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Watershed Species

(from the Silvio O. Conte National Fish and Wildlife Refuge Final Action Plan and Environmental Impact Statement, October, 1995, U. S. Fish and Wildlife Service, Hadley, MA)

Wildlife

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Wildlife

The Connecticut River watershed encompasses a large, diverse area. As a result, there are a great number of species which occur here; approximately 59 species of mammals, 250 birds, 22 reptiles, 23 amphibians, 142 fish, 1,500 invertebrates and 3,000 plants.

Mammals

Mammals include the largest animal in the watershed, moose (*Alces alces*), which are mostly associated with second growth boreal forests that are interspersed with semi-open areas and swamps or lakes. On the smallest end of the size scale is the pygmy shrew (*Sorex hoyi*) which is found in a variety of forested habitats in the northern third of the watershed. Bats are common throughout the watershed and include nine species. Most mammals within the watershed are forest inhabitants and include species such as chipmunks (*Tamias striatus*), deer mouse (*Peromyscus leucopus*), porcupine (*Erethizon dorsatum*) and black bear (*Ursus americanus*). Since forest is the predominant habitat type in the watershed, most forest species are widespread and common.

Birds



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Twenty-seven species of ducks, geese and swans, 15 species of shore birds and 24 other water dependent species such as rails, grebes and herons use the watershed for breeding, wintering or migration. The watershed is also host to 181 passerine and raptor species. Of these, 88 are neotropical migrants using the watershed for breeding, 77 are residents breeding and wintering in the watershed, and 16 are winter residents that migrate to the watershed from the north to avoid extremes of cold, deep snow or lack of food during the winter months. Certain species such as mourning dove (*Zenaida macroura*), red-tailed hawk (*Buteo jamaicensis*), American crow (*Corvus brachyrhynchos*), cedar waxwing (*Bombycilla cedrorum*), and American goldfinch (*Carduelis tristis*) have both migratory and resident populations.

Waterfowl, Waterbirds, and Shorebirds - The tidal wetlands of the Connecticut River have the greatest concentrations of waterfowl during migration and winter periods and the greatest variety of waterfowl, shorebirds and waterbirds than any other wetland areas in the watershed. The tidal marshes are also particularly important to rails during migration. Species such as the black rail (*Laterallus jamaicensis*) are rare and found almost exclusively in high salt marshes at the mouth of the Connecticut River while species such as the great blue heron (*Ardea herodias*) forage in almost every type of shallow water open wetland including fresh, brackish and saltwater wetlands. Wood ducks (*Aix sponsa*) are ubiquitous nesters in the watershed requiring large tree cavities which are associated with freshwater forested or shrub wetlands. They especially favor beaver ponds with heavy forest cover. The common loon (*Gavia immer*) nests on small and large ponds and lakes from Quabbin Reservoir north and winters along the coast. During migration mud flats along the mainstem of the Connecticut River provide critical foraging habitat to several species of shorebirds such as the solitary sandpiper (*Tringa solitaria*) and lesser yellowlegs (*Tringa flavipes*).

Black ducks (*Anas rubripes*) are a species of special management concern to the Fish and Wildlife Service due to their declining numbers over the past 30 years and are specifically mentioned by the Conte Act. Black ducks nest in low density throughout the watershed. Nesting habitat encompasses the full range of upland and lowland habitats (Kirby 1988). The northern third of the watershed, however, provides more critical nesting habitat because mallards (*Anas platyrhynchos*) are generally absent as breeders and therefore black ducks are less subject to the serious hybridization problems. The tidal wetlands of the lower Connecticut River are particularly important as stopover habitat during migration and as wintering habitat for thousands of black ducks (Merola and Chasko 1989).

Passerines and raptors - Within the watershed the White Mountains to the east, Green Mountains to the west and the Berkshire hills to the south provide the northern hardwood/spruce forest breeding habitat required by neotropical migrants and residents. Species dependent on this type of habitat include the black-throated blue warbler (*Dendroica caerulescens*), black-throated green warbler (*Dendroica virens*), American



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redstart (*Setophaga ruticilla*), least flycatcher (*Empidonax minimus*), grey-cheeked thrush (*Catharus minimus*), veery (*Catharus fuscescens*), pileated woodpecker (*Dryocopus pileatus*), and northern goshawk (*Accipiter gentilis*). The spruce grouse (*Dendragapus canadensis*), an inhabitant of northern coniferous forests, is a species of special management concern due to declining populations in the eastern part of its range. The only known viable population within the watershed occurs in the Nulhegan Basin of northern Vermont although there are other recent sightings and historic sites.

A number of birds associated with old fields, pastures and grasslands are declining in New England and are of special concern (Vickery 1992). Grasshopper sparrows (*Ammodramus savannarum*), Vesper sparrow (*Pooecetes gramineus*), and upland sandpipers (*Bartramia longicauda*) are grassland species particularly in trouble (Jones and Vickery 1993). Westover Air Reserve Base in Chicopee, Massachusetts hosts the most important populations of grasshopper sparrows and upland sandpipers in the watershed. The Connecticut River valley in Massachusetts provides the greatest potential for grassland habitat restoration in the watershed. As New England becomes increasingly forested and urbanized these species will be increasingly limited by available habitat.

The Connecticut River valley is a major corridor for raptor migration. Mt Tom in Massachusetts is a particularly well know site to observe raptor migrants in the fall. On certain days when strong fronts follow periods of bad weather thousands of broad-winged hawk (*Buteo platypterus*) can be observed. At least a dozen other raptor species including sharp-shinned hawks (*Accipiter gentilis*), American kestrels (*Falco sparverius*), merlins (*Falco columbarius*), red-shouldered hawks (*Buteo lineatus*) and osprey (*Pandion haliaetus*) are common migrants.

Area-sensitive Species

While not specifically mentioned in the purposes of the act, these species are currently being lost in the watershed due to human activities or can only be retained in the watershed by human intervention. In Chapter Four there is a discussion of how each alternative would affect these species.

All species have requirements for minimum size of habitat necessary to carry out their life cycles or specific parts of their life cycles. Some species are particularly sensitive to fragmentation of their habitat and require large expanses of grassland or woodland habitat of a particular successional stage to successfully reproduce or avoid high predation rates. Grassland bird species and a number of forest breeding birds referred to as forest interior birds fall within this category. Another species that is particularly sensitive to habitat fragmentation is the timber rattlesnake. Large expanses of protected forest habitat such as occur in the White Mountain National Forest, New Hampshire; Nash Stream, New Hampshire; Quabbin Reservoir, Massachusetts; and Barkhamsted Reservoir, Connecticut, are particularly important to forest interior birds. Similarly, large expanses of grassland habitat at Westover Air Reserve Base are crucial for grasshopper sparrow and upland





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sandpiper populations in the watershed. Preventing the further fragmentation of the Meshomasic Highlands area in Connecticut is critical to maintaining the long term viability of the timber rattlesnake population in the watershed.

Reptiles

One of the most imperiled vertebrate species in New England is the timber rattlesnake (*Crotalus h. horridus*). This snake is an inhabitant of deciduous forests but it also requires rock ledges or outcroppings with southerly exposures for winter denning. There are nine known timber rattlesnake den sites within the watershed in Massachusetts and Connecticut, the majority of which have been severely impacted by development, collecting or persecution.

A nonvenomous snake which is common throughout most of the watershed is the northern watersnake (*Nerodia s. sipedon*), an inhabitant of ponds, stream, and freshwater marsh edges. The painted turtle (*Chrysemys picta*) is probably the most ubiquitous turtle and the most frequently seen basking turtle in ponds, oxbows, and other quiet shallow bodies of water. The northern diamondback terrapin (*Malaclemys t. terrapin*), an estuarine species, is restricted to the tidal creeks and bays at the mouth of the Connecticut River. It may also nest on some of the sandy spoil islands. The eastern box turtle (*Terrepenne c. carolina*) is the only completely terrestrial species within the watershed and is a resident of woodlands, field edges and well drained forest bottomlands.

Amphibians

The redback salamander (*Plethodon cinereus*), probably the most widespread and abundant salamander within the watershed, is a small woodland salamander with a completely terrestrial life history. It inhabits deciduous or mixed conifer-deciduous forests residing beneath wet leaf litter, within or beneath logs or other retreats. The mudpuppy (*Necturus m. maculosus*) is the only completely aquatic species within the watershed and occurs primarily in the mainstem Connecticut River and immediate tributaries from Massachusetts to central Connecticut. The northern spring peeper (*Pseudacris c. crucifer*) is a diminutive woodland frog widely distributed throughout the watershed. It is the earliest frog to call in the spring and found breeding in a variety of wetlands including woodland swamps and ponds, vernal pools, and roadside ditches. The rarest frog in the watershed is the eastern spadefoot toad (*Scaphiopus h. holbrookii*). This burrowing frog is associated with sandy, well drained soils and open forest or sparse shrub or fields. It is an explosive breeder following heavy rains and lays its eggs in temporary rain filled pools. There are six known breeding sites in the watershed.

Fishes

Overview

The Connecticut River watershed supports a diversity of fishery resources. Cold-, cool- and warmwater species are in general abundance throughout the watershed. The



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watershed did not historically support as diverse a group of fishes as it does presently: many of the species considered resident were introduced. Original flowing habitats of the river and many of its tributaries were impounded and polluted. Many lakes, ponds, and wetlands were also degraded. The creation of habitats and the degradation of others resulted in native species declines and exotic species introductions.

There are 142 fish species found within the watershed. Native or indigenous freshwater species account for 33 fish; non-indigenous freshwater fish, 35; anadromous fish, 10; catadromous fish, 1; amphidromous fish, 15; and, saltwater fish, 48. Indigenous freshwater fish are with few exceptions generally found throughout the watershed. Anadromous fish are primarily found in the lower reaches of the watershed. Saltwater species generally occur within Long Island Sound and amphidromous species are found in the lower reach of the Connecticut River and its tributaries.

The northern reaches of the river provide habitat for lake and brook trout and land-locked salmon. The mid-section of the river supports pickerel, largemouth and smallmouth bass, northern and walleyed pike, and a variety of panfish. Summer flounder and striped bass are found at the mouth of the river. Carp, suckers, eels and catfish are present in many areas. Populations of Atlantic salmon and American shad are gradually being restored to the river.

Anadromous fish - Atlantic salmon, American shad, shortnose sturgeon and river herring are all specifically mentioned in the purposes of the Conte Act. In addition, they are a responsibility of the Fish and Wildlife Service.

Anadromous fish returning to the Connecticut River formerly consisted of large numbers of Atlantic salmon, (*Salmo salar*), American shad (*Alosa sapadissima*), alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), and lesser numbers of Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*Acipenser brevirostrum*), rainbow smelt (*Osmerus mordax*), striped bass (*Morone saxatilis*), sea lamprey (*Petromyzon marinus*), and gizzard shad (*Dorosoma cepedianum*). Anadromous fish life histories are described by Scarola (1987); Corps of Engineers (1974); and Scott and Crossman (1973). Atlantic salmon, American shad, blueback herring, sea lamprey and alewife ascended far upriver and into most, if not all, of the tributaries to spawn. American shad ascended the river to Bellows Falls, Vermont and Atlantic salmon reached the vicinity of Beecher Falls, Vermont.

Early settlers harvested large amounts of anadromous fish. Dams blocked return runs and prevented the fish from reaching the spawning grounds. Since the late 1700's there has been a steady decline in anadromous fish as result of dam construction and water degradation. Recognition of the devastation to the anadromous fish populations was quickly apparent to the inhabitants of the river valley upon completion of the dams. Anadromous fish returns above dams ended and steadily and dramatically declined below





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the Holyoke Dam, the lowermost impassable dam on the mainstem of the Connecticut River.

Two early (1873 and 1940) attempts to provide fish passage at the Holyoke Dam, Massachusetts failed, then in 1955 an elevator⁷ type fishway was constructed and was successful in passing a portion of the remnant population of American shad and blueback herring. Atlantic salmon had been extirpated from the watershed by this time as a result of inadequate spawning and juvenile rearing habitat. Atlantic salmon generally utilize the tributaries for spawning, although suitable habitat in the river will be utilized as well. American shad are broadcast spawners utilizing the river and larger tributaries for spawning. Blueback herring utilize the river and tributaries while alewives utilize the smaller tributaries, upper sections of larger tributaries and coves for spawning. Rainbow smelt spawn in the tributaries and coves.

The enactment of the Anadromous Fish Conservation Act in 1965 provided the states and federal agencies with the means to initiate anadromous fish enhancement and restoration programs within the watershed. The Atlantic salmon and American shad restoration programs are now being administered by the Connecticut River Atlantic Salmon Commission. Information on the Atlantic salmon restoration program within the watershed is provided in the Final Environmental Impact Statement, 1989-2021: Restoration of Atlantic Salmon to New England Rivers (U.S. Fish and Wildlife Service 1988) and A Strategic Plan For The Restoration Of Atlantic Salmon To The Connecticut River watershed (Stolte 1980 and 1982). Fish passage requirements for the Atlantic salmon restoration program are addressed in these documents. The strategic planning document is being updated (John O'Leary, Chair, Connecticut River Atlantic Salmon Commission Technical Committee personal communication) based on the progress made in providing fish passage and information acquired as a result of past and on-going efforts. The Atlantic salmon Final Environmental Impact Statement and Strategic Plan are sources of additional information on fishes within the watershed. Additionally, a planning document for American shad within the watershed has been endorsed by the Connecticut River Atlantic Salmon Commission (1992).

Shortnose sturgeon within the Connecticut River were thought to be extirpated until vestigial populations were located. It occurs in low numbers in the reaches of the river southward of the Turners Falls Dam, Turners Falls, Massachusetts. Recovery of the shortnose sturgeon is being undertaken cooperatively among the federal and state fishery agencies. Important spawning, feeding and loafing/resting areas utilized by the sturgeon are being identified. A shortnose sturgeon recovery plan is nearing the final stages of preparation and will address the protection of this species (Kynard personal communication).





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The remaining anadromous fish occurring in the Connecticut River with the exceptions of the blueback herring and sea lamprey are not found as far upriver in the watershed. Blueback herring and sea lamprey utilize many of the major tributaries to the Connecticut River for spawning. The blueback herring is a prolific fish that can ascend the river as far northward as the American shad. Blueback herring and sea lamprey presently migrate into the Vernon Pool passing through the Vernon Dam fishway, Vernon, Vermont. Blueback herring and sea lamprey are abundant within the watershed. Alewife, similar in appearance to the blueback herring, occur in the lower reaches of the Connecticut River. Alewives migrate upriver to the vicinity of the Enfield Dam. Gizzard shad a relatively recently observed anadromous species found within the Connecticut River has been observed in limited numbers in the fishlift at the Holyoke Dam, Holyoke, Massachusetts. Gizzard shad may occur in greater abundance in the river's reach below the Holyoke Dam. Striped bass have also been observed in limited number in the fishlift at the Holyoke Dam. A sport fishery has developed since 1990 in the rapids area below the Enfield Dam. Although both sexually mature male and large female (up to 42 inches) striped bass have been collected in this area by federal and state biologists (Savoy, personal communication), aggregations of striped bass are thought to be present for feeding purposes rather than spawning. Merriman and Thorpe (1976), found no evidence of striped bass spawning in the Connecticut River during a five year investigation of fish eggs and larvae in the lower river. Investigations undertaken by graduate students from the University of Massachusetts, Massachusetts Cooperative Fish and Wildlife Research Unit, on striped bass in the vicinity of the mouth of the river suggest that striped bass occur in relative abundance in that area (Schulze and Mather 1994). Rainbow smelt are reported in the lower river. The size of the population and the utilization of spawning areas is not well known. There is a limited fishery for this species. Occasional collections of rainbow smelt have been made incidental to the catch of other species during sampling (Savoy personal communication). Insufficient information is available on the Atlantic sturgeon population utilizing the Connecticut River: The information that exists, however, suggests that immature Atlantic sturgeon utilize the river during the summer months (Savoy 1991).

The populations of American shad and blueback herring within the Connecticut River increased from 1955, when the fishlift was installed at the Holyoke Dam, to 1992. The populations of these species, specifically American shad have declined dramatically in the past two years as evidenced by the number of shad and herring passing through the Holyoke Dam fishlift. The decline seen in 1993 and 1994 were especially surprising given the moderate to high numbers of returning adults were expected based on strong juvenile production throughout the late 1980's. The reason(s) for the population declines remain unknown, although, preliminary analyses indicate that elevated mortality rates of clupeids are associated with increased abundance of striped bass (Savoy personal communication).





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Catadromous Fish - The American eel (*Anguilla rostrata*) is the only catadromous fish (reverse of anadromous, i.e., living in freshwater and going to the sea to spawn). Life history information for the American eel is presented in (Stone et al. 1994; Corps of Engineers 1974; Scott and Grossman 1973; Bigelow and Schroeder 1953). American eel are ubiquitous throughout the watershed with greatest abundance being found lower in the watershed and decreasing northward. It is rarely observed in the watershed above the confluence with the White River, Vermont. This species is thought to be declining throughout its range. Information from commercial fisherman (for this species) in the lower reaches (Savoy personal communication) appear to substantiate this concern.

Amphidromous Fish - Amphidromous fish are those fish that utilize the estuary of the Connecticut River and the marine environment of Long Island Sound. Fifteen amphidromous fish species occur in this classification. The most commonly recognized species in this category are: white perch (*Morone americana*), mullets (*Mugil spp.*) and killifishes (*Fundulus spp.*).

Resident Species - Resident species of fishes may be considered in two categories:

indigenous (native) and non⁷ indigenous (introduced). The distribution of fish species in the watershed is strongly correlated to temperature regimes. In the northern part of the watershed and in the mountainous tributary streams are found the cool and coldwater fishes e.g., trout, sculpin, burbot (cusk) and salmon. In the southern part of the watershed, the lower reaches of the main tributaries and the impounded areas of the mainstem where warmwaters occur, the basses, pickerels, horned pout (bullhead) and perch are found. Forage fishes are abundant in the mainstem of the river and in the larger tributaries and include blacknose dace (*Rhinichthys atratulus*), spottail shiner (*Notropis hudsonius*), fallfish (*Semotilus corporalis*), white or common sucker (*Catostomus commersoni*) and common shiner (*Notropis cornutus*). There are 33 native species in addition to the anadromous fish discussed previously. These species are normally distributed throughout the watershed in cool-, cold- and warmwater ponds, lakes and streams.

Non-indigenous species are fishes that were introduced into the watershed as a result of human activity. Many species identified in this category are often thought of as "natives". Notable examples are the rainbow (*Oncorhynchus mykiss*) and brown (*Salmo trutta*) trouts, smallmouth (*Micropterus dolomieu*) and largemouth (*Micropterus salmoides*) basses, walleyed pike (*Stizostedion vitreum vitreum*), carp (*Cyprinus carpio*), blue gill (*Lepomis macrochirus*), and northern pike (*Esox lucius*).

Indigenous fishes in Vermont and New Hampshire - The 10 most abundant indigenous species within the New Hampshire⁷ Vermont reach of the watershed are: blacknose dace, white sucker, common shiner (*Notropis cornutus*), brook trout, fallfish, longnose dace



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(*Rhinichthys cataractae*), chain pickerel (*Esox niger*), yellow perch (*Perca flavescens*), slimy sculpin (*Cottus cognatus*), and creek chub (*Semotilus atromaculatus*) (Bailey and Oliver 1939). Other indigenous species found commonly in this section of the watershed are: longnose dace, longnose sucker (*Catostomus catostomus*), American eel, redbreast sunfish (*Lepomis auritus*), northern redbelly dace (*Phoxinus eos*) and tessellated darter (*Etheostoma olmstedii*). The American eel are rarely observed in the upper watershed above the White River.

Indigenous species found predominantly in the lower section of this reach are: spottail shiner, eastern silvery minnow (*Hybognathus regius*), pumpkinseed (*Lepomis gibbosus*), redbreast sunfish, banded sunfish (*Enneacanthus obesus*), and the yellow perch (Bailey and Oliver 1939). Bailey and Oliver (1939), also reported that three indigenous species, namely, golden shiner (*Notemigonus crysoleucas*), brown bullhead (*Ameiurus nebulosus*), and creek chubsucker abundant in the southern section of the reach were scarce in the northern waters of the reach. Conversely, they (Bailey and Oliver 1939) reported that seven native northern species were infrequently found in the southern section of the reach. These are: round whitefish (*Prosopium cylindraceum*), lake trout (*Salvelinus namaycush*), longnose sucker (*Catostomus catostomus*), northern redbelly dace (*Phoxinus eos*), finescale dace (*Phoxinus neogaeus*), lake chub, and burbot (*Lota lota*).

Atlantic salmon, American shad, shortnose sturgeon, and Sunapee trout (*Salvelinus aureolus*) were extirpated from the northern reach of the watershed: the anadromous fish, because of damming the river and the trout because of over exploitation and introductions. Sea-run Atlantic salmon, American shad and blueback herring populations have ongoing restoration and/or enhancement programs. Round whitefish numbers are seriously reduced because of over exploitation and habitat loss due to water quality degradation.

Many of the dams within the tributaries of this reach are discussed in the planning document for the Atlantic salmon restoration program. The mainstem hydroelectric dams up to and including the Rygate Dam presently have fish passage facilities as part of their operating license agreement. Blueback herring utilize the river (below Bellows Falls Dam) for spawning and juvenile nursery habitat. American shad and sea lamprey have been passed into the Bellows Falls pool.

Connecticut, Vermont and New Hampshire do not have any endangered fish species listed that are found within the watershed.

Vermont and New Hampshire do not have any state-listed endangered fish species that are found within the watershed.

Indigenous fishes in Massachusetts





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The native fishes found in this reach are typical of those in the lower reaches of the lower Vermont-New Hampshire reach. These are: brook trout; blacknose and longnose dace; white sucker; fallfish; creek chub; slimy sculpin; and, common shiner. Species distribution as was previously mentioned is closely correlated to temperature regimes. Many of the native species found in the mainstem of the Connecticut River (see below) are also found in the tributaries, but to a much lesser degree.

Many of the dams within the tributaries of this reach are discussed in the strategic planning document for the Atlantic salmon restoration program. The two mainstem dams presently have both up-river and down-river fish passage facilities. American shad, blueback herring, shortnose sturgeon and sea lamprey utilize this reach for spawning and juvenile nursery habitat.

Native species found in the mainstem include: the endangered shortnose sturgeon; American eel; white sucker; pumpkinseed; yellow perch; chain and redbfin pickerel; brown bullhead; white perch; spottail shiner; fallfish; and, common shiner.

There are three fish species listed as endangered in Massachusetts, the shortnose sturgeon (*Acipenser brevirostrum*), the lake chub (*Cousesius plumbeus*) and the northern redbelly dace (*Phoxinus eos*): they are on the southern periphery of their range and are present and unlisted in Vermont and New Hampshire.

Indigenous fishes in Connecticut - The lower reach of the river extends from the Massachusetts-Connecticut border to Long Island Sound. The number of fish species utilizing this reach is far greater than for any other reach. The reason being that in addition to the resident indigenous and non⁷ indigenous species, the full compliment of anadromous, amphidromous and saltwater species listed for the watershed also occur within this reach. The native fishes found in the tributaries of this reach are typical of those in the central reach tributaries in Massachusetts. These are: brook trout; blacknose and longnose dace; white sucker; fallfish; creek chub; and, common shiner. Many of the native species found in the mainstem of the Connecticut River (see below) are also found in the tributaries, but to a lesser degree.

Native species found in the mainstem include: the endangered shortnose sturgeon; American eel; white sucker; pumpkinseed; yellow perch; chain and redbfin pickerel; brown bullhead; white catfish; white perch; spottail shiner; fallfish; and, common shiner. The composition and relative seasonal abundance of fish species occurring in the Connecticut River between Higganum and Essex was surveyed intensively for the years 1965-1972 (Merriman and Thorpe 1976). The data from Merriman and Thorpe (1976), identifies 50 fish species and discusses in detail seasonal abundance and distribution. They indicated that 65% of the resident fish biomass consisted of the following fishes:





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white perch, brown bullhead, white catfish, yellow perch and American eel. Seasonally, large numbers of American shad, blueback herring and alewives were present.

There are numerous low-head dams in the tributary streams in the Connecticut portion of the watershed. Many of these dams may be made passable to anadromous fish.

Connecticut does not have any state-listed endangered fish species except the shortnose sturgeon (*Acipenser brevirostrum*) and Atlantic sturgeon (*Acipenser oxyrinchus*) that are found within the watershed.

Non-indigenous Species – Non-indigenous fish species are generally found throughout the length of the Connecticut River and in the lower reaches of many of the tributaries.. Many species were introduced in an effort to provide recreational fisheries. Native species populations were reduced because of exploitation, habitat loss and water quality degradation. Agricultural practices including forestry and dairy and truck farms, damming for industry, and industrial discharges resulted in altered habitat and water quality conditions that were better suited for non¹ indigenous species.

Invertebrates

Invertebrates are the most diverse and abundant group of animals within the watershed. A conservative estimate of the number of described species would be 1,500 (D. Smith personal communication). These range from familiar insects such as butterflies, bees and beetles to more obscure species of invertebrates such as clam shrimp and bryozoans. Perhaps the rarest species in the watershed is Faxon's clam shrimp (*Eulimnadia agassizii*). This species is actually a crustacean which is less than one-half inch long and enclosed by a chitinous clamlike shell. Its only known location in the world is a vernal pool in Massachusetts west of the Connecticut River.

Plants

There are roughly 3,000 plant species in the watershed area. Based on figures for Massachusetts, roughly 35% of the plants are not native to the area (Bickford and Dymon 1990).

