found that improper management activities for mosquito control and marsh alteration could have severe negative impacts on the Black Rail. Surveys conducted throughout Connecticut over more than ten years, combined with the SHARP surveys of approximately 90 individual sites statewide between 2011-2013, suggest that black rail likely have been extirpated from the state.

Additional Bird Projects in Connecticut

Common Nighthawk – From 2005 to 2007, the Wildlife Division conducted inventories for common nighthawk habitat availability and occupancy in historical locations. No nighthawks were detected during these surveys; and this, combined with the lack of public reports of sightings, strongly suggests that breeding nighthawks also have been extirpated from Connecticut. The Wildlife Division piloted common nighthawk migration count protocols, determining that migration roost counts may serve to monitor nighthawks much like hawk watch stations are used to monitor migrating raptors. However, implementing such roost counts involves large time commitments as well as regional coordination, and the results are subject to variability in animal movements from year to year.

Marine birds – From 2012 to 2014, a regional project supported by the North Atlantic Landscape Conservation Cooperative focused on identification and mapping of marine bird distribution, abundance, and relative risk from offshore activities, such as wind energy development (Gardner 2014). The maps are intended to be used for informing decisions about siting offshore facilities; marine spatial planning; and other purposes requiring maps of seabird distributions.

Citizen science - Much of the monitoring of bird populations in Connecticut is done by "citizen scientists" who volunteer their observation skills to survey particular sites as part of nationwide projects. The Christmas Bird Count (CBC), coordinated by the National Audubon Society for more than a century, is one example. It is primarily a volunteer effort that provides consistent data on wintering bird populations throughout North America. At a more local scale, observers can subscribe to the Cornell Lab of Ornithology Project FeederWatch program which collects data from thousands of backyards throughout the winter to draw an annual picture of winter bird abundance and distribution. During the winter of 2013-2014, more than 200 Connecticut observers took part in Project FeederWatch (Cornell University 2014). Additionally, many of the Wildlife Division avian monitoring programs for species ranging from bluebirds to piping plovers to bald eagles, ospreys, and many others rely on the assistance of these dedicated volunteers.

HERPETOFAUNA (REPTILES AND AMPHIBIANS)

The Northeast RSGCN list includes 29 reptile species, including 14 turtles, two lizards, and 13 snakes. Of these species, the wood turtle, Northern diamondback terrapin, and Northern black racer are Connecticut species considered to be of high regional responsibility for management, as well as high or very high regional conservation concern. These high-priority reptile species are threatened by habitat loss, habitat fragmentation, water pollution, habitat conversion to agriculture, and illegal harvest.

P.J. Fusco

Increased fragmentation of habitats has been identified as a threat to eastern box turtle populations.

The RSGCN list for the Northeast includes 35 species of amphibians, of which 28 are salamanders, five are frogs and two are toads. Amphibian species in the Northeast are under many threats, including wetland loss, water pollution, groundwater contamination, exurban and suburban sprawl, increased habitat fragmentation from roads, new human developments, and exotic diseases.

Global evidence also indicates widespread declines in reptiles and amphibians. In general, little information is currently available to identify the specific causes or the population impacts on these taxonomic groups (Gibbons et al. 2000). There is a recognized national and regional need for advocacy focused on conservation of amphibians and reptiles and the use of an ecosystem approach that will incorporate herpetofauna species protection into existing management plans. 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.

The herpetofauna of Connecticut are diverse and have been thoroughly described by Lamson (1935), Babbitt (1937), Peterson (1970), and Klemens (1991, 1993, and 2000). 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.

Changes in land use have had a significant impact on isolating herpetofaunal populations. This factor continues to affect distribution of reptile and amphibian species in the state, as habitat that is otherwise suitable may become too fragmented to support colonization by these species (Klemens 1993, 2000).

Three regional projects have been implemented to address many of the threats to herpetofauna species. One project assessed priority amphibian and reptile conservation areas, known as PARCAs, and their vulnerability to climate change (Nanjappa 2014). Another project, completed in 2013, developed a State of the Frogs report for northeastern frog species (http://rcngrants.org/content/northeast-state-frogs-development-regional-analysis-frog-call-survey-data-north-american) (Weir 2013). A third involved the development of a conservation strategy for Wood Turtles in the northeastern United States

(http://rcngrants.org/content/wood-turtle-glyptemys-insculpta-northeastern-united-states-status-assessment-and) (Sievert 2014).

Other statewide projects have expanded knowledge of status, abundance, distribution, and population dynamics for many species. In 2007, DEEP, CTHerpConsultant, LLC, and the University of Maine's Wildlife Ecology Department conducted studies to determine movement patterns of the eastern spadefoot toads and diploid blue-spotted salamanders in Connecticut. Diploid blue-spotted salamanders are rare in the Northeast with only three known populations, one of which occurs in eastern Connecticut. Concurrently, a Central Connecticut State University master's study used GIS (geographic information systems) software, examining soil texture, drainage, deposit type, and elevation to identify potential eastern spadefoot toad habitat in eastern Connecticut and create a habitat model (Moran and Button 2011). To test the habitat model, eastern spadefoot toad observations made during 2008 were compared to the model's predicted habitat. In 26 of 27 observations, eastern spadefoot toads were documented in the areas predicted by the habitat model with "hotspots" identified for additional reconnaissance. Potential habitat for the eastern spadefoot toads was mapped using GIS, which led in turn to the discovery of a new breeding pool in August of 2011. These data provided a better understanding of the type and extent of habitat required for these species, and of how habitat disturbances may affect their movement patterns (CT DEEP Report to USFWS 2010).

To increase public awareness about declines in reptiles and amphibians, DEEP partnered with the Partners in Amphibian and Reptile Conservation (PARC) to declare 2011 the Year of the Turtle, 2012 the Year of the Lizard, 2013 the Year of the Snake, and 2014 the Year of the Salamander. This partnership sought to educate the public on a multitude of conservation issues and species vulnerability by raising awareness of these topics through press releases, community events, informational newsletters, species profiles, and more (CT DEEP Report to USFWS 2011, 2012; CT DEEP 2013, 2014).

Reptiles

Reptiles in Connecticut include skinks, sea turtles, land turtles, and snakes. Fourteen species of snakes are found in Connecticut, two of them venomous; and one of these, the timber rattlesnake, is listed as state endangered. The Eastern ribbon snake and the Eastern hognose snake are designated as state species of special concern due to their low population numbers.

P.J. Fusco

The timber rattlesnake is a state endangered species in Connecticut.

Habitat loss and urban sprawl are the main factors affecting the decline in snake populations. Several reptile species in Connecticut have been identified as rare, declining, or of unknown population status. Among all taxonomic groups, reptiles have the highest proportion of species ranked as special concern.

Five species of marine sea turtles are included on the RSGCN list (loggerhead, Atlantic green turtle, leatherback, Atlantic hawksbill, and Atlantic Ridley), all of which are protected under the United States Endangered Species Act. Because of their broad distributions and significant

range-wide declines, these species are considered to be of low regional responsibility but of very high conservation concern. Sea turtles visit Connecticut's estuarine and marine waters during the warmer months, and information about their distribution, abundance, migratory movements, and population characteristics are collected by the U.S. Fish and Wildlife Service, National Marine Fisheries Service (NMFS) and other partners to help guide actions identified in Federal Recovery Plans. The Mystic Aquarium documents strandings and mortalities of sea turtles along the southern New England shore, and a summary of these data for Connecticut during the period 1990-2015 is shown in Table 1.5.

TABLE 1.5: KNOWN SEA TURTLE STRANDINGS AND MORTALITIES IN CONNECTICUT WATERS FOR THE PERIOD 1990-2015.

Species of Sea Turtle	No. of Strandings
Atlantic Green Turtle	2
Atlantic Ridley	0
Leatherback	24
Loggerhead	21
Unknown	2
Total Sea Turtles	**49**

Recently, as part of the Rhode Island Ocean Special Area Management Plan, Kenney and Vigness-Raposa (2010) summarized information on sea turtles in Rhode Island. Based on their analysis of existing data and the absence of any specimen or photographic records, these authors concluded that the Atlantic Hawksbill is only of hypothetical occurrence in Rhode Island. For similar reasons, this species is also considered of hypothetical occurrence in Connecticut. More information is needed on the distribution, abundance, migratory movements and population characteristics of sea turtles in Connecticut.

The bog turtle is also federally and state listed, and its recovery plan includes specific actions focused on the Hudson/Housatonic area (USFWS 2001). The plan specifies conservation and management actions for the protection and recovery of the bog turtle. The U.S. Fish and Wildlife Service New England field office has begun planning habitat restoration efforts for the bog turtle in Connecticut and Massachusetts (USFWS 2011). Annual bog turtle surveys have been conducted at known sites by the Wildlife Division, with modest success. New sites have been surveyed in areas with appropriate habitat, but no additional bog turtles were found. SWG-funded work has documented continued reproductive success at known locations, however.

The wood turtle has been the subject of recent regional conservation efforts sponsored by the RCN Grant Program and NEPARC in response to evidence of population declines. A Wood Turtle Working Group was formed in 2009, and a status assessment and conservation planning process was initiated in 2011. A SWG-funded multi-year wood turtle study conducted in Fairfield and southern Litchfield Counties allowed DEEP to obtain baseline data on this species in highly impacted areas. It resulted in verification of two previously identified populations and the recording of three additional populations (CT DEP 2009). Suitable habitat was also surveyed, and a total of 40 potential sites were identified (CT DEEP Report to USFWS 2010).

SWG funding was used to implement a timber rattlesnake study, which yielded the capture of eight snakes that were then implanted with radio-transmitters and tracked during the 2008 field season. Beginning in 2010, patrol officer presence was established in rattlesnake habitat to educate the public, record snake kills, and protect timber rattlesnake habitat from illegal ATV use (CT DEEP Report to USFWS 2010). In 2012, monitoring efforts successfully thwarted several illegal collection incidents. Blood samples were taken from timber rattlesnakes statewide in 2013-2014 as part of an RCN grant study (Assessment and Evaluation of Fungal Dermatitis in New England Timber Rattlesnake Populations) in conjunction with the Roger Williams Park Zoo (Perotti 2014) (http://rcngrants.org/content/assessment-and-evaluation-prevalence-fungal-dermatitis-new-england-timber-rattlesnake). Subsequently, Connecticut participated in a SWG Competitive Program study (Conserving Snake Species of Greatest Conservation Need Threatened by Emerging Fungal Skin Disease), funded in 2013 (http://wsfrprograms.fws.gov/Subpages/GrantPrograms/SWG/SWG2013FundedProjects.pdf).

Amphibians

P.J. Fusco

Vernal pools are critical to the life cycle of many amphibians including the wood frog.

Many amphibians are found in Connecticut's wetlands, but require more than one habitat to complete their life cycle. For this reason, juxtaposition and connectivity of habitats is especially important. Connecticut's Amphibian Monitoring Program (CAMP) is a state-wide monitoring effort to track the distribution and abundance of amphibians in the state. Several amphibian species in Connecticut are rare, declining, or of unknown population status.

For example, the Mudpuppy is listed as a State Species of Special Concern and as an important GCN species. They are uncommon, occurring in only two riverine systems in Connecticut. Genetic research is needed to determine if they are a native species or introduced.

To enhance the protection of amphibian habitats, guidelines on conservation of upland buffers around wetlands, including vernal pools, have been developed (NEPARC 2004). Northeast Partners in Amphibian and Reptile Conservation (NEPARC) has also developed Northeast Habitat Management Guidelines (NEPARC 2009) and Model State Herpetofauna Regulatory Guidelines (NEPARC 2004) to demonstrate how northeastern states could alter their regulations and conservation actions to benefit amphibian and reptile species. Best Development Practices have been created for the Northeast, to conserve pool-breeding amphibians in commercial and residential developments (Calhoun and Klemens 2002).

A SWG project conducted in 2010-11 involved sampling Connecticut's amphibians to determine the presence of an infectious skin disease known as Chytridiomycosis, or Chytrid fungus. With the help of Connecticut Audubon Society and White Memorial Foundation, 600 samples from 76 locations in 49 towns were collected and subsequently analyzed by Yale University. Despite a significant presence of the fungus throughout the state, not all susceptible amphibians were found to be declining due to the disease (CT DEEP Report to USFWS 2010).

Ranavirus, which affects both reptiles and amphibians, has been implicated as a contributing factor in the global decline of amphibian populations. Dr. Tracy Rittenhouse and students at UConn are working to determine whether ranavirus is a conservation threat to amphibian populations in the northeastern United States, by studying demographics of local populations and the movement of ranavirus among populations. Ongoing surveillance work is designed to quantify the prevalence of ranavirus in Connecticut and the frequency of mass morality events.

FISH

One hundred fish species have been identified as RSGCN in the Northeast, making them one of the most numerous vertebrate groups listed. These fish taxa include representatives of all of the major fish families found in the Northeast, with certain families (Percidae, Cyprinidae, Salmonidae) frequently listed. Associated habitats for these fish species span the full range of northeastern aquatic environments, including freshwater, estuarine, and marine systems. Migratory (both anadromous and catadromous) species as well as non-migratory species were represented. This list incorporates the best current knowledge about the conservation status of fish species in the Northeast, and was recently updated by the members of NEFWDTC using the American Fisheries Society's 2013 list for the most current taxonomic classification of these species.

Human activities continue to impact aquatic systems across the Northeast, and fish populations face many threats as a result. The recent analysis by the American Fisheries Society and the U.S. Geological Survey (USGS) (http://www.actionbioscience.org/biodiversity/walsh.html) describes the most significant threats to freshwater fish. Estuarine and near-shore marine species are affected by these same threats which include destruction or modification of habitat, dam construction, stream channelization and navigational dredging, mining, sediment and toxic runoff, and riparian and coastal armoring. In some cases, pollution from point and non-point source contaminants in run-off reduces water quality to the point where only highly tolerant fish species survive. Sedimentation of fine particulates can also smother bottom substrates, causing declines in bottom-dwelling species and/or benthic forage species that require clean substrates and good water quality. During summer months, eutrophication and resulting hypoxia make rivers, such as the Norwalk, and sections of western Long Island Sound unsuitable for sensitive species.

Other impacts include non-native species, disease or parasitism, and over harvest. In the Northeast, introduced non-native species such as the Northern snakehead (now established in the Potomac River), rusty crayfish, fishhook water flea, and the aggressive red alga (*Heterosiphonia japonica)* have the potential to alter aquatic systems for all species including RSGCN fish. Parasitism or diseases, such as whirling disease introduced from Europe, affect many wild and hatchery populations of trout and salmon species. Blackspot disease in tautog and the intestinal parasite *Glugia sp.* in winter flounder impact the health of local populations and in isolated outbreaks renders them unmarketable. Over harvesting for commercial, recreational, scientific, or educational purposes can affect some species, such as the federally endangered shortnose and Atlantic sturgeons.

Global climate change and associated changes in weather and rainfall patterns across the Northeast have the potential to alter water quality and quantity in many streams, lakes, and rivers, with resulting detrimental effects for many fish species. Climate change can also exacerbate the other threats listed above. Significant changes in the Long Island Sound finfish community have already been documented as either caused by or occurring in synchrony with rising water temperatures over the past 30 years (Howell and Auster 2012).

R. Jacobs

The bridle shiner is one of the twenty-two fish listed in the "Most Important" tier of GCN species.

The Inland Fisheries Division has been working to develop a model system that uses fish populations as a tool to assess the condition of rivers and streams for additional taxa, including invertebrates. Another tool to be incorporated into the assessment process is the Biological Condition Gradient (BCG) (Gerritsen and Jessup 2007), a neural net tool that simulates the decision-making process of a biologist to categorize the streams. The BCG concept has been incorporated into invertebrate assessments and is being developed for fish assessments as well (Stamp and Gerritsen 2013). The Multi-Metric Index (MMI) (Kanno et al. 2010) is a fish population health index developed specifically for mid-sized Connecticut streams.

Since the original 2005 WAP, multiple SWG projects have contributed research toward better understanding of the fish species found in Connecticut's waters. For example, from 2005 to 2008, DEEP studied striped bass populations and the return of herring to the Connecticut River, investigating whether predation of striped bass on herring was a factor in previous herring declines. Results revealed that striped bass predation causes significant mortality among adult herring in the Connecticut River (CT DEEP Report to USFWS 2008). The bridle shiner, a globally threatened fish, was also studied by DEEP. Stream surveys were conducted to study movement patterns of bridle shiners to determine whether population declines were accurate based on likelihood of detection. Results of all studies showed that there was a significant reduction in the number of locations where bridle shiners occur (CT DEEP report to USFWS 2012).

The bridle shiner was added as a GCN species in 2010 due to evidence of regional population declines. Assessments of the status and distribution of bridle shiner were conducted in 2010, 2011, and 2013. Nine populations of bridle shiner that were previously thought to be extirpated were found. Results of the study indicated that ponds offer more suitable habitat for bridle shiners, and populations that were found in streams were commonly found in impoundment areas. Current bridle shiner distribution is mapped in Figure 1.8. Additional bridle shiner research may result in discovery of additional populations (CT DEEP 2014a).

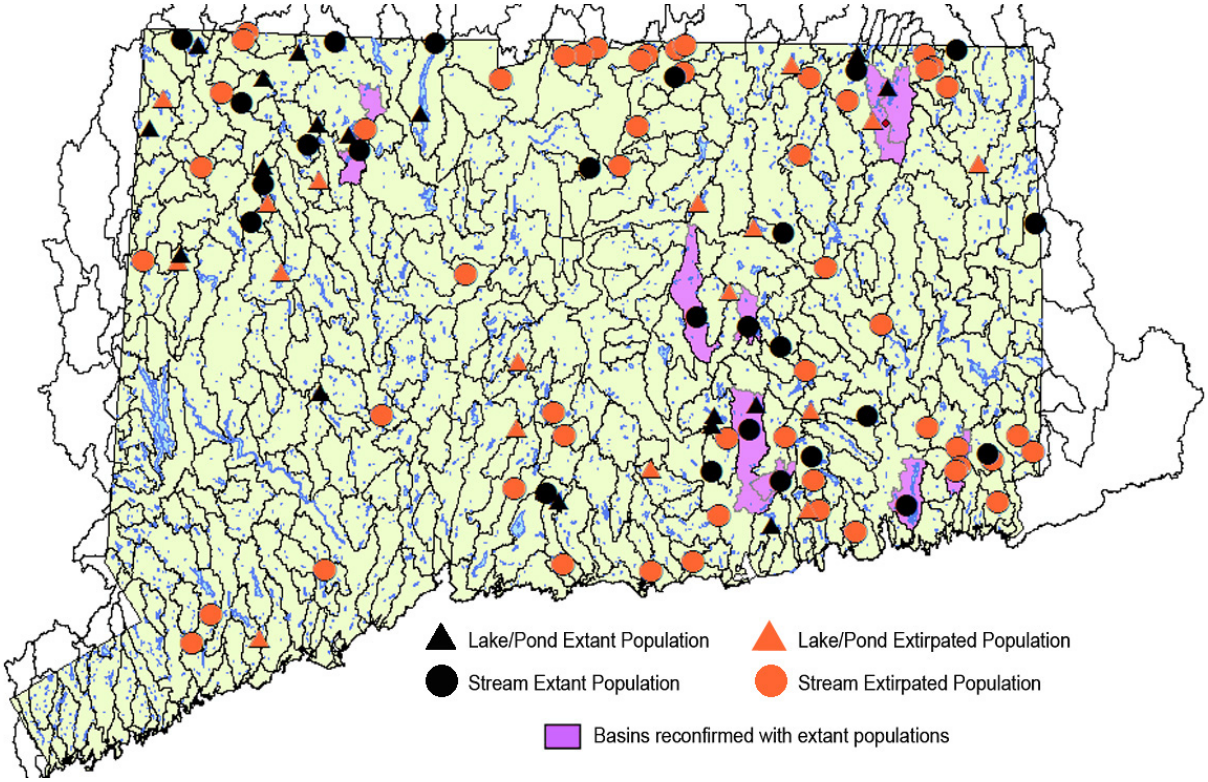

FIGURE 1.8: CURRENT BRIDLE SHINER DISTRIBUTION. (SOURCE: BRIDLE SHINER ASSESSMENT FINAL REPORT, DEEP INLAND FISHERIES DIVISION, 2014a)

Rainbow smelt populations have declined severely in Connecticut. The Connecticut Endangered Species Program Fish Advisory Committee recommended that the rainbow smelt be listed as threatened in Connecticut, while NMFS recently listed the species as a federal concern. In response, DEEP conducted a two-year study (2003-05) to examine historical and current trends in abundance and distribution of the species within state waters. The study identified management actions and associated impacts for conservation efforts in the region and characterized population dynamics and relative abundance in different state estuaries. A similar study was conducted for Atlantic tomcod (CT DEEP Report to USFWS 2005). This study concluded that there was insufficient data to determine whether Atlantic tomcod are declining seriously or non-cyclically in Connecticut, and that further study is needed.

The Atlantic Coastal Fish Habitat Partnership (ACFHP) developed a Conservation Strategic Plan for 2012-2016, which proposed key conservation strategies to address serious threats to fish habitats along the Atlantic coast (ACFHP 2012a). ACFHP also developed an accompanying 2012-2013 Implementation Plan, a subset of the Conservation Strategic Plan, which described specific objectives and actions to be accomplished during the 2012-2013 period (ACFHP 2012b).

The Association of Fish and Wildlife Agencies (AFWA) published a National Fish Habitat Action Plan (AFWA 2006), which detailed specific actions for the restoration and conservation of fish habitat across the United States. The National Fish Habitat Partnership (NFHP) recently published a second edition of the habitat action plan (NFHB 2012) with new conservation and management actions and updates on progress since the first plan was adopted. In 2010, NFHP conducted the first ever national assessment of fish habitat, *Through a Fish's Eye: The Status of Fish Habitats in the United States* (NFHB 2010), which detailed the status of fish habitats across the country and served to accomplish one of the major goals of AFWA's 2006 Action Plan.

Diadromous Fish

Diadromous fish migrate between saltwater and freshwater to spawn and are found in the fresh and estuarine waters of the state below the first migration barrier (e.g., dam, falls) upstream from Long Island Sound. Of the 14 diadromous species found in Connecticut waters (Whitworth 1996), 13 are anadromous (migration from saltwater to freshwater); and one, the American eel (*Anguilla rostrata*), is catadromous (migration from freshwater to saltwater).


R. Jacobs

The American eel migrates from freshwater to saltwater to spawn. It is listed in the "Most Important" tier of GCN species.

Dams on Connecticut's rivers and streams have substantially reduced the historic range of all of the anadromous species because they block the migration route to inland spawning habitat. As a result, 11 of the 14 diadromous species are considered to be in need of conservation and several have been identified as severely declining. Restoration of migratory routes is underway in many locations through dam removal and the construction of fishways. The Inland and Marine Fisheries Divisions work cooperatively with neighboring states, the U.S. Fish and Wildlife Service, the Connecticut River Atlantic Salmon Commission, and non-governmental organizations such as the Connecticut River Watershed Council to assess population status, develop management strategies, and implement fish passage projects (CT DEP 2002).

In addition to physical barriers, the timing of spawning migration has been altered for anadromous alewives (*Alosa pseudoharengus*), an important food source for numerous fish, birds, and mammals. An Inland Fisheries Division study (Ellis and Vokoun 2009) found that in recent years streams in the state have warmed to the mean migration temperature (13^0C) about 12 days earlier, on average, than they did in the 1970's; and that as a result, alewife runs are occurring about 13 days earlier. This change also affects water supply management at fish passage facilities, to ensure adequate water levels during the entire migration season.

Annual migrations of many diadromous species have supported both recreational and commercial fisheries for generations, but many of these fisheries have disappeared or become marginal and regulated through Atlantic States Marine Fisheries Commission (ASMFC) fisheries management plans. American shad *(Alosa sapidissima)* was once one of Connecticut's five most economically important commercial finfish. Today, it is among the smallest in terms of total landings.. Large scale commercial fisheries for alewife and blueback herring (*Alosa aestivalis*) ended in the 1960's, and recreational/personal use bait fisheries were closed for these species by emergency declarations beginning in 2002. Both species were considered by NOAA for listing under the federal Endangered Species Act, but listing was declared not warranted in 2013 (https://www.greateratlantic.fisheries.NOAA.gov/stories/2013/riverherringlistingFRnotice.pdf).

The Marine Fisheries Division has monitored annual changes in the Connecticut River shad stock composition since 1974. Data were also collected from mandatory annual reporting of commercial landings, as well as fish passage at Holyoke, MA (i.e., counts provided by MA Division of Fish and Wildlife from this first main stem dam on the Connecticut River). Data characterizing the recreational fisheries were periodically collected by a DEEP roving creel

survey. Although stock status was near median values, only 10 percent of mature fish survived both upstream and downstream spawning migrations more than once, which forced the population to rely on reproduction by only a few age classes (CT DEEP 2014b). Juvenile shad and blueback herring were monitored by DEEP through seine surveys of the Connecticut River, conducted annually since 1978, and the Thames River, conducted since 1996. Indices for both species remain low.

From 2006 to 2010, a DEEP assessment of Atlantic sturgeon (*Acipenser oxyrinchus*) revealed that significant numbers of individuals were present within state borders and that populations may be abundant at times. The study addressed several of the ASMFC Management Recommendations and Priority Research Monitoring needs from the 2005 WAP. These included identifying critical habitat and determining the extent and importance of seasonal use of the Long Island Sound estuary by sturgeon populations, among other needs (CT DEEP Report to USFWS 2010a). The Atlantic sturgeon was listed as federally endangered in 2013. The Marine Fisheries Division also focused efforts on research for the shortnose sturgeon *(Acipenser brevirostrum)*, the only other endangered fish species in the state (CT DEEP 2014c).

Commercial fishing for American eel has diminished to only a few fishers in the Connecticut River while a small recreational fishery continues under a very low creel limit. In 2007, this species was also considered for listing under the federal Endangered Species Act, but the U.S. Fish and Wildlife Service determined that the listing was not warranted. A second petition is pending (www.fws.gov/northeast/newsroom/eels.html).

Freshwater Fish

The abundance and distribution of freshwater fishes of Connecticut is described by Thorpe et al. (1968), Whitworth (1996), and more recently by Jacobs and O'Donnell (2009). There are 26 native freshwater fish species (three are extirpated). Observations indicate that 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 DEEP Stream Survey provides considerable data on the abundance, status, and distribution of stream fish species (Figure 1.9). Of the 26 naturally occurring species, 13 are considered to be in need of conservation, five are state listed, eight are state ranked, and four are ranked regionally in the Northeast.

Ongoing monitoring of fish populations shows that several non-native species are rapidly expanding and displacing or hybridizing with native species. Some species that show expanded ranges are the yellow bullhead, green sunfish, and rockbass. In addition, several species in the Connecticut River, such as bowfin and central mudminnow, show marked range expansions along the river corridor. More research is needed to understand how these range expansions will affect native species.

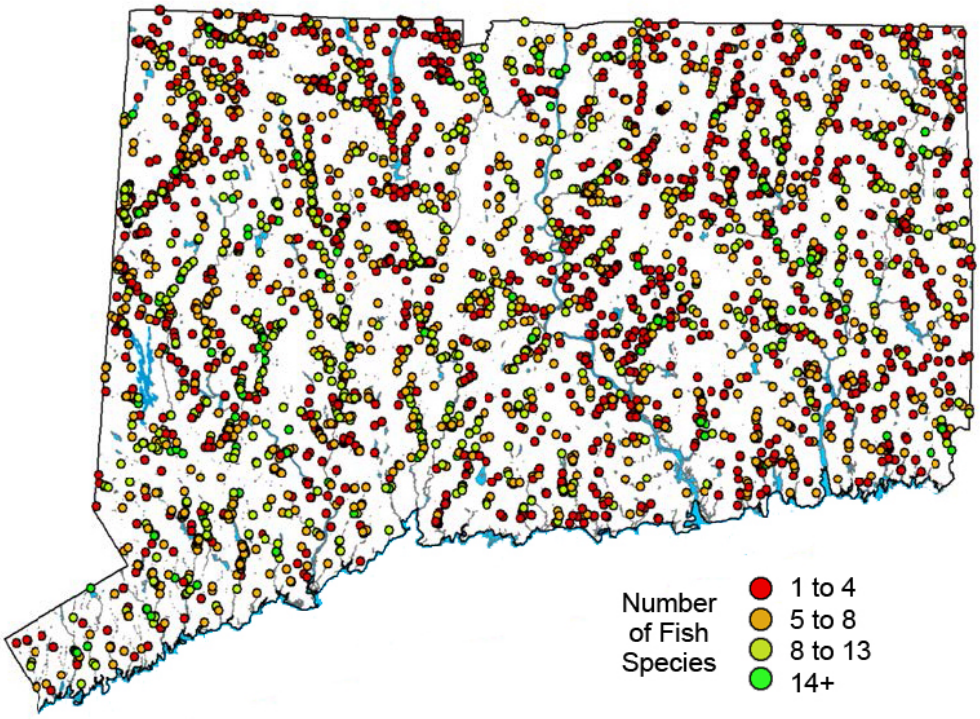

FIGURE 1.9: NUMBER OF FISH SPECIES IN CONNECTICUT'S RIVERS AND STREAMS. (SOURCE: CT DEEP)

Since the 2005 WAP, the Inland Fisheries Division has developed new programs to stay up-to-date and at the forefront of conservation efforts. In 2013, a new bass research program was established in collaboration with UConn. It examined a new management strategy for the potential re-introduction of natural bass populations from unfished waters into public lakes. The purpose of the re-introduction would be to improve the genetic diversity of fished populations. In 2007, a channel catfish stocking program was established for 12 lakes and ponds throughout the state. Connecticut also has a well-established walleye management program, focused on stocking and species management in lakes statewide, and a Northern pike management program that focuses on increasing population sizes in Bantam Lake, the Connecticut River, and other lakes (CT DEEP 2014b).

There are stocking programs for six salmonid species: Atlantic salmon, brook trout, brown trout, Kokanee salmon, rainbow trout, and tiger trout. These stocking programs provide Connecticut with ample supplies for year-round fishing and maintain healthy populations in Connecticut waters. There are 17 Trout Management Areas (TMAs) and 27 Wild Trout Management Area (WTMA) in the state. These areas are heavily monitored to measure effectiveness and success of these sites (CT DEEP 2014b). Stream temperature and brook trout population fragmentation were also examined by the Inland Fisheries Division (CT DEP 2009; CT DEEP Report to USFWS 2008).

Habitat use and population demographics of burbot, a state endangered fish, in northwestern Connecticut were studied in order to provide the state with benchmark data for future conservation efforts. The study focused on identifying habitat conditions associated with burbot presence, identifying migration and movement patterns, and describing population dynamics. Only one location supported an abundant population, possibly due to exclusion of burbot from other suitable habitat by mainstream dams. To determine an appropriate fish

passageway design, DEEP conducted a study of burbot swim performance and speed (CT DEEP 2010b).

Marine and Estuarine Fish

The distribution and abundance of the state's saltwater fish are described by Whitworth (1996) and Thomson et al. (1971, 1978). They identified 72 saltwater fish species occurring regularly in Connecticut waters. Of these, 47 are considered to be in need of conservation, six are state ranked; and according to all available scientific information and expert opinion, 28 marine species are in decline (e.g., Atlantic herring, tautog, and winter flounder). At least 50 species spawn in Long Island Sound, and 120 species, including 29 tropical and subtropical species, enter the Sound seasonally (CT DEEP 2013).

The Marine Fisheries Division conducts an annual Long Island Sound trawl survey to measure the abundance and distribution of important finfish. This survey has documented 99 finfish species and more than 60 invertebrate taxa since its inception. Survey results are used to help support local and coast-wide fishery management efforts (CT DEEP 2013). Additional inshore data are gathered in a long term beach seine survey which has documented 63 finfish species and 19 invertebrate taxa in Connecticut's sub-tidal habitat. These data are used to evaluate fish stock health and to guide effective management strategies (CT DEEP 2013).

The National Marine Fisheries Service oversees the development and implementation of fishery management plans developed by the New England Fishery Management Council, of which Connecticut is a participating member. The Atlantic States Marine Fisheries Commission develops fishery management plans for commercially and recreationally important migratory or shared fishery species occurring in states' waters. Connecticut is a participating member of this Commission as well (ASMFC 1997, 1998a-b, 2001, 2002a-d, 2006, 2012a-b, 2013a-e; MAFMC 1977, 1983, 1984, 1988, 1990, 2011a-d; NEFMC 1999a-b, 2003a-h, 2007, 2009a-b, 2010, 2011a-b, 2012, 2013; Murphy 2012). A compilation of the above-referenced plans can be found in Appendix 1a.

INVERTEBRATES

The RSGCN invertebrate list includes the federally listed invertebrates as well as representatives of two major invertebrate taxa, the tiger beetles (Order Coleoptera, Family Cicindelidae) and freshwater mussels (Order Unionoidea, Families Margaritiferidae and Unionidae). These taxa are listed and discussed separately in sections that follow, along with other invertebrate groups.

Invertebrates are among the least understood taxa, and efforts to acquire baseline information are vital to understanding the conservation needs for these species. Actions recommended in the 2005 WAP included invertebrate inventory and assessment focused on gathering baseline data and developing local resource management plans. With the help of the entomology laboratory at UConn and entomologists at the Connecticut Agricultural Experiment Station, the Wildlife Division has been developing baseline data on the distribution and abundance of Connecticut's invertebrate species of conservation concern.

Nationwide, invertebrates are underrepresented on lists of rare species. As a result, many scientists support an ecosystem-level approach to the conservation of endangered invertebrates. The hope is that eventually, population data will allow species-focused actions to

be incorporated into management plans to protect specific species (Black et al. 2001). The paucity of invertebrate information highlights the need to conduct additional surveys and monitoring programs to provide meaningful data for guiding species-specific conservation actions (M. Thomas, Connecticut Agricultural Experiment Station, pers. com., 2004).

Two regional projects have been underway since the original WAP in 2005. The first project, completed in 2012, focused on the development of an online database to enhance the conservation of GCN invertebrates in the Northeast (Fetzner 2011). This database can be accessed through the following link: http://iz.carnegiemnh.org/sgcninverts/default.asp. The second project focused on an assessment of Odonates (dragonflies and damselflies) in the Northeast (http://rcngrants.org/content/conservation-assessment-odonata-dragonflies-and-damselflies-northeastern-region) (White 2013).

The invertebrate fauna of Connecticut are incredibly diverse. It is estimated that at least 20,000 species of invertebrates are present in the state, and little information exists for the majority of them (D. Wagner, UConn, pers. com., 2004). Species groups include freshwater mussels, gastropods and crustaceans; arthropods including dragonflies and damselflies, butterflies and moths, bees, wasps, and flies; benthic marine mollusks and crustaceans; and numerous other taxa. Many representatives of these faunal groups are rare. One hundred ninety four species are listed as endangered, threatened, or as species of concern under the Connecticut Endangered Species Act (Section 26-306 of the Connecticut General Statutes).

Freshwater Benthic Invertebrates

Data from the Rotating Basin Survey, undertaken by DEEP's Bureau of Water Protection and Land Reuse, provides information on the distribution of riffle-dwelling benthic macroinvertebrates at the community level (Figure 1.10). The abundance and distribution of these macroinvertebrates serves as a barometer 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), represent high water quality (CT DEP 2004). Water Quality Index figures for Ephemeroptera-Plecoptera-Trichoptera (EPT) are detailed in subsequent chapters.

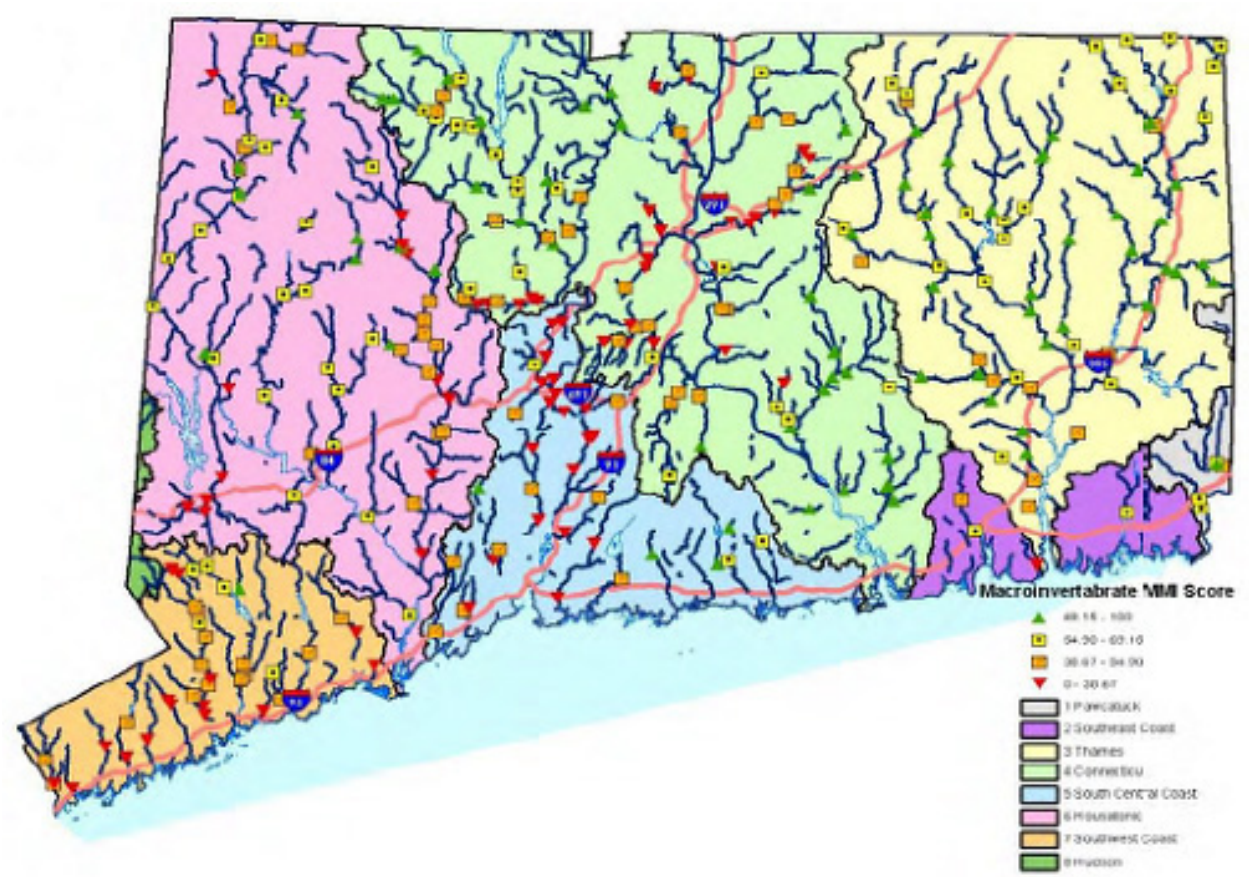

FIGURE 1.10: DISTRIBUTION OF BENTHIC MACROINVERTEBRATES IN CONNECTICUT (SOURCE: CT DEP BWM ROTATING BASIN STRATEGY)

The aquatic insects of Connecticut rely on healthy riparian and wetland habitats throughout their life cycles. Bog and calcareous wetlands in Connecticut's northwest highlands are important habitat for Odonate (dragonfly and damselfly) species. At least 22 percent of the dragonfly and damselflies of the state are rare. Demographic surveys are needed for these species to identify both larval aquatic and adult feeding and maturation habitat requirements (M. Thomas, Connecticut Agricultural Experiment Station, and D. Wagner, UConn, pers. com., 2004).

The Inland Fisheries Division conducted an assessment of the status and distribution of native crayfish over a three-year period (2010-2012) (Hagstrom et al. 2013). The statewide survey included a variety of collection techniques to investigate the distribution and habitat requirements of native and invasive species. This was the first documentation of the distribution of the nine species of crayfish in Connecticut. Crayfish were found more commonly in streams than in ponds. *Orconectes limosus*, a native species, was the most widely distributed and had the greatest numbers of individuals collected. Two introduced species, *Cambarus robustus* and *Orconectes virilis*, were also found in high abundance. *Orconectes virilis* was the next most commonly found species followed by *Cambarus robustus.* Some species showed clear environmental relationships. For example, Figure 1.11 depicts the relationship of abundance to elevation for *Cambarus robustus* (Hagstrom et al. 2013). The White River crayfish (*Procambarus acutus*) which had been a listed species was found to be far more abundant then initially reported and has been removed from the list of Connecticut's GCN species.

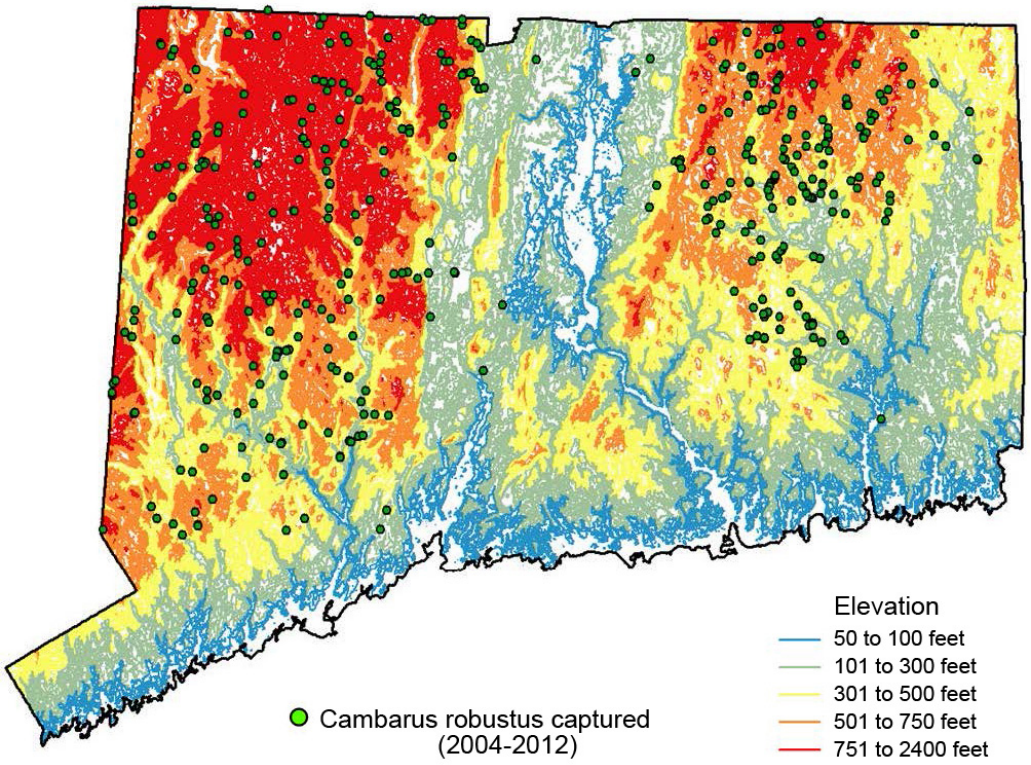

FIGURE 1.11: DISTRIBUTION OF *CAMBARUS ROBUSTUS* VS. ELEVATION FOR CONNECTICUT. (SOURCE: NATIVE CRAYFISH ASSESSMENT FINAL REPORT, CT DEEP INLAND FISHERIES DIVISION, 2013)

Freshwater Shellfish

Shellfish are habitat specialists with limited distributions and declining abundances. Nationally and regionally, many freshwater mussel species are in danger of extinction (Williams et al. 1993). An estimated 67 percent of freshwater mussel species and 65 percent of freshwater crayfish are rare or imperiled nationally (Abell et al. 2000). Of the 297 freshwater mussel species found in the United States, almost 72 percent have become endangered, threatened or species of concern in the last 50 years (LaRoe et al. 1995). Ten species of freshwater mussels have become extinct in North America within the last century (Abell et al. 2000). Freshwater mussels are one of the most imperiled groups of aquatic animals in Connecticut and throughout North America.

DEEP completed an inventory of freshwater mussels in 2010. This project was comprehensive and also sampled crayfish, snails, larval odonates, and non-native bivalves. A total of 28 taxa including 23 unique species of odonates, seven species of snails, and five species of crayfish were collected. Only one out of the five crayfish collected was thought to be native. The survey showed that in areas of high crayfish abundance few or no mussels were observed. Seven native mussel species were found: eastern elliptio (*Elliptio complanata*), eastern lampmussel (*Lampsilis radiata*), eastern floater (*Pyganodon cataracta*), triangle floater (*Alasmidonta undulata*), creeper (*Strophitus undulatus*), brook floater (*Alasmidonta varicose)*, and eastern pondmussel (*Ligumia nasuta*). Two new sites were located for the brook floater and pondmussel. Prior to this survey, no live brook floaters had been observed in the Housatonic River watershed in almost 90 years. Valuable information was collected on the distribution and population health of Connecticut's freshwater mussels. For instance, the eastern lampmussel's range stopped downstream of Falls Village, and the specimens found were geriatric with no sign

of regeneration. This survey also affirmed the spread of non-native bivalves (zebra mussel) found in at least two of Connecticut lakes. In 2012, SWG research efforts focused on determining distribution of freshwater mussels in southeastern Connecticut, which was the last area to be inventoried and assessed (CT DEEP Report to USFWS 2012).

The *Field Guide to the Freshwater Mussels of Connecticut* provides range maps for Connecticut's nine species along with key identification features, habitat, and conservation status (http://www.ct.gov/deep/lib/deep/wildlife/pdf_files/nongame/fwmusl.pdf) (CT DEP 2003). Figure 1.12 identifies the known sites for state-listed freshwater mussels in Connecticut. The status of the state and federally endangered dwarf wedge mussel is addressed in its current recovery plan (Cummings and Cordeiro 2011; USFWS 1993a).

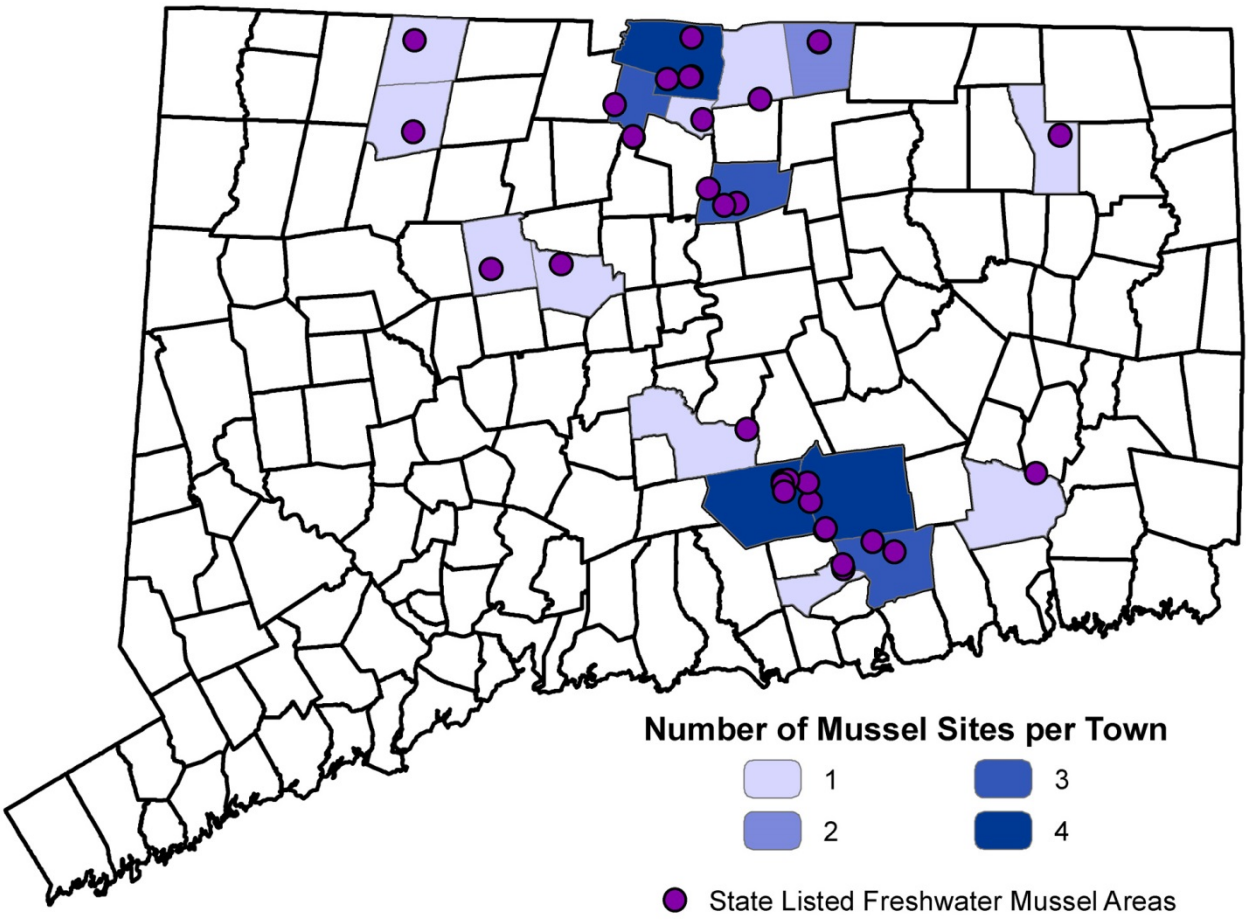

FIGURE 1.12: SITES FOR STATE-LISTED FRESHWATER MUSSELS IN CONNECTICUT (SOURCE: CT DEEP WILDLIFE DIVISION)

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

Marine Invertebrates

Marine invertebrates of commercial or recreational harvest interest, including lobsters, blue crabs and horseshoe crabs, are managed by the Marine Fisheries Division. The Division also

monitors the lobster population in the Long Island Sound. This 30-year program includes monitoring the commercial and recreational fisheries through sea-sampling of adults and larval studies (CT DEEP 2014; Gottschall et al. 2000) but it no longer has sufficient federal funding and continues on a very limited basis with short-term support from the state.

P.J. Fusco

Horseshoe crabs are a significant keystone invertebrate species.

Horseshoe crabs were identified as a keystone invertebrate species in Connecticut waters because their spawning is critical for migratory shorebirds that feed on their eggs. In 2007, three beach sites were closed to harvest in order to ensure horseshoe crabs' successful spawning. For activities such as beach nourishment and beach grading, permit conditions prohibit disturbance during the spawning season. Additionally, beach raking guidelines are being developed by DEEP's Office of Long Island Sound Programs to minimize impacts to horseshoe crabs. Since 2008, DEEP and UConn have identified specific habitat requirements for horseshoe crab spawning to ensure that all beach areas suitable for spawning could be protected from degradation (CT DEEP 2009, Landi et al. 2015). DEEP is also a partner in Sacred Heart University's Project *Limulus* which includes a community-based research program focused on Long Island Sound's horseshoe crab population.

Molluscan shellfish such as oysters, clams, and scallops are managed by the Connecticut Department of Agriculture's Aquaculture Bureau. There is a need to assess abundance and distribution of these species as well as many non-harvested benthic marine macroinvertebrates. As with the other invertebrate species discussed above, a broad habitat approach will be necessary to start this process, as baseline information is lacking.

Butterflies and Moths

Based on the high numbers of moths and butterflies on GCN lists in the Northeast, it is apparent that many of these species are declining. More than 1,000 species of moths have been documented in southern New England, with some groups receiving greater attention than others. Groups commonly represented in GCN lists include *Papaipema* moths, sphinx or hawk moths, and giant silkworm moths. Among butterflies two families predominate, the skippers (Family Hesperiidae) and the blues, coppers, and elfins (Family Lycaenidae). The latter family includes the well-known Karner blue butterfly (*Lycaeides melissa samuelis*), a federally endangered species that occurred historically from Wisconsin east to New Hampshire.

Many of the butterflies of the these two families are found on the regional and state GCN lists because they tend to be small-bodied, relatively weak fliers with very specific host plant requirements, or to exhibit other narrow ecological specializations such as association with specific vegetation communities. In Connecticut, examples of these butterflies and their host plants include bog copper (cranberry), frosted elfin (wild lupine and wild indigo), and hoary elfin (bearberry). In addition, the larvae of many species of Lycaenidae participate in symbiotic relationships with ants, so that both the larval host plant and suitable ant partners must be available in order for the species to thrive.

Efforts to map the distribution of Connecticut's butterfly species are being undertaken through the Connecticut Butterfly Atlas Project (http://peabody.yale.edu/collections/entomology/connecticut-butterfly-atlas-project). In general, species declines are primarily due to habitat loss and alteration by development (Wagner et al. 2003; L. Rogers-Castro, DEEP Wildlife Division, pers. com. 2015).

In 2012, SWG funding aided the production of two new books on moths and butterflies: *Rare, Declining, and Poorly Known Butterflies and Moths of Forests and Woodlands in the Eastern United States* (Schweitzer et al. 2011) and *Owlet Caterpillars of Eastern North America* (Wagner et al. 2011). In addition, Connecticut has undertaken multiple efforts to survey moth and butterfly species. Surveys of grassland and sandplain moths were conducted in 2012. This survey found several state-listed species, along with a state record *Zanclognatha theralis* and one potential new species within the genus *Zanclognatha.*

The northern metalmark (a state endangered species) has been the focus of habitat restoration efforts. To aid in the restoration of roundleaf ragwort, the butterfly's host plant, UConn and DEEP removed invasive species at three remaining colony sites. Nectar plants were also planted to encourage females to remain near larval-food plant sources (CT DEEP Report to USFWS 2009). A captive rearing plan was developed. However, efforts to secure an egg-laying female in 2012 failed due to low population numbers. Conservation efforts focused on specialists such as the northern metalmark also benefit generalist butterfly and moth species (Swengel 1998) as well as native bees (L. Saucier, DEEP Wildlife Division, pers. com. 2015; O'Donnell 2007).


P.J. Fusco

The monarch is renowned for its long distance seasonal migration.

The monarch (*Danaus plexippus*) is renowned for its long distance seasonal migration and spectacular winter gatherings in the oyamel fir forests north of Mexico City. Beginning in the 1990's, researchers have documented a steady decline in monarch numbers so that today less than 33 million remain, representing more than a 90 percent decline throughout North America. A primary threat to the monarch is a decline in populations of milkweed, the key food plant required by monarch caterpillars. The decline in milkweed is partially due to the reduction of open habitats, but in the Midwest losses are mostly due to the dramatic increase in the use of the herbicide Roundup (glyphosphate) which has been made possible by the mass-planting of genetically modified herbicide resistant corn and soybeans. In addition, the widespread use of systemic insecticides such as neonicotinoids within the breeding range of the monarch poses a considerable threat; illegal logging of fir forests in Mexico has reduced wintering habitat; and extreme weather events in the eastern United States may also be negatively impacting survival of this species.

In recognition of the decline in monarchs, the Monarch Joint Venture (MJV) was initiated in December 2008 as a partnership of federal and state agencies, non-governmental organizations, and academic programs working together to protect the butterfly and its annual long-distance migration. Guided by the North American Monarch Conservation Plan (CEC 2008), the MJV took a science-based approach to addressing monarch conservation issues. The MJV

promoted the monarch as a flagship species whose conservation will sustain habitats for pollinators and other plants and animals. For more information about MJV: http://www.monarchjointventure.org/.

Actions to benefit the monarch include working with various landowners and land managers to restore breeding habitat and increasing both the supply of and the demand for locally-sourced milkweed plants and seeds for garden and larger restoration projects. MJV also supports the expansion of monitoring programs, data analyses to shed light on conservation issues, and research to help inform and improve the success of habitat restoration efforts.

Giant silkworm moths (Family Saturniidae) are among the most colorful and spectacular species of northeastern Lepidoptera. Several of the largest and most beautiful species of these moths have declined across the Northeast. These declines are attributed to the increased spraying of chemicals for mosquito and pest control and to increased anthropogenic light pollution, which disrupts the normal nocturnal flight patterns of these insects. The buck moth (*Hemileuca maia*) is a diurnal silkworm moth closely associated with scrub oak. It occurs primarily in pitch pine areas of Connecticut where this oak often dominates the understory. The buck moth is experiencing noticeable declines in the Northeast, and this is partially attributed to the loss of suitable barrens habitat, as well as to the broadcast spraying of insecticides.

Pollinators

Considerable concern has been expressed about the conservation status and population trends of native pollinators across North America. Available evidence indicates that certain pollinator species have been declining in the United States, and flower-visiting insects account for 50 percent of all known insect extinctions (NRCS 2007). Reduced pollinator populations could result in decreased pollination of plant species that require pollinators for fertilization and reproduction. As a result, the plants corresponding to each declining pollinator could also face population declines or even increased threat of extinction (NRCS 2007).

P.J. Fusco

Some species such as bumble bees and honey bees have experienced declines as a result of the spread of pathogens and disease from commercially managed colonies to native populations (NRCS 2007).

Declines in pollinator populations have been traced to a multitude of causes, such as intensive agricultural practices, use of certain pesticides, and habitat loss and degradation. Climate change is also expected to create additional challenges for pollinator populations, ranging from disruption of migratory paths of hummingbirds and bats to decoupling of plant-pollinator interactions when plants and pollinators respond differently to climate cues.

Since 2005, SWG projects allowed DEEP and UConn to begin collecting data on Connecticut bee species through inventory and assessment. A database was generated with more than 16,000 records of bees, making it possible to identify the highest risk species in the state. One new state record was documented, one species new to science was discovered, and multiple bee species were proposed for state listing between 2005 and 2009. In 2010, five bee species were

proposed for state listing and all five were accepted, making Connecticut the first northeastern state to provide protection for bee species through legislation (CT DEEP Report to USFWS 2010). Bees and their pollination services have become increasingly important topics. In summer 2014, President Obama passed a Presidential Memorandum (http://www.whitehouse.gov/the-press-office/2014/06/20/presidential-memorandum-creating-federal-strategy-promote-health-honey-b) (WHOPS 2014) mandating that a federal strategy to promote the health of honey bees and other pollinators be created.

The Xerces Society has published a *Red List of Native Bees in Decline.* This list included two species of bumble bees found in Connecticut, the affable bumble bee (*Bombus affinis*) and the yellow-banded bumble bee (*Bombus terricola*), both listed by the Xerces Society as "imperiled" or at a high risk of extinction due to restricted range, few or steeply declining populations, or other factors (Xerces Society 2014). The Heinz Center for Science Economics and Environment (2013) prepared guidance for incorporating information about the conservation of animal pollinators into State Wildlife Action Plans (see Chapter 4).

Tiger Beetles

P.J. Fusco

The RSGCN list includes 11 tiger beetle taxa, encompassing over half of the Northeast tiger beetle fauna.

Tiger beetles of the genus *Cicindela* are a group of highly active, predatory beetles that have been the focus of conservation biologists for many years because of the relative wealth of data regarding their distribution and ecology. The RSGCN list includes 11 tiger beetle taxa, encompassing more than half of the Northeast tiger beetle fauna. One species is entirely endemic to the region, the federally-listed Puritan tiger beetle, *Cicindela puritana*, which is only found at sites along the Connecticut River and Chesapeake Bay.

Several tiger beetles on the RSGCN list are known to be in decline range-wide and thus may merit regional conservation attention. One of these is *Cicindela patruela*, a pine barrens and ridge-top barrens specialist that has been lost from several states in the Northeast, including Connecticut (Sikes 1997).

Fourteen species of tiger beetles have been documented in Connecticut, but only ten of these are believed to still inhabit the state, following a statewide tiger beetle survey was conducted in 1996 (Sikes 1997). Only three species of tiger beetles are considered secure as most populations are localized in patches of habitat and have declined as these specialized beach and barrens habitats have diminished. Some species have adopted abandoned sand and gravel extraction sites as alternative habitats. The two federally endangered tiger beetles in the Northeast are specifically adapted to ocean beaches and sandbars along the Connecticut River and have only been found in a few locations in the region.

In 2011, tiger beetle surveys funded by SWG resulted in updated information on these two species as well as on the occurrences of several other state-listed tiger beetles. A new population of the federally listed Puritan tiger beetle was discovered in Cromwell, Connecticut. Research, monitoring, and survey actions for this species are on-going in accordance with the

federal recovery plan (Kinsley 2014; USFWS 1993b, 2007). Other sites along the Connecticut River may be suitable for reintroduction of this species following protocols outlined in the Recovery Plan. The second federally listed species in this region, the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*), was last recorded in Connecticut in 1950 (Sikes 1997).

Cicadas

The northern dusk-singing cicada is the largest cicada species in North America and is a species of special concern in Connecticut. The northern dusk-singing cicada was thought to be extirpated from Connecticut, but was rediscovered in 2004. In addition, six sandplain sites were visited to listen for cicadas. No new occurrences were documented, but the extent of the known population was determined using adaptive cluster sampling (a sampling method that takes into account the tendency of a species to occur in clusters, and that expands the sample plot once the target species is found). One female, collected in 2010, was the first voucher specimen collected from Connecticut in 99 years.

The 17-year periodical cicada has been surveyed formally or informally since 1911. A DEEP-sponsored citizen-science baseline study on the location of extant populations was conducted in 2013. Populations of 17-year periodical cicadas were concentrated in the central and south-central portions of Connecticut, in 20 towns in 2013 compared to 22 towns in 1996. Inclement weather in 2013 may have hampered survey accuracy (Maier 2014).

PLANTS

Plants comprise a significant proportion of Connecticut's biodiversity. Assessments of plant populations are important to consider when determining the condition of the habitats in which these plants are found. For example, brackish marshes are a rare community type on the coast of Connecticut. These marshes have been slowly degraded by a variety of intrusions, and may be highly vulnerable to climate change related impacts, including stronger storms and rising sea level. Brackish marshes provide the habitat for a well-defined flora that includes many plant species found in no other community type, and these habitats have been the focus of inventory and monitoring efforts for many years. The Northeastern Terrestrial Wildlife Habitat Classification System (Gawler 2008) uses plants to define habitats, and the Northeast Habitat Guide (Anderson et al. 2013) provides a list of representative plant species and a list of rare plants for each habitat type.

The New England Plant Conservation Program (NEPCoP) recently submitted the second edition of *Flora Conservanda*: *New England plants in need of conservation* (NEWFS 2012). The list included plants currently growing in New England that are globally, regionally, and/or locally rare. It also listed plants that are considered historic to New England (though they may exist elsewhere) and plants whose status in the region was yet undetermined but that were believed to be rare.

Nelson DeBarros

Sandplain agalinis is a Federally Endangered plant found in Connecticut.

Originally published in 1996, *Flora Conservanda* has been updated for 2012 based on research accumulated over the past 15 years including taxonomic studies and field research by professionals and volunteers. Some species have been added to the list based on their rarity in the wild. Others have been removed because they are now known to be more common than was previously understood, or because taxonomic understanding of the species has changed so that it is no longer considered rare in New England. Of the more than 500 species listed for New England, 265 have been documented in Connecticut. At the state level, the Connecticut Natural Diversity Database maintains the list of rare plants, including 335 species or roughly twenty percent of Connecticut's native flora.

The threats to plants are similar to those affecting animals, especially in community types that have limited distributions in the state, such as bogs and other small wetlands, pitch pine barrens, and tidal marshes. Herbaceous understory species represent the majority of plant diversity in forests, region-wide. In Connecticut forests, that diversity is slowly being diminished by the gradual loss of species due to habitat fragmentation (Flinn and Vellend 2005). This phenomenon is well documented after more than 30 years of monitoring through the combined efforts of The Nature Conservancy, the State Natural Heritage Programs, the Connecticut Botanical Society, and many individual collaborators and surveyors affiliated with NEPCoP.

WILDLIFE RESOURCE VALUE AND PUBLIC USE

Connecticut's fish and wildlife diversity serves as a significant recreational attraction for residents and tourists alike. The state's 29 Nature Conservancy preserves, the U.S. Fish and Wildlife Service's Stewart B. McKinney and Silvio O. Conte national wildlife refuges, 19 Connecticut Audubon Society wildlife sanctuaries, and four major Audubon Connecticut sanctuaries , together with 107 state parks, 32 state forests, and 51 wildlife management areas (WMAs), all provide crucial habitats for Connecticut's most intriguing and important wildlife species. Some WMAs are very popular destinations for walking and wildlife viewing. Belding WMA, in the town of Vernon, is visited by approximately 560 third and fourth grade school children each year along with roughly 200 summer program attendees and 40 college students. About a dozen walkers per day visit Belding WMA year-round. Sessions Woods WMA, in the town of Burlington, is used by about 50 walkers per day year-round. Monthly public programs at Sessions Woods WMA are attended by approximately 25 people per program. Five articles about WMAs and watchable wildlife have been printed in Connecticut Wildlife magazine since 2012, in an effort to inform the public about places to view wildlife.

Viewing platforms, boardwalks, blinds, and educational signs were constructed at various DEEP locations statewide in 2002, to provide the public the opportunity to observe and photograph wildlife in its natural habitat and at the same time increase public awareness of the diversity and complexity of Connecticut's natural resources.

DEEP staff and many DEEP-produced educational materials are involved in the Connecticut Envirothon. The Connecticut Envirothon is a natural resource based education program started in 1992 by the state's Soil and Water Conservation Districts. High School students work in teams led by a teacher/advisor. During the school year, teams receive curriculum materials and are invited to a series of training workshops in the Envirothon study areas of Soils, Aquatics, Wildlife, Forestry, and a Current Environmental Issue. These workshops are presented by foresters, soil scientists, aquatic ecologists, wildlife biologists, and many others. Students benefit from meeting people working in a broad range of environmental careers. Teachers also benefit and find the program a wonderful source of networking and professional growth for their own careers. A spring competition among teams results in a state winner. The winning team earns the chance to represent Connecticut at the North American Envirothon, a weeklong event held at a college campus in the summer. They compete with about 60 teams from across the USA and Canada for scholarships and other prizes. Many Envirothon Alumni go on to further study leading to environmental careers and are eligible for special scholarships.

The State Comprehensive Outdoor Recreation Plan (SCORP) is a planning document that provides guidance to state and municipal officials in the development and expansion of outdoor recreational activities in the state (CT DEEP 2011). Connecticut's SCORP notes that there are a plethora of outdoor recreational challenges, including a lack of transportation linking urban residents to recreational areas, the size of these areas (many state recreation sites are small because the majority of land in the state is privately owned), and historical impacts on fish and wildlife (e.g., deforestation, industrialization, reforestation, and urban sprawl). To overcome these challenges, the SCORP outlines management and policy objectives, goals, and actions for Connecticut officials to take into account during the five-year period from 2011 through 2016 (CT DEEP 2011).

Connecticut's 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation report estimates that a total 1.4 million residents and non-residents utilize the state's fish and wildlife recreational resources. Approximately 342,000 anglers (25%), 50,000 hunters (4%), and 1,178,000 wildlife-watchers (87%) are included in this total of 1.4 million (US DOI et al. 2013).

These recreational users contributed approximately $1.7 billion to the state's economy. Trip-related expenditures totaled $514 million, while expenditures for equipment totaled $833 million. Another $355 million was spent on licenses, contributions, land ownership and leasing, and other items (US DOI et al. 2013).

Connecticut's annual hunting and trapping guide (CT DEEP 2014a) provides detailed information on licenses, permit and tag requirements, and state hunting laws and regulations. It also provides details on deer hunting, turkey hunting, small game hunting, and trapping. Information on permit-required hunting areas, public hunting areas, trap and target shooting, state-leased areas, and other similar topics is also included. Additional information can also be found at the DEEP hunting and trapping website: www.ct.gov/deep/Hunting .

The annual Migratory Bird hunting guide provides a summary of laws and regulations concerning the hunting of migratory birds, as well as detailed information regarding season dates and regulations (CT DEEP 2014a).

Connecticut's annual Angler's guide for inland and marine fishing (CT DEEP 2014b) provides general information on permits, licenses, trophy regulations, and other pertinent material. The guide also includes program information and fisheries details for both inland and marine fisheries within the state.

CONNECTICUT'S SPECIES OF GREATEST CONSERVATION NEED (GCN)

The process used to select GCN species in Connecticut involved the collection, compilation, and evaluation of data from a variety of sources. The AFWA Best Practices for Wildlife Action Plans (AFWA, BPWG 2012) and the Northeast Lexicon (Crisfield and NEWDTC 2013) were applied in Connecticut's process for selecting and ranking GCN species. AFWA's Best Practices document provided voluntary guidance to states for the revision and implementation of their Wildlife Action Plans. The Northeast Lexicon described a customized language and data framework for each of the eight elements required for WAPs.

After identifying potential criteria in the northeastern region, drawing standards and measures from WAPs across the country, and surveying conservation approaches used by other conservation organizations, the Northeast Lexicon developed a list of common considerations, encompassing the range of criteria used by states in the northeast region for the GCN species selection process. A primary consideration was the inclusion of a species on an established list that was generated externally using a range of conservation assessment procedures. These listings included:

- Federal (USFWS and NOAA-NMFS) Official Threatened and Endangered species lists
- State (CT DEEP) Official Endangered, Threatened and Species of Special Concern lists
- DEEP– Natural History Survey
- DEEP Natural Diversity Data Base (NDDB) – rare and tracked species
- EPA and DEEP – Resource Protection Areas (CT DEP 1997)
- Dowhan and Craig (1976) – listing of rare species and habitats
- Special Projects including Farmington River Watershed Association (FRWA) 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)
- NEFWDTC Regional Species of Greatest Conservation Need list (Terwilliger Consulting, Inc. and NEFWDTC 2013)
- IUCN Red List – global ranks for species occurring in state
- American Fisheries Society

In addition, quantitative and qualitative input was obtained from DEEP staff and stakeholders, including:

- Wildlife Division
- Inland Fisheries Division
- Marine Fisheries Division
- Office of Long Island Sound Programs
- Watershed coordinators
- Academic Institutions
- Non-profit organizations
- State and federal agency partners
- Tribes
- Scientific experts

Connecticut's Endangered Species Act Scientific Advisory Committees (ESSAC), were asked to provide information on status, abundance, distribution and habitat associations. ESSAC includes six taxonomic committees comprised of approximately 50 recognized experts (from academia, conservation stakeholder groups, and state agencies) with extensive knowledge of wildlife species and issues. Their input, along with the contributions of DEEP staff and other stakeholders, was used to guide development of the database for GCN species (Appendices 7 and 8 have more information on Connecticut's stakeholder input). The following criteria recommended by the Northeast Lexicon Committee (Table 1.6) were also used to determine GCN species.

TABLE 1.6: NORTHEAST LEXICON GUIDANCE CRITERIA FOR IDENTIFYING GCN SPECIES. (Source: Adapted from Crisfield and NEWDTC 2013)

Species-specific	
Species Abundance and Trend	Population status and trends for a species, including extirpation status
Threat	The number, immediacy, extent, and/or reversibility of known threats to species populations
State Responsibility	The relative importance of the state to conservation of the species, compared to other states or countries in the species' range.
Habitat Trend	Changes in the extent or condition of habitat which may be closely related to threats (e.g., climate change, land use change associated with development, or insect pests which can change the composition of a forest)
Information Deficient	Species that lack sufficient documentation to appear in sources listed in Table 1, or to be justified based on abundance, trend, threat, or habitat concerns may be considered SGCN with an interest in research to better understand conservation needs
Official Listing	
Federal Legal Listing	Species that are federally-listed as threatened or endangered if the species occurs within the state; some states may also consider candidate or petitioned species after positive 90-day finding
Regional SGCN	Species that are listed as NEAFWA Regional GCN (2013) if the species occurs within the state
State Legal Listing	Species that are state-listed with a legal designation that indicates need for conservation (e.g., threatened, endangered)
State Natural Heritage Program and NatureServe Rankings	Species with global ranks (G1-G3) and state ranks (S1-S3); some states may also consider historical, extirpated or possibly extirpated species (GX, GH, SX, SH) or species with uncertain ranks
Regional or Species Group Conservation Prioritization	Conservation prioritizations are available for some species groups through prominent organizations and planning systems (e.g., Partners in Flight, National Marine Fisheries Service, and Partnership for Amphibian and Reptile Conservation)
IUCN Red List	Species that are Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Near Threatened (NT)

All available information from existing plans and partner programs (Appendix 1a) and a survey of expert opinion were used to characterize species rank, status, abundance, and habitat information. The process followed the Connecticut State Endangered Species update process and utilized the standing committee of experts to update these lists (ESSAC). Existing designations, including the Northeast Lexicon recommended criteria, were used to develop an initial list of Connecticut's GCN species. Three qualitative tiers (most important, very important, and important) were used to highlight the relative ranking of GCN species. Species listed as "most important" are of high regional or state conservation responsibility and have populations

that are at high risk of declining in the absence of immediate conservation effort to address the threats they face. Species listed as "very important" are of regional or state conservation responsibility and have populations that are at risk of declining in the absence of near-term (one to ten years) conservation effort to address the threats they face. Species listed as "important" are of regional or state conservation responsibility, or there is a lack of adequate life history information to make management decisions, or whose populations are at risk of declining in the absence of long-term (ten or more years) conservation effort to address the threats they face.

The initial GCN list was provided to experts and interested stakeholders for refinement and confirmation. Additional input was provided at subsequent meetings and posted on the DEEP website. There was considerable overlap of priorities among expert opinion and status classifications indicating significant concurrence on GCN species and their ranking.

Relative Ranking of GCN Species

Most Important - Species of high regional or state conservation responsibility and have populations that are at high risk of declining in the absence of immediate conservation effort to address the threats they face.

Very Important - Species of regional or state conservation responsibility and have populations that are at risk of declining in the absence of near-term (one to ten years) conservation effort to address the threats they face.

Important - Species of regional or state conservation responsibility, or there is a lack of adequate life history information to make management decisions, or whose populations are at risk of declining in the absence of long-term (ten or more years) conservation effort to address the threats they face.

The 2015 GCN species list includes 26 mammals, 95 birds, 31 reptiles and amphibians, 73 fish, 242 invertebrates, and 100 plants (Table 1.7). GCN species include some species currently considered extirpated. They were included because it is possible that undiscovered populations may persist or because there is the potential for reintroduction if suitable habitat exists. GCN species also include several harvested fish and wildlife species. These harvested species were included if they met one or more of the criteria used for deciding GCN status (e.g., classified as RSGCN, declining habitat, population trend). However, funding for the conservation of harvested fish and wildlife is for the most part adequately addressed through existing programs and/or plans, which are included by reference throughout this WAP. Transient species are generally not considered unless Connecticut is critical to their overall survival. Additional species not covered here also benefit from conservation actions aimed at GCN species and/or their habitats. GCN species and taxa-level data gaps are prioritized into species conservation actions in Chapter 4.

TABLE 1.7: SUMMARY OF CONNECTICUT'S GCN SPECIES

Taxa	Most Important	Very Important	Important	Total
Mammals	12	6	8	26
Birds	22	38	35	95
Herpetofauna	6	13	12	31
Fish	17	14	42	73
Invertebrates	36	58	148	242
Plants	6	8	86	100
Total	**99**	**137**	**331**	**567**

GCN Mammals

Eighty-four mammal species have been found in Connecticut, including eleven state-listed and four federally-listed species. Connecticut has identified twelve mammals in the "most important" tier of GCN species, six as "very important," and eight as "important" (Table 1.8).

TABLE 1.8: GCN MAMMALS IN CONNECTICUT

Most Important	
Big Brown Bat	*Eptesicus fuscus*
Eastern Small-footed Bat	*Myotis leibii*
Hoary Bat	*Lasiurus cinereus*
Indiana Bat	*Myotis sodalis*
Least Shrew	*Cryptotis parva*
Little Brown Bat	*Myotis lucifugus*
New England Cottontail	*Sylvilagus transitionalis*
Northern Long-eared Bat	*Myotis septentrionalis*
Red Bat	*Lasiurus borealis*
Silver-haired Bat	*Lasionycteris noctivagans*
Southern Bog Lemming	*Synaptomys cooperi*
Tri-colored Bat	*Perimyotis subflavus*
Very Important	
Deer Mouse	*Peromyscus maniculatus*
Harbor Porpoise	*Phocoena phocoena phocoena**
Meadow Jumping Mouse	*Zapus hudsonius*
Northern Flying Squirrel	*Glaucomys sabrinus*
American Water Shrew	*Sorex palustris*
Woodland Jumping Mouse	*Napaeozapus insignis*
Important	
Hairy-Tailed Mole	*Parascalops breweri*
Harbor Seal	*Phoca vitulina*
Long-tailed Weasel	*Mustela frenata*
Mink	*Mustela vison*
Muskrat	*Ondatra zibethicus*
Short-tailed Weasel	*Mustela erminea*
Southern Red-backed Vole	*Clethrionomys gapperi*
Woodland Vole	*Microtus pinetorum*

* *Latin name updated to reflect subspecies*

GCN Birds

A total of 335 birds are found in Connecticut, of which 50 are state-listed and three are federally-listed species. Twenty-two bird species are listed in the "most important" tier of GCN species, 38 are "very important," and 35 are "important" (Table 1.9).

TABLE 1.9: GCN BIRDS IN CONNECTICUT

Most Important	
American Kestrel	*Falco sparverius*
American Woodcock	*Scolopax minor*
Barn Owl	*Tyto alba*
Blue-winged Warbler	*Vermivora pinus*
Eastern Meadowlark	*Sturnella magna*
Golden-winged Warbler	*Vermivora chrysoptera*
Grasshopper Sparrow	*Ammodramus savannarum*
Horned Lark	*Eremophila alpestris*
Least Tern	*Sterna antillarum*
Northern Goshawk	*Accipiter gentilis*
Northern Harrier	*Circus cyaneus*
Pied-billed Grebe	*Podilymbus podiceps*
Piping Plover	*Charadrius melodus*
Prairie Warbler	*Dendroica discolor*
Red-headed Woodpecker	*Melanerpes erythrocephalus*
Roseate Tern	*Sterna dougallii*
Saltmarsh Sparrow	*Ammodramus caudacutus*
Sharp-shinned Hawk	*Accipiter striatus*
Snowy Egret	*Egretta thula*
Upland Sandpiper	*Bartramia longicauda*
Whip-poor-will	*Caprimulgus vociferus*
Wood Thrush	*Hylocichla mustelina*
Very Important	
American Bittern	*Botaurus lentiginosus*
American Black Duck	*Anas rubripes*
American Oystercatcher	*Haematopus palliatus*
Bank Swallow	*Riparia riparia*
Black-billed Cuckoo	*Coccyzus erythropthalmus*
Black-throated Blue Warbler	*Dendroica caerulescens*
Bobolink	*Dolichonyx oryzivorus*
Broad-winged Hawk	*Buteo platypterus*
Brown Thrasher	*Toxostoma rufum*
Canada Warbler	*Wilsonia canadensis*
Cerulean Warbler	*Dendroica cerulea*
Chestnut-sided Warbler	*Dendroica pensylvanica*
Chimney Swift	*Chaetura pelagica*
Clapper Rail	*Rallus longirostris*
Common Moorhen	*Gallinula chloropus*
Common Nighthawk	*Chordeiles minor*
Eastern Towhee	*Pipilo erythrophthalmus*
Field Sparrow	*Spizella pusilla*
Great Egret	*Ardea alba*
Greater Scaup	*Aythya marila*

Indigo Bunting	*Passerina cyanea*
King Rail	*Rallus elegans*
Least Bittern	*Ixobrychus exilis*
Least Flycatcher	*Empidonax minimus*
Long-eared Owl	*Asio otus*
Louisiana Waterthrush	*Seiurus motacilla*
Marsh Wren	*Cistothorus palustris*
Northern Flicker	*Colaptes auratus*
Ruffed Grouse	*Bonasa umbellus*
Sanderling	*Calidris alba*
Scarlet Tanager	*Piranga olivacea*
Seaside Sparrow	*Ammodramus maritimus*
Semipalmated Sandpiper	*Calidris pusilla*
Vesper Sparrow	*Pooecetes gramineus*
White-winged Scoter	*Melanitta fusca*
Worm-eating Warbler	*Helmitheros vermivorus*
Yellow-billed Cuckoo	*Coccyzus americanus*
Yellow-breasted Chat	*Icteria virens*
Important	
Alder Flycatcher	*Empidonax alnorum*
Bald Eagle	*Haliaeetus leucocephalus*
Baltimore Oriole	*Icterus galbula*
Black Scoter	*Melanitta nigra*
Black-and-white Warbler	*Mniotilta varia*
Blackburnian Warbler	*Dendroica fusca*
Brown Creeper	*Certhia americana*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Loon	*Gavia immer*
Common Tern	*Sterna hirundo*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Wood-pewee	*Contopus virens*
Glossy Ibis	*Plegadis falcinellus*
Ipswich Sparrow	*Passerculus sandwichensis princeps*
Little Blue Heron	*Egretta caerulea*
Northern Parula	*Parula americana*
Northern Saw-whet Owl	*Aegolius acadicus*
Northern Waterthrush	*Seiurus noveboracensis*
Osprey	*Pandion haliaetus*
Ovenbird	*Seiurus aurocapillus*
Peregrine Falcon	*Falco peregrinus*
Purple Martin	*Progne subis*
Rose-breasted Grosbeak	*Pheucticus ludovicianus*
Ruddy Turnstone	*Arenaria interpres*
Savannah Sparrow	*Passerculus sandwichensis*
Sedge Wren	*Cistothorus platensis*
Short-eared Owl	*Asio flammeus*
Sora	*Porzana carolina*
Surf Scoter	*Melanitta perspicillata*
Veery	*Catharus fuscescens*
Virginia Rail	*Rallus limicola*

White-eyed Vireo	*Vireo griseus*
Willet	*Catoptrophorus semipalmatus*
Willow Flycatcher	*Empidonax traillii*
Yellow-crowned Night-heron	*Nyctanassa violacea*

GCN Herpetofauna (Reptiles and Amphibians)

There are 50 reptile and amphibian species found in Connecticut, with 22 (44%) of these listed by the state as endangered, threatened or species of concern. Five are federally-listed. Six reptiles and amphibians are listed in the "most important" tier of GCN species, thirteen are "very important," and twelve are "important" (Table 1.10).

TABLE 1.10: GCN REPTILES AND AMPHIBIANS IN CONNECTICUT

Most Important	
Atlantic Ridley	*Lepidochelys kempii*
Blue-spotted Salamander (diploid)	*Ambystoma laterale*
Bog Turtle	*Glyptemys muhlenbergii*
Eastern Spadefoot	*Scaphiopus holbrookii*
Leatherback	*Dermochelys coriacea*
Timber Rattlesnake	*Crotalus horridus*
Very Important	
Atlantic Green Turtle	*Chelonia mydas*
Blue-spotted Salamander (complex)	*Ambystoma laterale*
Common Five-lined Skink	*Plestiodon fasciatus**
Eastern Box Turtle	*Terrapene carolina*
Eastern Hog-nosed Snake	*Heterodon platirhinos*
Eastern Ribbonsnake	*Thamnophis sauritus*
Jefferson Salamander (complex)	*Ambystoma jeffersonianum*
Loggerhead	*Caretta caretta*
Northern Leopard Frog	*Lithobates pipiens**
Northern Slimy Salamander	*Plethodon glutinosus*
Northern Spring Salamander	*Gyrinophilus porphyriticus*
Spotted Turtle	*Clemmys guttata*
Wood Turtle	*Glyptemys insculpta*
Important	
Copperhead	*Agkistrodon contortrix*
Diamond-backed Terrapin	*Malaclemys terrapin*
Eastern Newt	*Notophthalmus viridescens*
Eastern Racer	*Coluber constrictor*
Fowler's Toad	*Anaxyrus fowleri**
Gray Treefrog	*Hyla versicolor*
Marbled Salamander	*Ambystoma opacum*
Mudpuppy	*Necturus maculosus*
Northern Dusky Salamander	*Desmognathus fuscus*
Smooth Green Snake	*Opheodrys vernalis*
Spotted Salamander	*Ambystoma maculatum*
Wood Frog	*Lithobates sylvatica**

* *Latin name updated since 2005.*

GCN Fish

A total of 169 species of fish (67 freshwater and diadromous; 102 saltwater) are found in Connecticut's aquatic habitats, including nine species that are state-listed and two that are federally listed. Seventeen fish species are listed in the "most important" tier of GCN species, 14 are "very important," and 42 are "important" (Table 1.11). Four marine species have been added to the 2015 GCN list: Sand Tiger Shark, Radiated Shanny, Atlantic Seasnail, and Scup.

TABLE 1.11: GCN FISH IN CONNECTICUT

Most Important	
Alewife	*Alosa pseudoharengus*
American Brook Lamprey	*Lethenteron appendix**
American Eel	*Anguilla rostrata*
Atlantic Sturgeon	*Acipenser oxyrinchus oxyrinchus*
Atlantic Tomcod	*Microgadus tomcod*
Banded Sunfish	*Enneacanthus obesus*
Blueback Herring	*Alosa aestivalis*
Bridle Shiner	*Notropis bifrenatus*
Brook Trout (wild)	*Salvelinus fontinalis*
Brown Trout (wild)	*Salmo trutta*
Burbot	*Lota lota*
Rainbow Smelt	*Osmerus mordax*
Shortnose Sturgeon	*Acipenser brevirostrum*
Slimy Sculpin	*Cottus cognatus*
Swamp Darter	*Etheostoma fusiforme*
Tautog	*Tautoga onitis*
Winter Flounder	*Pseudopleuronectes americanus*
Very Important	
American Sand Lance	*Ammodytes americanus*
American Shad	*Alosa sapidissima*
Atlantic Salmon	*Salmo salar*
Chain Pickerel	*Esox niger*
Creek Chubsucker	*Erimyzon oblongus*
Cunner	*Tautogolabrus adspersus*
Fourspine Stickleback	*Apeltes quadracus*
Hickory Shad	*Alosa mediocris*
Longnose Sucker	*Catostomus catostomus*
Mummichog	*Fundulus heteroclitus*
Redfin Pickerel	*Esox americanus*
Sea Lamprey	*Petromyzon marinus*
Sea Raven	*Hemitripterus americanus*
Windowpane Flounder	*Scophthalmus aquosus*
Important	
Atlantic Herring	*Clupea harengus*
Atlantic Menhaden	*Brevoortia tyrannus*
Atlantic Seasnail	*Liparis atlanticus*
Atlantic Silversides	*Menidia menidia*
Bay Anchovy	*Anchoa mitchilli*
Black Crappie	*Pomoxis nigromaculatus*

Black Sea Bass	*Centropristes striata*
Blacknose Dace	*Rhinichthys atratulus*
Butterfish	*Peprilus triacanthus*
Clearnose Skate	*Raja eglanteria*
Common Shiner	*Luxilus cornutus*
Cutlips Minnow	*Exoglossum maxillingua*
Fallfish	*Semotilus corporalis*
Fourspot Flounder	*Paralichthys oblongus*
Golden Shiner	*Notemigonus crysoleucas*
Hogchoker	*Trinectes maculatus*
Largemouth Bass	*Micropterus salmoides*
Lined Seahorse	*Hippocampus erectus*
Longnose Dace	*Rhinichthys cataractae*
Northern Pipefish	*Syngnathus fuscus*
Northern Searobin	*Prionotus carolinus*
Ocean Pout	*Macrozoarces americanus*
Oyster Toadfish	*Opsanus tau*
Pumpkinseed	*Lepomis gibbosus*
Radiated Shanny	*Ulvaria subbifurcata*
Red Hake	*Urophycis chuss*
Redbreast Sunfish	*Lepomis auritus*
Sand Tiger Shark	*Carcharias taurus*
Sandbar Shark	*Carcharhinus plumbeus*
Scup	*Stenotomus chrysops*
Sheepshead Minnow	*Cyprinodon variegatus*
Silver Hake	*Merluccius bilinearis*
Smallmouth Bass	*Micropterus dolomieu*
Smooth Dogfish	*Mustelis canis*
Spiny Dogfish	*Squalus acanthias*
Striped Bass	*Morone saxatilis*
Striped Searobin	*Prionotus evolans*
Threespine Stickleback	*Gasterosteus aculeatus*
Weakfish	*Cynoscion regalis*
White Sucker	*Catostomus commersoni*
Winter Skate	*Leucoraja ocellata*
Yellow Perch	*Perca flavescens*

* *Latin name updated since 2005.*

Inclusion of Selected Non-native GCN Fish Species: Many freshwater aquatic organisms, fish in particular, lack the ability to easily spread across the inland landscape the way mammals, birds, insects or even plants do. As a result, Connecticut's native freshwater fish fauna is relatively low in species richness when compared to nearby regions unaffected by the most recent glaciation. Human intervention since the early part of the 19th century has led to the movement of native fish species among Connecticut watersheds (e.g., canals, rail lines), the intentional and unintentional introduction of non-native species, and the modification of aquatic habitats (impoundments, loss of wetlands). In many of Connecticut's waters, more than half of the presently existing fish species are non-native. As a result, Connecticut's aquatic habitats and fish populations no longer reflect their pre-colonial condition, having evolved over the past two centuries to include some non-native species as key components of community structure and ecosystem function.

One of the important objectives of this Wildlife Action Plan is to inform conservation actions that will ensure the continuance of a broad array of habitats, ecosystems, and species across Connecticut's landscape. In the freshwater aquatic realm, this often requires recognizing the critical role played by species that are not native to either the watershed in question or to the state as a whole. This need is probably best illustrated by the association of wild brown trout with cold water stream habitat throughout the state. Cold water streams and riparian zones are among our most threatened habitats (e.g., by climate change). Many cold water streams still exist; however, they have been impacted by development to the extent that water temperature and flow are significantly altered (due to loss of groundwater and warming in impoundments) and fish movement and therefore gene flow are restricted (dams). As a result, much of this cold water habitat is not and cannot be occupied by native brook trout. Brown trout have been established in Connecticut waters for more than 130 years. And while many of our smaller streams still support brook trout or sympatric populations of both species, most of our larger waters are today only suitable for brown trout. Other fish species coexisting with trout in these larger cold water environments are tolerant of a wider range of conditions and therefore less reliable as index species. Long-term protection of these high-priority habitats must revolve around conservation of both wild brook trout and wild brown trout populations.

Brown trout are but one example of a non-native fish species that now plays a central role in the functioning and conservation of Connecticut's freshwater ecosystems. For this reason, it is listed in the most important tier of GCN fish species. Many of our other non-native fish originate from regions close to Connecticut where they are sympatric with our native species with whom they likely coevolved. From among the many introductions made over the past 150 years, there are a small number of non-native but long-established fish species that today serve as critical components or key indicators of aquatic environmental health and have thus been included on Connecticut's list of GCN species.

GCN Invertebrates

It is estimated that at least 20,000 species of invertebrates exist in Connecticut. Thirty-six invertebrates are listed in the "most important" tier of GCN species, fifty-eight are "very important," and one hundred and forty-eight are "important" (Table 1.12).

TABLE 1.12: GCN INVERTEBRATES IN CONNECTICUT

Most Important	
American Lobster	*Homarus americanus*
Appalachian Blue	*Celastrina neglectamajor*
Atlantis Fritillary Butterfly	*Speyeria atlantis*
Barrens Chytonix	*Chytonix sensilis*
Bay Scallop	*Argopecten irradians*
Black-eyed Zale	*Zale curema*
Bog Tiger Moth	*Grammia speciosa*
Brick-red Borer Moth	*Papaipema marginidens*
Brook Floater	*Alasmidonta varicosa*
Buck Moth	*Hemileuca maia maia**
Columbine Borer	*Papaipema leucostigma*
Columbine Duskywing	*Erynnis lucilius*
Common Roadside Skipper	*Amblyscirtes vialis*
Dune Ghost Tiger Beetle	*Cicindela lepida*
Dwarf Wedgemussel	*Alasmidonta heterodon*
Eastern Oyster	*Crassostrea virginica*
Fairy Shrimp	*Eubranchipus holmanii*
Herodias Underwing	*Catocala herodias gerhardi*
Hessel's Hairstreak	*Callophrys hesseli**
Horse Fly	*Hybomitra longiglossa*
Horseshoe Crab	*Limulus polyphemus*
Labrador Tea Tentiform Leafminer	*Phyllonorycter ledella*
Lace-winged Horse Fly	*Haematopota rara*
Little 17-year Periodical Cicada	*Magicicada septendecula*
Macropis Cuckoo	*Epeoloides pilosula*
New Jersey Tea Inchworm	*Apodrepanulatrix liberaria*
Noctuid Moth	*Anarta luteola*
Northern Metalmark	*Calephelis borealis*
Persius Duskywing	*Erynnis persius persius*
Phyllira Tiger Moth	*Grammia phyllira*
Pitcher Plant Borer	*Papaipema appassionata*
Puritan Tiger Beetle	*Cicindela puritana*
Ringed Boghaunter	*Williamsonia lintneri*
Silvery Checkerspot (Extirpated)	*Chlosyne nycteis*
Slender Flower Moth	*Schinia gracilenta*
Two-spotted Skipper	*Euphyes bimacula*
Very Important	
American Rubyspot	*Hetaerina americana*
Apamea Moth	*Apamea inordinata*
Atlantic Bluet	*Enallagma doubledayi*
Aureolaria Seed Borer	*Pyrrhia aurantiago**
Barrens Itame	*Speranza exonerata**

Big Sand Tiger Beetle	*Cicindela formosa generosa*
Blue Crab	*Callinectes sapidus*
Blue Mussel	*Mytilus edulis*
Brown-bordered Geometer	*Eumacaria latiferrugata**
Channeled Whelk	*Busycotypus canaliculatum*
Coastal Heathland Cutworm	*Abagrotis nefascia benjamini*
Common Sanddragon	*Progomphus obscurus*
Coppery Emerald	*Somatochlora georgiana*
Crimson-ringed Whiteface	*Leucorrhinia glacialis*
Dark-bellied Tiger Beetle	*Cicindela tranquebarica*
False Heather Underwing	*Drasteria graphica atlantica*
Frosted Elfin	*Callophrys irus*
Grassland Thaumatopsis	*Thaumatopsis edonis*
Gray Spring Zale (Extirpated)	*Zale submediana*
Green Crab	*Carcinus maenas*
Harpoon Clubtail	*Gomphus descriptus*
Horse Fly	*Hybomitra trepida*
Horse Fly	*Hybomitra typhus*
Horse Fly	*Tabanus fulvicallus*
Knobbed Whelk	*Busycon carica*
Lady Crab	*Ovalipes ocellatus*
Lanced phaneta	*Phaneta clavana*
Long-finned Squid	*Loligo pealeii*
Mantis Shrimp	*Squilla empusa*
Mayfly	*Paraleptophlebia assimilis*
Midland Clubtail	*Gomphus fraternus*
Morrison's Mosaic	*Eucosma morrisoni*
Noctuid Moth	*Zanclognatha theralis*
Northern Flower Moth	*Schinia septentrionalis*
Pine Barrens Bluet	*Enallagma recurvatum*
Pine Barrens Zanclognatha	*Zanclognatha martha*
Pine Sphinx	*Lapara coniferarum*
Pink Sallow	*Psectraglaea carnosa*
Pink Streak	*Dargida rubripennis**
Pitcher Plant Moth	*Exyra fax**
Rapids Clubtail	*Gomphus quadricolor*
Riverine Clubtail	*Stylurus amnicola*
Rock Crab	*Cancer irroratus*
Scrub Euchlaena	*Euchlaena madusaria*
Seaside Goldenrod Stem Borer	*Papaipema duovata*
Sedge Skipper	*Euphyes dion*
Sleepy Duskywing	*Erynnis brizo*
Slender Clearwing	*Hemaris gracilis*
Soft Shell Clam	*Mya arenaria*
Sparkling Jewelwing	*Calopteryx dimidiata*
Tabanid Fly	*Merycomyia whitneyi*
Tabanid Fly	*Atylotus ohioensis*
Tidewater Mucket	*Leptodea ochracea*
Tiger Spiketail	*Cordulegaster erronea*
Toothed Apharetra Moth	*Sympistis dentata*

Tusked Sprawler	*Anthopotamus verticis*
Yellow Lampmussel	*Lampsilis cariosa*
Yellow-banded Bumble Bee	*Bombus terricola*
Important	
American Bumble Bee	*Bombus pennsylvanicus*
American Burying Beetle (Extirpated)	*Nicrophorus americanus*
Annointed Sallow Moth (Extirpated)	*Pyreferra ceromatica*
Apamea Moth	*Apamea burgessi*
Ashton's Cuckoo Bumble Bee (Extirpated)	*Bombus ashtoni*
Attenuated Bluet	*Enallagma daeckii*
Banded Pennant	*Celithemis fasciata*
Barrens Dagger Moth (Extirpated)	*Acronicta albarufa*
Barrens Metarranthis Moth	*Metarranthis apiciaria*
Bay Underwing Moth	*Catocala badia badia*
Bee Fly	*Dipalta banksi*
Black Lordithon Rove Beetle (Extirpated)	*Lordithon niger*
Blue Corporal Dragonfly	*Ladona deplanata*
Blueberry Gray Moth (Extirpated)	*Glena cognataria*
Bog Copper	*Lycaena epixanthe*
Bombardier Beetle	*Brachinus cyanipennis*
Bombardier Beetle	*Brachinus fumans*
Bombardier Beetle	*Brachinus medius*
Bombardier Beetle	*Brachinus ovipennis*
Bombardier Beetle	*Brachinus patruelis*
Boreal Fossaria (Extirpated)	*Fossaria galbana*
Boreal Turret Snail	*Valvata sincera*
Bronze Copper	*Lycaena hyllus*
Clam Shrimp (Extirpated)	*Eulimnadia agassizii*
Coastal Mud Shrimp	*Upogebia affinis*
Coastal Pond Amphipod	*Synurella chamberlaini*
Cobra Clubtail	*Gomphus vastus*
Comet Darner	*Anax longipes*
Common Crayfish	*Cambarus bartonii*
Common Razor Clam	*Ensis directus*
Corylus Dagger Moth	*Acronicta falcula*
Cow Path Tiger Beetle (Extirpated)	*Cicindela purpurea*
Disc Gyro	*Gyraulus circumstriatus*
Drasteria Moth (Extirpated)	*Drasteria occulta*
Dune Sympistis	*Sympistis riparia*
Eastern Cactus-boring Moth	*Melitara prodenialis*
Eastern Pearlshell	*Margaritifera margaritifera*
Eastern Pondmussel	*Ligumia nasuta*
Equivocal Looper	*Digrammia equivocata*
Eyed Brown	*Lethe eurydice**
Fawn Brown Dart Moth	*Euxoa pleuritica*
Fiddler Crabs	*Uca spp.*
Flat Claw Hermit Crab	*Pagurus pollicaris*
Fragile Dagger Moth	*Acronicta fragilis*
Fringed Loosestrife Oil-bee	*Macropis ciliata*
Ghost Shrimp	*Gilvossius setimanus*

Grass Shrimp	*Hippolyte spp.*
Ground Beetle	*Amara chalcea*
Ground Beetle	*Helluomorphoides praeustus bicolor*
Ground Beetle	*Harpalus erraticus*
Ground Beetle	*Agonum darlingtoni*
Ground Beetle	*Agonum mutatum*
Ground Beetle	*Geopinus incrassatus*
Ground Beetle	*Carabus serratus*
Ground Beetle	*Carabus vinctus*
Ground Beetle	*Badister transversus*
Ground Beetle	*Harpalus caliginosus*
Ground Beetle	*Bembidion quadratulum*
Ground Beetle	*Nebria lacustris lacustris*
Ground Beetle	*Bembidion lacunarium*
Ground Beetle	*Bembidion planum*
Ground Beetle	*Bembidion pseudocautum*
Ground Beetle	*Scaphinotus viduus*
Ground Beetle	*Loxandrus vulneratus**
Ground Beetle	*Bembidion semicinctum*
Ground Beetle	*Bembidion carinula*
Ground Beetle	*Bembidion simplex*
Hairy-necked Tiger Beetle	*Cicindela hirticollis*
Harris's Checkerspot (Extirpated)	*Chlosyne harrisii*
Henry's Elfin	*Callophrys henrici*
Hoary Elfin (Extirpated)	*Callophrys polios*
Hops-stalk Borer Moth (Extirpated)	*Papaipema circumlucens*
Horace's Duskywing	*Erynnis horatius*
Horse Fly	*Hybomitra frosti*
Horse Fly	*Hybomitra lurida*
Horse Fly	*Goniops chrysocoma*
Imperial Moth	*Eacles imperialis imperialis**
Lemmer's Noctuid Moth	*Lithophane lemmeri*
Little Beggar	*Eubaphe meridiana*
Little Bluet	*Enallagma minusculum*
Long-horned Beetle	*Prionus pocularis*
Lymnaeid Snail	*Fossaria rustica*
Maritime Sunflower Borer Moth (Extirpated)	*Papaipema maritima*
Maroonwing Moth (Extirpated)	*Sideridis maryx*
Marsh Fern Moth	*Fagitana littera*
Martha's Pennant	*Celithemis martha*
Mayfly	*Leptophlebia bradleyi*
Mayfly	*Baetisca lacustris*
Mayfly	*Cinygmula subaequalis*
Mayfly	*Baetisca obesa*
Monarch	*Danaus plexippus*
Mottled Duskywing (Extirpated)	*Erynnis martialis*
Mud Crabs	*Xanthidae spp. **
Mustached Clubtail	*Gomphus adelphus*
Mystic Valley Amphipod	*Crangonyx aberrans*
New England Buckmoth	*Hemileuca lucina*

Newman's Brocade	*Meropleon ambifusca*
Nine-spotted Lady Beetle	*Coccinella novemnotata*
Noctuid Moth	*Dichagyris acclivis*
Noctuid Moth	*Eucoptocnemis fimbriaris*
Noctuid Moth	*Schinia spinosae*
Northeastern Beach Tiger Beetle (Extirpated)	*Cicindela dorsalis dorsalis*
Northern Dusk-singing Cicada	*Tibicen auletes*
Oblique Zale	*Zale obliqua*
Pale Green Pinion Moth	*Lithophane viridipallens*
Piedmont Groundwater Amphipod	*Stygobromus tenuis tenuis*
Pink Prominent	*Hyparpax aurora*
Pink Star Moth	*Derrima stellata*
Pointed Dagger Moth (Extirpated)	*Acronicta lanceolaria*
Precious Underwing Moth (Extirpated)	*Catocala pretiosa pretiosa**
Purse Web Spider	*Sphodros niger*
Regal Fritillary (Extirpated)	*Speyeria idalia*
Regal Moth (Extirpated)	*Citheronia regalis*
Robber Fly	*Ceraturgus aurulentus*
Robber Fly	*Stichopogon argenteus*
Robber Fly	*Laphria cinerea*
Robber Fly	*Nicocles politus*
Rusty-patched Bumble Bee (Extirpated)	*Bombus affinis*
Saltmarsh Tiger Beetle	*Cicindela marginata*
Sand Prairie Wainscot	*Leucania extincta*
Sand Shrimp	*Crangon septemspinosa*
Sand Wainscot Moth	*Apamea lintneri*
Scarlet Bluet	*Enallagma pictum*
Scribbled Sallow Moth	*Sympistis perscripta**
Shore Shrimp	*Palaemonetes spp.*
Short-lined Chocolate	*Argyrostrotis anilis*
Silvery Blue	*Glaucopsyche lygdamus*
Skillet Clubtail	*Gomphus ventricosus*
Ski-tailed Emerald	*Somatochlora elongata*
Slender Walker	*Pomatiopsis lapidaria*
Spartina Borer Moth	*Photedes inops**
Speyer's Paint (Extirpated)	*Cucullia speyeri*
Spider Crab	*Libinia emarginata*
Spongillafly	*Sisyra fuscata*
Spotted Dart Moth	*Agrotis stigmosa*
Starfish spp.	*Asteriid spp.*
Stinging Rose Caterpillar Moth	*Parasa indetermina*
Sugar Maple Borer	*Glycobius speciosus*
Syrphid Fly (Extirpated)	*Mixogaster johnsoni*
Tabanid Fly	*Stonemyia isabellina*
Tabanid Fly	*Atylotus sphagnicolus*
Taper-tailed Darner	*Gomphaeschna antilope*
Turret Snail	*Valvata tricarinata*
Violet Dart Moth	*Euxoa violaris*
Virginia River Snail	*Elimia virginica*
Waxed Sallow	*Chaetaglaea cerata*

Woodland Pondsnail	*Stagnicola catascopium*
Yellow-horned Beaded Lacewing	*Lomamyia flavicornis*

** Latin name updated since 2005.*

GCN Plants

The GCN plant list (Table 1.13) includes species listed as globally rare (G1-G3) by NatureServe, those with restricted geographic ranges, and those that serve as important host plants for GCN invertebrate species.

TABLE 1.13: GCN PLANTS IN CONNECTICUT

Most Important	
Barratt's Sedge	*Carex barrattii*
Ogden's Pondweed	*Potamogeton ogdenii*
Sandplain Agalinis	*Agalinis acuta*
Small whorled Pogonia	*Isotria medeoloides*
Spreading Globe Flower	*Trollius laxus*
Torrey Mountain-mint	*Pycnanthemum torrei*
Very Important	
Capillary Pondweed	*Potamogeton pusillus* ssp. *gemmiparus*
Eaton's Beggarticks	*Bidens eatonii*
Hill's Pondweed	*Potamogeton hillii*
Nantucket Juneberry	*Amelanchier nantucketensis*
New England Blazing-star	*Liatris scariosa var. novae-angliae*
Parker's Pipewort	*Eriocaulon parkeri*
Quill-leaved Arrowhead	*Sagittaria teres*
Variable Sedge	*Carex polymorpha*
Important	
American Beachgrass	*Ammophila breviligulata*
American Ginseng	*Panax quinquefolius*
American Hazel	*Corylus americana*
Atlantic White Cedar	*Chamaecyparis thyoides*
Bayard's White Adder's Mouth (Extirpated)	*Malaxis bayardii*
Bayberry	*Morella caroliniensis*
Beach Pinweed	*Lechea maritima*
Beach Plum (Extirpated)	*Prunus maritime var. gravesii*
Beaked Hazel	*Corylus cornuta*
Big Bluestem	*Andropogon gerardii*
Black Bugbane	*Actaea racemosa*
Black Oak	*Quercus velutina*
Bog Laurel	*Kalmia polifolia*
Bur Oak	*Quercus macrocarpa*
Bushy Frostweed	*Helianthemum dumosum*
Butterfly Milkweed	*Asclepias tuberosa*
Chaffseed (Extirpated)	*Schwalbea americana*
Clasping Milkweed	*Asclepias amplexicaulis*
Common Hops	*Humulus lupulus var. americanus*
Common Milkweed	*Asclepias syriaca*
Common Serviceberry	*Amelanchier arborea*
Common Yarrow	*Achillea millefolium*
Creeping St. John's-wort (Extirpated)	*Hypericum adpressum*
Dragon's-mouth (Extirpated)	*Arethusa bulbosa*
Dwarf Chinkapin Oak	*Quercus prinoides*

Dwarf Serviceberry	*Amelanchier spicata*
Eastern Prickly-pear	*Opuntia humifusa*
Fern-leaf False Foxglove	*Aureolaria pedicularia*
Flax-leaved Stiff-aster	*Ionactis linariifolia*
Fogg's Goosefoot	*Chenopodium fogii*
Goldenseal	*Hydrastis canadensis*
Greater Water Dock	*Rumex britannica*
Green Milkweed	*Asclepias viridiflora*
Highbush Blueberry	*Vaccinium corymbosum*
Hillside Blueberry	*Vaccinium pallidum*
Indian Paintbrush	*Castilleja coccinea*
Labrador-tea	*Rhododendron groelandicum*
Lakeside Sedge	*Carex lacustris*
Large Cranberry	*Vaccinium macrocarpon*
Laurentian Fragile-fern	*Cystopteris laurentiana*
Little Bluestem	*Schizachyrium scoparius*
Long's Bitter-cress	*Cardamine longii*
Long's Bulrush (Extirpated)	*Scirpus longi*
Lowbush Blueberry	*Vaccinium angustifolium*
New Jersey Tea	*Ceanothus americanus*
Nodding Pogonia	*Triphora trianthophora*
Northern Adder's Tongue Fern	*Ophioglossum pusillum*
Oldfield-toadflax	*Nuttallanthus canadensis*
Pignut Hickory	*Carya glabra*
Pin Cherry	*Prunus pensylvanica*
Pitch Pine	*Pinus rigida*
Post Oak	*Quercus stellata*
Prairie Cordgrass	*Spartina pectinata*
Purple Milkweed	*Asclepias purpurascens*
Purple Pitcherplant	*Sarracenia purpurea*
Ram's-Head Lady's-slipper (Extirpated)	*Cypripedium arietinum*
Red Cedar	*Juniperus virginiana*
Red Pine	*Pinus resinosa*
Roundleaf Ragwort	*Packera obovata*
Sand Cherry	*Prunus pumila*
Schweinitz's Sedge	*Carex schweinitzii*
Scrub Oak	*Quercus ilicifolia*
Sea-beach Amaranth (Extirpated)	*Amaranthus pumilus*
Seabeach Knotweed	*Polygonum glaucum*
Seaside Goldenrod	*Solidago sempervirens*
Showy Aster	*Eurybia spectabilis*
Showy Lady's-slipper	*Cypripedium reginae*
Showy Orchid	*Galearis spectabilis*
Sickle-leaf Golden-aster	*Pityopsis falcata*
Small Cranberry	*Vaccinium oxycoccos*
Smooth False Foxglove	*Aureolaria flava*
Smooth Serviceberry	*Amelanchier laevis*
St. Lawrence Grapefern	*Botrychium rugulosum*
Sugar Maple	*Acer saccharum*
Sundial Lupine	*Lupinus perennis spp. Perennis*

Swamp Milkweed	*Asclepias incarnata*
Switchgrass	*Panicum virgatum*
Tall White-aster	*Doellingeria umbellata*
Tidal Spikerush	*Eleocharis aestuum*
White Meadowsweet	*Spiraea alba*
Wild Columbine	*Aquilegia canadensis*
Wild Lupine	*Lupinus perennis*
Woolly Beach-heather	*Hudsonia tomentosa*
Wright's Spikerush	*Eleocharis diandra*
Yellow Nutsedge	*Cyperus esculentus*
Yellow Wild Indigo	*Baptisia tinctoria*

GCN Species Status Changes Since 2005

The original GCN species list from the 2005 WAP was compared to the 2015 list (Tables 1.15, 1.16, and 1.17). For 2015, the GCN mammals list had minimal changes. The most important change was that all bat species (little brown bat, northern long-eared bat, and tri-colored bat) were elevated from a tier status of "important" to "most important," due to severe regional population declines resulting from the re-introduction of white-nose syndrome. The bobcat was removed from the list because abundance was documented to be more common since its original listing in 2005. Herpetofauna had only one new addition, the Mudpuppy. It was listed as "important" because of its scarcity and recent addition to the State Endangered Species list as a "Special Concern" species. Birds had numerous tier changes, additions, and removals for the 2015 list. In total, 53 bird species were removed from the list. Birds also had 42 species re-listed for 2015 but with tier changes. A total of 59 new invertebrate species were added to the 2015 list and, a total of 13 invertebrate species were removed. There were also six new fish species added to the GCN list, and seven fish species were removed.

Table 1.14: Tier changes for Connecticut's GCN Species since 2005

Species	Tier Changes for 2015	Reason for change
Mammals		
Little Brown Bat	Important to Most Important	Imperiled and declining
Northern Long-eared bat	Important to Most Important	Imperiled and declining
Tri-colored bat	Important to Most Important	Imperiled and declining
Birds		
Alder Flycatcher	Very Important to Important	Population increase
American Bittern	Most Important to Very Important	Population increase
American Kestrel	Very Important to Most Important	Population decrease
American Woodcock	Very Important to Most Important	Population decrease
Bald Eagle	Very Important to Important	Population increase
Bank Swallow	Important to Very Important	Population decrease
Black-and-white Warbler	Very Important to Important	Population increase
Blue-winged Warbler	Very Important to Most Important	Population decrease
Broad-winged Hawk	Important to Very Important	Population decrease
Common Loon	Very Important to Important	Population increase
Common Nighthawk	Most Important to Very Important	Population increase
Common Tern	Very Important to Important	Population increase
Eastern Meadowlark	Very Important to Most Important	Population decrease
Glossy Ibis	Very Important to Important	Population increase
Great Egret	Most Important to Very Important	Population increase
Ipswich Sparrow	Very Important to Important	Population increase
King Rail	Most Important to Very Important	Population increase
Least Bittern	Most Important to Very Important	Population increase
Little Blue Heron	Most Important to Important	Population increase
Louisiana Waterthrush	Important to Very Important	Population decrease
Northern Flicker	Important to Very Important	Population decrease
Northern Goshawk	Important to Most Important	Population decrease
Northern Saw-whet Owl	Very Important to Important	Population increase
Peregrine Falcon	Very Important to Important	Population increase
Prairie Warbler	Very Important to Most Important	Population decrease

Species	Tier Changes for 2015	Reason for change
Rose-breasted Grosbeak	Very Important to Important	Population increase
Sanderling	Important to Very Important	Population decrease
Savannah Sparrow	Very Important to Important	Population increase
Scarlet Tanager	Important to Very Important	Population decrease
Seaside Sparrow	Most Important to Very Important	Population increase
Sedge Wren	Most Important to Important	Population increase
Semipalmated Sandpiper	Important to Very Important	Population decrease
Sharp-shinned Hawk	Very Important to Most Important	Population decrease
Short-eared Owl	Very Important to Important	Population increase
Snowy Egret	Very Important to Most Important	Population decrease
Sora	Very Important to Important	Population increase
Vesper Sparrow	Most Important to Very Important	Population increase
Whip-poor-will	Very Important to Most Important	Population decrease
White-winged Scoter	Important to Very Important	Population decrease
Wood Thrush	Very Important to Most Important	Population decrease
Yellow-breasted Chat	Most Important to Very Important	Population increase
Yellow-crowned Night-heron	Very Important to Important	Population increase
Herpetofauna		
No Changes		
Fish		
Atlantic Menhaden	Very Important to Important	Population increase coastwide
Clearnose Skate	Very Important to Important	Population increase
Cunner	Most Important to Very Important	Population decrease in localized areas but stable coastwide
Northern Searobin	Very Important to Important	Population increase
Ocean Pout	Very Important to Important	Population decreased but managed outside of state waters
Red Hake	Very Important to Important	Population decreased but managed outside of state waters
Sea Raven	Most Important to Very Important	Population decrease in localized areas but stable coastwide
Silver Hake	Very Important to Important	Population decreased but managed outside of state waters
Smooth Dogfish	Very Important to Important	Population increase
Spiny Dogfish	Very Important to Important	Population increase
Weakfish	Very Important to Important	Population increase in Long Island Sound; mortality increase outside of state waters
Windowpane Flounder	Most Important to Very Important	Population stable at low levels
Winter Skate	Very Important to Important	Population increase
Invertebrates		
American Rubyspot	Important to Very Important	Imperiled
Appalachian Blue	Very Important to Most Important	Imperiled

Species	Tier Changes for 2015	Reason for change
Atlantic Bluet	Important to Very Important	Imperiled
Atlantis Fritillary Butterfly	Important to Most Important	Imperiled
Atylotus ohioensis	Important to Very Important	Imperiled
Aureolaria Seed Borer	Important to Very Important	Imperiled
Big Sand Tiger Beetle	Important to Very Important	Habitat Vulnerable
Black-eyed zale	Important to Most Important	Imperiled
Columbine Borer	Important to Most Important	Imperiled
Common Roadside Skipper	Very Important to Most Important	Imperiled
Common Sanddragon	Important to Very Important	Imperiled
Dark-bellied Tiger Beetle	Important to Very Important	Imperiled
Grassland Thaumatopsis	Important to Very Important	Population decrease
Harris's Checkerspot	Very Important to Important	Believed to be extirpated
Herodias Underwing	Very Important to Most Important	Imperiled
Hybomitra frosti	Very Important to Important	Population increase
Hybomitra trepida	Important to Very Important	Vulnerable
Hybomitra typhus	Important to Very Important	Limited Dispersal
Merycomyia whitneyi	Important to Very Important	Imperiled
Mustached Clubtail	Very Important to Important	Population increase
New Jersey Tea Inchworm	Important to Most Important	Imperiled
Paraleptophlebia assimilis	Important to Very Important	Imperiled
Phyllira Tiger Moth	Important to Most Important	Imperiled
Pine Barrens Zanclognatha	Important to Very Important	Imperiled
Pitcher Plant Moth	Important to Very Important	Imperiled
Scrub Euchlaena	Important to Very Important	Imperiled
Seaside Goldenrod Stem Borer	Important to Very Important	Population decrease
Sparkling Jewelwing	Important to Very Important	Imperiled
Tabanus fulvicallus	Important to Very Important	Imperiled
Tusked Sprawler	Important to Very Important	Population decrease
Two-spotted Skipper	Very Important to Most Important	Imperiled
Violet Dart Moth	Very Important to Important	Population increase
Virginia River Snail	Most Important to Important	Population increase
Yellow Lampmussel	Important to Very Important	Not extirpated

TABLE 1.15: GCN SPECIES LIST ADDITIONS SINCE 2005.

Species	Tier status for 2015
Mammals	
Big Brown Bat	Most Important
Birds	
None added to list	
Herpetofauna	
Mudpuppy	Important
Fish	
Atlantic Seasnail	Important
Black Sea Bass	Important
Radiated Shanny	Important
Sand Tiger Shark	Important
Scup	Important
Threespine Stickleback	Important
Invertebrates	
American Bumble Bee	Important
Apamea Moth	Very Important
Ashton's Cuckoo Bumble Bee (Extirpated)	Important
Attenuated Bluet	Important
Banded Pennant	Important
Barrens Chytonix	Most Important
Bay Underwing Moth	Important
Bee Fly	Important
Blueberry Gray Moth (Extirpated)	Important
Brick-red Borer Moth	Most Important
Brown-bordered Geometer	Very Important
Comet Darner	Important
Common Crayfish	Important
Coppery Emerald	Very Important
Corylus Dagger Moth	Important
Drasteria Moth (Extirpated)	Important
Dune Sympistis	Important
Eastern Cactus-boring Moth	Important
Equivocal Looper	Important
Fairy Shrimp	Most Important
False Heather Underwing	Very Important
Fragile Dagger Moth	Important
Fringed Loosestrife Oil-bee	Important
Lace-winged Horse Fly	Most Important
Lanced phaneta	Very Important
Little 17-year Periodical Cicada	Most Important
Little Beggar	Important
Long-horned Beetle	Important
Macropis Cuckoo	Most Important
Maroonwing Moth (Extirpated)	Important
Marsh Fern Moth	Important

Species	Tier status for 2015
Martha's Pennant	Important
Monarch	Important
Morrison's Mosaic	Very Important
New England Buckmoth	Important
Nine-spotted Lady Beetle	Important
Noctuid Moth (*Dichagyris acclivis*)	Important
Noctuid Moth *(Zanclognatha theralis)*	Very Important
Northern Flower Moth	Very Important
Pine Barrens Bluet	Very Important
Pine Sphinx	Very Important
Pink Prominent	Important
Pink Star Moth	Important
Robber Fly (*Ceraturgus aurulentus*)	Important
Robber Fly *(Nicocles politus)*	Important
Robber Fly (*Laphria cinerea*)	Important
Robber Fly (*Stichopogon argenteus*)	Important
Rusty-patched Bumble Bee (Extirpated)	Important
Sand Prairie Wainscot	Important
Sand Wainscot Moth	Important
Short-lined Chocolate	Important
Silvery Blue	Important
Slender Flower Moth	Most Important
Stinging Rose Caterpillar Moth	Important
Sugar Maple Borer	Important
Tabanid Fly (*Atylotus sphagnicolus*)	Important
Taper-tailed Darner	Important
Toothed Apharetra Moth	Very Important
Yellow-banded Bumble Bee	Very Important
Plants	
American Beachgrass	Important
American Ginseng	Important
American Hazel	Important
Atlantic White Cedar	Important
Barratt's Sedge	Most important
Bayard's White Adder's Mouth (Extirpated)	Important
Bayberry	Important
Beach Pinweed	Important
Beach Plum (Extirpated)	Important
Beaked Hazel	Important
Big Bluestem	Important
Black Bugbane	Important
Black Oak	Important
Bog Laurel	Important
Bur Oak	Important
Bushy Frostweed	Important
Butterfly Milkweed	Important
Capillary Pondweed	Very important

Species	Tier status for 2015
Chaffseed (Extirpated)	Important
Clasping Milkweed	Important
Common Hops	Important
Common Milkweed	Important
Common Serviceberry	Important
Common Yarrow	Important
Creeping St. John's-wort (Extirpated)	Important
Dragon's-mouth (Extirpated)	Important
Dwarf Chinkapin Oak	Important
Dwarf Serviceberry	Important
Eastern Prickly-pear	Important
Eaton's Beggarticks	Very important
Fern-leaf False Foxglove	Important
Flax-leaved Stiff-aster	Important
Fogg's Goosefoot	Important
Goldenseal	Important
Greater Water Dock	Important
Green Milkweed	Important
Highbush Blueberry	Important
Hill's Pondweed	Very important
Hillside Blueberry	Important
Indian Paintbrush	Important
Labrador-tea	Important
Lakeside Sedge	Important
Large Cranberry	Important
Laurentian Fragile-fern	Important
Little Bluestem	Important
Long's Bitter-cress	Important
Long's Bulrush (Extirpated)	Important
Lowbush Blueberry	Important
Nantucket Juneberry	Very important
New England Blazing-star	Very important
New Jersey Tea	Important
Nodding Pogonia	Important
Northern Adder's Tongue Fern	Important
Ogden's Pondweed	Most important
Oldfield-toadflax	Important
Parker's Pipewort	Very important
Pignut Hickory	Important
Pin Cherry	Important
Pitch Pine	Important
Post Oak	Important
Prairie Cordgrass	Important
Purple Milkweed	Important
Purple Pitcherplant	Important
Quill-leaved Arrowhead	Very important

Species	Tier status for 2015
Ram's-head Lady's-slipper (Extirpated)	Important
Red Cedar	Important
Red Pine	Important
Roundleaf Ragwort	Important
Sand Cherry	Important
Sandplain Agalinis	Most important
Schweinitz's Sedge	Important
Scrub Oak	Important
Sea-beach Amaranth (Extirpated)	Important
Seabeach Knotweed	Important
Seaside Goldenrod	Important
Showy Aster	Important
Showy Lady's-slipper	Important
Showy Orchid	Important
Sickle-leaf Golden-aster	Important
Small Cranberry	Important
Small Whorled Pogonia	Most important
Smooth False Foxglove	Important
Smooth Serviceberry	Important
Spreading Globe Flower	Most important
St. Lawrence Grapefern	Important
Sugar Maple	Important
Sundial Lupine	Important
Swamp Milkweed	Important
Switchgrass	Important
Tall White-aster	Important
Tidal Spikerush	Important
Torrey Mountain-mint	Most important
Variable Sedge	Very important
White Meadowsweet	Important
Wild Columbine	Important
Wild Lupine	Important
Woolly Beach-heather	Important
Wright's Spikerush	Important
Yellow Nutsedge	Important
Yellow Wild Indigo	Important

TABLE 1.16: SPECIES REMOVED FROM THE GCN LIST SINCE 2005 BECAUSE THEY DO NOT MEET THE GCN CRITERIA.

Mammals		
Black Bear	Bobcat	
Birds		
Acadian Flycatcher	Eastern Screech-owl	Olive-sided Flycatcher
American Redstart	Golden-crowned Kinglet	Orchard Oriole
Barred Owl	Gray Catbird	Pileated Woodpecker
Bay-breasted Warbler	Gray-cheeked Thrush	Purple Finch
Belted Kingfisher	Great Blue Heron	Red-breasted Nuthatch
Black Rail	Great Cormorant	Red-necked Grebe
Black Skimmer	Great Crested Flycatcher	Red-shouldered Hawk
Black-crowned Night-heron	Great Horned Owl	Red-throated Loon
Black-throated Green Warbler	Green Heron	Rough-legged Hawk
Blue-gray Gnatcatcher	Hermit Thrush	Ruby-throated Hummingbird
Blue-headed Vireo	Hooded Merganser	Snowy Owl
Blue-winged Teal	Hooded Warbler	Spotted Sandpiper
Canvasback	Horned Grebe	Swainson's Thrush
Cape May Warbler	Lesser Scaup	Warbling Vireo
Common Merganser	Long-tailed Duck	Winter Wren
Common Raven	Magnolia Warbler	Yellow-rumped Warbler
Cooper's Hawk	Northern Bobwhite	Yellow-throated Vireo
Dark-eyed Junco	Northern Rough-winged Swallow	
Herpetofauna		
None removed from list.		
Fish		
Atlantic Mackerel	Lumpfish	Roughtail Stingray
Little Skate	Northern Puffer	Spotfin Killifish
Longhorn Sculpin		
Invertebrates		
Bembidion tetracolum	Hop Vine Borer Moth	*Sargus fasciatus*
Calosoma wilcoxi	Jonah Crab	*Scaphinotus elevatus*
Carabus sylvosus	*Omophron tesselatum*	*Tetragonoderus fasciatus*
Culvers Root Borer	*Panagaeus fasciatus*	Whiteriver Crayfish
Gray Comma		

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