Description of the Basin

The Lake Champlain Basin covers 8,234 square miles in New York, Vermont, and Quebec, about 3,015 square miles (37%) of which lie within New York State (NYS). The New York portion of the Basin is composed of land areas that drain into Lake Champlain and that are located within Essex, Clinton, Franklin, Warren, and Washington counties. There are about 5,400 miles of mapped rivers and streams in the New York portion of the Basin (USGS Watershed Index). Some of the major water bodies include Chazy Lake and the Great Chazy River (Clinton County) in the northern part of the Basin, the Ausable River (Essex County), Saranac River (Clinton, Essex, Franklin counties), Lake Placid (Essex County), and the Saranac Lake Complex (Upper, Middle, and Lower; Franklin County) in the north-central part of the Basin, and Lake George (Warren County) in the southern part of the Basin. The largest and most significant water body, of course, is Lake Champlain. The Lake is 435 mi^2 in total surface area, 120 miles long, flowing north from Whitehall, New York (Washington County) to the Richelieu River in Quebec, and has 587 miles of total shoreline (Lake Champlain Basin Program, 2002). The Lake consists of five distinct segments, two of which are in New York State: the main lake and the south lake. The main lake consists of the vast majority of the Lake (primarily Clinton and Essex counties) and contains its widest and deepest points. The narrower, river-like south lake extends from lower Essex County southward, with the NYS portion largely restricted to South Bay in Washington County.

Lake Champlain, the sixth largest natural lake in the United States (only the five Great Lakes are larger), was formed about 12,000 years ago as the last glacial period came to an end and the retreating glaciers left behind a large body of freshwater which included the Great Lakes, Lake Champlain, and much of the St. Lawrence River Valley (Lake Champlain Research Consortium, 2004). The Lake has supported the human inhabitants of the Basin since that time; from the Native Americans who hunted, fished, and farmed there, to the European settlers who came after Samuel de Champlain explored the Lake in 1609, and finally modern-day New Yorkers who derive economic, recreational, and cultural benefits in the form of drinking water, agriculture, fishing, hunting, trapping, boating, and wildlife viewing. Lake Champlain provides critical fish and wildlife habitat such as nursery and spawning grounds for a diverse array of fish species, it functions as an important migratory corridor for passerine birds, raptors, and waterfowl, and it contains marshes teeming with biodiversity.

The second largest lake in the Basin is Lake George (Warren and Essex counties). Lake George lies within Lake George Park, a 300 mi^2 area of public and private land lying wholly within the Adirondack Park. Lake George Park is comprised of about 100 square miles of State-owned land, primarily “forever wild” forest preserve, 155 square miles of privately-owned land, and 45 square miles of water surface, of which about 44 square miles is the surface of Lake George. There are about 115 streams flowing into Lake George. The health of the lake and that of the people, fish, and wildlife that depend upon it, is largely a reflection of the quality of these tributary streams. The Lake and its tributaries provide drinking water, recreation, and aesthetic and cultural benefits to people, and provide invaluable habitat to several fish and wildlife species including land-locked Atlantic salmon, native mussels, and odonates.

From a terrestrial perspective, the Lake Champlain Basin is comprised of three ecoregions (as defined by The Nature Conservancy). The majority of the watershed is classified as Northern Appalachian Boreal Forest, and is made up primarily of the Adirondack Mountains. The St. Lawrence/Champlain Valley ecoregion defines the area from northern Clinton County, along Lake Champlain, southward through the northern tip of Washington County. The Lower New England/Northern Piedmont ecoregion comprises the smallest part of the Basin: the northern extent of the Hudson River Valley and the Taconic Highlands in Washington County. About 3/4 of the Lake Champlain Basin falls within the Adirondack Park boundary (southeastern Franklin County, the southwestern two-thirds of Clinton County, all of Essex County, northeastern Warren County, and northwestern Washington County). The remaining 1/4 of the region outside the boundary includes the relatively open habitats of eastern Clinton County and central Washington County, and the relatively forested northern extent of the Taconic Highlands of northeastern Washington County.

With about 230,000 people and a mean population density of 75 people per square mile, the Lake Champlain Basin is among the least populated in the State (US Census Bureau, 2002). There are two main population centers in the Basin: Plattsburgh (population 19,156; Clinton County) and Glens Falls (population 14,194; Warren County; US Census Bureau, 2002). The majority of the human population in this Basin is condensed within the Champlain Valley (eastern Clinton County through northern Washington County), with additional significant concentrations of residents within the Village of Lake Placid (Essex County) and Village of Saranac Lake (Essex and Franklin counties), and as a result, many of the threats to wildlife and their habitats also occur there. However, despite these stresses, the Lake Champlain Basin remains a relatively healthy area, ecologically speaking, with a diverse array of habitats. Habitat types range from the extensive hardwood and boreal forest and wetland systems of the Adirondacks to the agricultural, marsh, and low elevation forested habitats of the Champlain Valley.

The predominant habitat type within the watershed is forest (about 75%), including deciduous, coniferous, and mixed forest habitats (Lake Champlain Figure 1, Lake Champlain Table 1). Anthropogenic uses dominate about 14% of the Basin (Lake Champlain Figure 1, Lake Champlain Table 1). This includes agriculture (row crops 8%, pasture, and hay land 4%), residential and commercial/industrial development (2%), lawns and golf courses (0.2%), and barren areas (quarries, strip mines, gravel pits 0.1%). About 8% of the remaining land cover is classified as open water (primarily the Lake itself), and 2% is classified as emergent wetlands and wooded wetlands (Lake Champlain Figure 1, Lake Champlain Table 1). These habitats accommodate 106 Species of Greatest Conservation Need (SGCN; Lake Champlain Table 2). This is about 20% of the 537 species designated as SGCN in New York State (Lake Champlain Table 3), and includes 53 bird species, 18 insect species, 17 amphibian and reptile species, 7 freshwater fish species, 6 mammal species, 4 mollusk species, and 1 species of marine fish. There are 21 species that historically occurred in the Basin, but are now believed to be extirpated (Lake Champlain Table 4).

Critical Habitats of the Basin and the Species That Use Them

Species of Greatest Conservation Need (SGCN) within the Lake Champlain Basin occupy a landscape mosaic of interconnected terrestrial and aquatic habitats. The mineral-rich bedrock and soils of this region support communities high in plant and animal diversity. Emergent marshes, bogs and fens, clayplain forests, boreal forests and wetlands, floodplain forests, maple-ash swamps, hardwood-cedar swamps, pine-oak-heath sandplain forests, and large lake systems are some of the critical habitats found in this Basin.

Forested Habitats

Forested habitats dominate the Lake Champlain Basin, and range from lowland deciduous, coniferous, and mixed forests to the boreal forests of the higher elevations of the Adirondacks. For the purposes of this document, the forested habitats will be broken up into three general regions: the Adirondack Mountains, the Champlain Valley, and the Taconic Highlands.

The six-million acre matrix of public and private lands of the Adirondack Park is comprised of some of the largest, intact stretches of forest (including some first growth) in the State including alpine/boreal forest communities. Predominant vegetation types in this region are beech-maple forest, hemlock-northern hardwood forest, and spruce-fir forests. These habitats support wide-ranging mammals such as marten and fisher, early successional birds such as Canada warbler, raptors such as long-eared owl, northern harrier, and peregrine falcon, and forest interior birds such as wood warblers and various thrushes. Abandoned mines and natural caves provide bat habitat and support listed species such as the Indiana bat. Alpine tundra ecosystems exist on several of the Basin's highest mountain peaks such as Mt. Marcy (the State's highest peak) and Whiteface Mountain. These areas are characterized by shrubs, herbs, mosses and lichens. The plant communities of the alpine zone have survived in these isolated and exposed habitats since the end of the last glacial period.

A critical habitat type of the Adirondacks is the lowland boreal system. This is an area of moderately low diversity in which the plants and animals are adapted to short summers and deep snow and in which songbirds, insects, and evergreens are common (Jenkins, in review). The Adirondacks are technically south of the true Boreal Zone, but still have extensive tracts of habitat characteristic of the southern edge of the true boreal and where northern animals and plants are subject to boreal processes (Jenkins, in review). Common forest vegetation types of the lowland boreal include conifer swamps and low bog forests. The largest corridors of boreal habitat are found in the northwest Adirondacks, but the eastern part of the Adirondacks located within the Lake Champlain Basin also contains many patches of isolated boreal vegetation (Jenkins, in review). Some of these patches are large, but most are a couple of hundred acres or less (Jenkins, in review). Despite this, they are a significant habitat feature and contain significant populations of northern plants such as black spruce, white spruce, dwarf cranberry, bog aster, and various sedges, and northern animals such as spruce grouse, Bicknell's thrush, and bay-breasted warbler (Jenkins, in review).

The transitional lowland forests of the Champlain Valley lie between the boreal forests and the broadleaf deciduous zone. The Champlain Valley also represents the northern extent of the range of many tree species such as shagbark hickory, red and white oak, and hop hornbeam. The forested habitats found here are relatively intact compared to other forested habitats in New York State and the Great Lakes region, but due largely to anthropogenic causes are more fragmented than the extensive forests of the Adirondacks. These forests are characterized by conifers such as hemlock and pine, and deciduous species such as birch, beech, maple, and to a lesser extent, oak. The area is a mosaic of deciduous stands in locations with good soils (lower elevations in the base of the Valley). These habitats support species such as timber rattlesnakes, common five-lined skink, a variety of raptors including peregrine falcons, and migratory and breeding birds such Canada warbler and American woodcock. Forests in the Champlain Valley dominated by conifers tend to be located in less favorable habitats with poorer soils. These coniferous habitats include transitional areas between the mountains of the Adirondacks and the Champlain Valley, and unique areas like the Clintonville Pine Barrens and the Gadway Sandstone Pavement Barrens Preserve (Adirondack Nature Conservancy parcels in Clinton County). These tracts are pitch pine-heath and jack pine barrens established on lands scoured by the retreating glacier 12,000 years ago and support rare insects such as the pine pinion moth and the Acadian swordgrass moth. Clintonville barren is dominated by pitch pine. This site has deep sandy soils and sand dunes created when melt water emptied into glacial Vermont. Gadway is dominated by jack pine. This site is on sandstone pavement (very shallow soil). The pavement was created when a tremendous flood of glacial melt water scoured the surface material and exposed bedrock. The largest stands of jack pine in northeastern New York are owned by the W. H. Miner Agricultural Research Institute. This barren is known as the Altona Flat Rock. It is also a sandstone pavement barren. Fire has been the predominant ecological factor regenerating and structuring the barrens at Clintonville, Gadway and Altona Flat Rock.

The Taconic Mountains in the southeastern part of the Basin encompass large areas of contiguous, high quality, northern hardwood forest, and it serves as a recharge area for numerous rich fens in the lower Hudson Valley. The far northern extent of this region in northeastern Washington County contains a diverse mix of wetland and upland communities including spruce-fir swamp, hemlock-northern hardwood forest, and spruce flats. The large, contiguous nature of this area provides habitat for forest-interior bird species and large mammals (e.g., fisher, river otter). Important habitats in the Taconics include hemlock-northern hardwood forest and Appalachian oak-hickory forest. This area supports a diverse population of resident and migratory bird species as wintering and breeding habitat, and as a migratory corridor for passerine birds and raptors. Rare reptile species found here include timber rattlesnake.

Wetland and Other Aquatic Habitats

Much of the wetland and other aquatic habitat in the Basin is embedded in a forested matrix and is distributed throughout the Basin. The following descriptions attempt to provide a general feel for the wetlands and other aquatic habitats in the watershed.

More than 300,000 acres of wetlands can be found in the Lake Champlain Basin (NYS and Vermont portions). Estimates from New York National Wetland

Inventory (NWI) maps indicate that there may be over 200,000 acres in the New York portion of the Basin. Wetland types found here include bogs (characterized by sphagnum mosses), wooded swamp/bottomland forest (mature trees including cedar, red maple, silver maple, and black ash), shrub swamp (woody shrubs such as speckled alder and various species of willow and dogwoods), emergent marsh (frequently or continually flooded wetlands with plants such as cattails and rushes), wet meadows (seasonal wetlands with grasses and sedges), and vernal pools (seasonal/temporary ponds or wetlands often associated with wooded habitats). In the Lake Champlain Basin a number of wetland types and plant communities are uncommon. Bogs, fens, alpine peatlands, cedar swamps, and black gum swamps are all examples of rare wetland plant communities. Lake Champlain Basin wetlands are located on the Atlantic flyway, a migratory corridor for waterfowl and other birds. They provide critical resting and feeding sites during fall and spring migration. Certain fish species in Lake Champlain, such as the northern pike, require wetlands as spawning grounds and as nursery areas for their young. Amphibian and reptiles such as western chorus frog, blue-spotted salamanders, and Jefferson salamanders rely on these habitats year round. Excellent examples of wetland habitat can be seen at the Lake Champlain Marshes Bird Conservation Area (BCA). This BCA includes six Wildlife Management Areas (Kings Bay, Montys Bay, Wickham Marsh, Ausable Marsh, Putts Creek, East Bay) from near the Canadian border to the southern tip of the Lake, and includes large emergent marshes, forested swamps, and shrub swamps (as well as adjacent upland habitats).

Over 1/3 of New York State's wetlands are found in the Adirondacks, and wetland types include spruce-fir swamp, shallow emergent marsh, sedge meadow, and boreal wetlands. This region also has unique habitats such as the ice meadows found along the Hudson River and vernal pools dotted across the landscape. These habitats support wetland birds such as American bittern, least bittern, and pied-billed grebe. Marsh and vernal pool habitats also support herpetofauna such as blue-spotted and Jefferson salamanders. The ponds and lakes in the Adirondacks provide habitat for rare fish species such as round whitefish, reptiles such as the wood turtle, foraging sites for raptors such as osprey, and are the stronghold for nesting common loons in the State. As discussed above, wetlands of the lowland boreal system found in the Adirondacks are a significant habitat feature and contain significant populations of wetland-dependent northern plants and animals. Common vegetation types of the lowland boreal include conifer swamps, low bog forests, open sphagnum bogs, tall-shrub swamps, and shrub-sedge meadows.

The southeastern portion of the Basin is characterized by the ridges and valleys of the northern Taconic Highlands. This area contains high quality habitat for wetland-dependent species. Important habitats include red maple-hardwood swamp, floodplain forest, and vernal pools. All are of regional importance to breeding and migratory birds, resident herps, and rare plant communities. Where wetland complexes are still relatively intact, species that require large, contiguous areas of undisturbed wetland habitats such as wood turtle can be found. Other rare wildlife found here includes sedge wren, American bittern, Jefferson salamander, and blue-spotted salamander.

Of the roughly 5,000 miles of rivers and streams and 235 significant lakes, ponds and reservoirs in the Basin, Lake Champlain is the dominant feature of the

watershed, covering about 5% of the entire Basin and accounting for 61% of the total lake acres. The Lake provides habitat for 81 species of fish including lake sturgeon, eastern sand darter, mooneye, and lake whitefish. The Adirondack region contains an estimated 2,800 ponds and lakes (both within and outside the Basin), miles of pristine headwater streams, and several large river systems. Other significant aquatic lake habitats within the Basin include Lake George, Lake Placid, and Saranac Lake (Upper, Middle and Lower). Large river systems include the Great Chazy River, Saranac River, and Ausable River (both East and West branches). These aquatic habitats provide spawning habitat for fish, breeding, feeding, and migratory stopover sites for birds, and support a diverse array of amphibians, reptiles, and invertebrates.

Grassland Habitats

Conservationists often think of areas in the St. Lawrence Valley and the Lake Plains when considering management actions for grassland-dependent wildlife in New York State; however, the Lake Champlain Basin contains natural and human-created (i.e., pasture, hay land) grassland habitats that support grassland species of conservation concern. Work done by DEC and New York Natural Heritage Program for the Grassland Reserve Program (USDA Farm Bill) indicate that there are significant grassland habitats and associated plant and animal communities (e.g., butterflies, birds) in central Washington, eastern Essex, and northern and eastern Clinton counties. Two examples are the Fort Edward Grassland Important Bird Area (Audubon and other private landowners) in central Washington County and grasslands associated with the Kings Bay Wildlife Management Area in northeastern Clinton County. The Fort Edward grassland is important for grassland birds including northern harrier, upland sandpiper, and short-eared owl. The Kings Bay Wildlife Management Area historically contained nesting black terns, northern harriers, and other grassland nesters. Furthermore, areas with significant amounts of agriculture in the Champlain Valley (northeastern Clinton County) and the northern extent of the Hudson Valley (central Washington County) can provide habitat for grassland-dependent species, although agricultural practices incompatible with wildlife may reduce the value of these habitats.

Publicly Held or Designated Lands - Opportunities to Develop Conservation Partnerships

Many of the critical habitats in the basin have unique ecological (wildlife and plant communities, geological formations) or cultural (recreational, historical value) characteristics, and thus have been designated with some protective status by State agencies such as the Office of Parks, Recreation and Historic Preservation (OPRHP) and DEC. These areas include state parks, state forests (and unique areas), forest preserve (also wilderness area, wild forest, and primitive areas), wildlife management areas (WMA), and bird conservation areas (BCA), and total about 750,000 acres distributed throughout the Lake Champlain Basin. The majority of protected land is in large forest tracts (primarily wilderness areas, wild forests, and primitive areas) located in the Adirondack Park and in nearby state forests. Other critical tracts such as the Four Brothers Islands complex in Lake Champlain, an important colonial bird nesting area, is owned and managed by The Nature Conservancy. The Conservancy owns a number of important habitats within the Champlain Basin.

Lists of public land holdings areas have been provided here (Lake Champlain Table 5-8) to provide a spatial context (i.e., location and size) for these large pieces of habitat, and to recognize their importance in the implementation of the conservation recommendations that follow. The species and habitats found on these parcels provide an excellent opportunity for research, survey, and inventory efforts. Additionally, these areas, due to their protected status, can act as "ecobeakers", intact blocks of relatively healthy habitat where conservation partners can observe properly functioning ecological processes and gain insight into how to address conservation dilemmas in landscapes that have been heavily altered by human activity. Finally, these properties give public and private natural resource managers the chance to partner with the agency that administers the land to help deliver habitat and population management actions designed to benefit SGCN.

There are four state designated critical environmental areas (CEA) in the Basin, all of which are in Warren County (Lake Champlain Table 9). CEAs are traditionally designated by DEC to protect drinking water supplies (surface waters or ground water aquifers), but other government agencies may designate CEAs for reasons such as preservation of wetland habitat (Rush Pond), protection of a unique aquatic or geologic feature (Round Pond), and protection of natural resources (Lake George). As with the state parks, state forests, WMAs, and BCAs mentioned above, CEAs may be important areas to focus management actions. These actions can take the form of population and habitat surveys, land protection initiatives (e.g., conservation easements), or habitat management/restoration efforts, and offer an excellent opportunity to for local governments and land use groups to get involved.

These lists are not meant to be a comprehensive catalogue of all publicly held or designated lands in the Lake Champlain Basin. There are many parcels owned by local governments that provide benefits to SGCN (e.g., town parks, green belts), and there are many privately held parcels that have been designated as protected through perpetual conservation easements, fee acquisitions, and other methods (e.g., Audubon's Important Bird Areas). These private lands are usually acquired because of their unique biological character and/or highly imperiled status, and should not be overlooked during more targeted conservation planning efforts. Local land trusts such as the Adirondack Land Trust and the Lake Champlain Land Trust, and private groups such as The Nature Conservancy that own and/or administer these lands are important partners in the conservation of fish and wildlife species of concern.

Species of Greatest Conservation Need and their Critical Habitats

DEC staff members who compiled the SGCN information in the CWCS Planning Database were asked to indicate habitats associated with critical life stages and activities for those species. During the analysis for each basin, a listing of species occurring in the basin and the critical habitats associated with their life cycle at the system and sub-system level was extracted from the database (Lake Champlain Tables 10 and 11). The habitat classifications in the database were adapted from the New York Natural Heritage Program's *Ecological Communities of New York State, Second Edition* (Edinger, et al., 2002). In most cases the habitats were simplified from the many vegetation associations listed in the

community classifications. In the case of the Lacustrine and Riverine systems, the subsystems were modified to reflect the classifications most often used by DEC fisheries managers (e.g., cold water-shallow). These critical habitats are not a comprehensive listing of all habitat associations found in the basin, rather it is a subset of the habitats deemed critical to SGCN that occur in the basin.

Each of these systems and subsystems are further refined into a habitat category in the SWG species database and can be viewed in the taxa reports in Appendix A. The habitat categories are excluded here for the sake of simplicity, but were considered during the basin analysis. A complete listing of habitat types used in the preparation of the CWCS can also be found in the Appendix B.

Overall Trends in the Basin

Biodiversity Trends

The Lake Champlain Basin (NYS and Vermont) supports about 318 species of birds, 81 species of fish, 56 species of mammals, 21 species of amphibians, and 20 species of reptiles, a number of which are at the northern edge of their range (Lake Champlain Basin Program, 1999). This diversity is due, in part, to the diversity of habitat types seen here, from the alpine habitats of the Adirondack High Peaks to the aquatic habitats of Lake Champlain. New York Natural Heritage Program element occurrence records indicate that the Lake Champlain Basin is of critical importance to wildlife diversity in New York State. Almost half of all birds of greatest conservation need are found within this Basin (Lake Champlain Table 3). Almost 40% of herpetofauna and 30% of mammals of greatest conservation need call the Basin home as well (Lake Champlain Table 3). Additionally, NYNHP data indicate that the Champlain Valley and extensive forests and wetlands of the Adirondacks are of vital importance to rare insects and mollusks. The region's extensive rivers, tributaries, and marshes support rare fish like sturgeon and rare insects such as odonates and stoneflies.

While this biodiversity is impressive, trends in land use that are incompatible with wildlife have taken their toll on populations. Populations of some rare, threatened, and endangered plant and animal species and rare natural communities in the Lake Champlain Basin are declining as a result of habitat degradation, invasions on non-native species, collection, and other factors. Over 50% (41) of the 81 fish species that reside in the Basin have been classified as SGCN, and over 40% (17) of the 41 herpetofauna have been so classified. Of the 318 bird species, 17% (53) have been designated as SGCN in NYS, and of the 56 mammals, 11% (6) have been listed as SGCN in NYS.

Of the 106 SGCN in this Basin, 37% are declining (Table 2). Of those species in decline, the majority (74%) is birds; however, there is insufficient data to suggest that a disproportionate number of bird species are declining relative to other taxa. This statistic may just be a function of the rigorous monitoring that has occurred for birds. Thirteen percent of the reptiles and amphibians, 8% of insects, and 5% of freshwater fish designated as SGCN are declining. Many of these declining species specialize in a few select habitats or foraging guilds, and in so doing, inhibit their ability to adapt to declining habitat quantity and quality.

More troublesome still is the 45% of SGCN whose status we do not know (Lake Champlain Table 2). The majority of these are insects (27%), followed closely by birds and herpetofauna (25% for both). Wildlife managers do not know the status of 8% of the mammals, 8% of the mollusks, and 6% of the fish listed as SGCN. Anecdotal evidence and preliminary data suggest that these species may be rare and/or declining, but without sufficient data on their distribution and abundance it is exceedingly difficult to try to combat threats to their populations and habitats.

Changing Human Population, Land Use, and Habitat Quality

As described above in the description of the Basin and its critical habitats, this region contains an extraordinary diversity of ecosystems that are still in comparatively good health. Despite the relatively small human population compared to other watersheds in the State, human population growth and the development (e.g., residential, industrial, roads) that accompanies it are still a problem for the Lake Champlain Basin. From 1990-2000, the fastest growing counties in the Basin were Franklin County (10%), Warren County (7%), and Essex County (5%; US Census Bureau, 2002). These areas of high human population growth coincide with locations of some of the most sensitive habitats and the rare species that depend upon them (e.g., boreal forests and wetlands of the Adirondacks). Between 2000 and 2015, it is estimated that the greatest increases in human populations will be in the northern part of the Basin; specifically, in Franklin (13% by 2015) and Clinton (9% by 2015) counties (New York Statistical Information System, Cornell Institute for Social and Economic Research, 2002). The growth in these counties is expected to be two or more times that of the growth in the remaining three counties. In some areas the development centers on building of second homes and a significant seasonal increase in population. Fortunately, human population density is still relatively low in these counties and there are still vast stretches of land that are untrammeled. While population growth may bring economic prosperity to the region, it is important that the development that will surely accompany this growth be sustainable and compatible with wildlife and the critical habitats they rely upon.

Historically, land use in the Basin resembles the rest of New York State. It was forested prior to European colonization followed by intense silviculture (throughout the State, but particularly in the Adirondacks) and agriculture (particularly in the fertile lands of the Champlain Valley), and has now returned to forested land (Stanton and Bills, 1996). Records indicate that in 1910, on average, over 50% of the Lake Champlain Basin was classified as farmland (i.e., row crops, pasture, hay land; Stanton and Bills, 1996). By the 1990s this trend had completely reversed itself, and today over 75% of the watershed is classified as forest (Stanton and Bills, 1996; MRLC data, 2005). The nature of the remaining agricultural land has changed as well. Cropland diversity has decreased and smaller farms have been consolidated into larger units. The number of farms dropped dramatically between 1910 and 1992, but the average farm size almost doubled (Stanton and Bills, 1996). Consequently, adjacent edge habitats in the form of grasslands, woodlands, and strip cover (e.g., fencerows, hedgerows) have either been lost outright or dramatically altered in size and shape. This loss of habitat not only affects resident wildlife communities but may also have played a role in the decline of migratory species such as Neotropical migratory birds that breed in the Basin.

The Lake Champlain Basin includes some of the highest quality wetlands in the Northeast, including lakeside wetland complexes and many rare or declining natural wetland communities (Howland et al., 2003). Similar to the rest of NYS, wetland habitats declined dramatically in the Basin from 1900 until the 1970s. During this time it was common practice to drain marshes for agriculture and other land use practices. The Freshwater Wetlands Act protected these habitats, and wetland losses have been slowed dramatically since 1975. With the exception

of the Adirondack Park, only wetlands larger than 12.4 acres, or certain wetlands of unusual local significance, are regulated. In the Adirondack Park, all wetlands larger than one acre, or wetlands of any size when adjacent to a water body are protected. From the 1980s through the 1990s the Adirondacks experienced a small net gain in wetlands. Today wetlands are incrementally destroyed, and wetland complexes fragmented, by smaller, more numerous projects, many of which are less than one acre and scattered throughout the Lake Champlain Basin (Lake Champlain Basin Program, 1998). Also, the quality of existing wetlands is threatened by siltation, runoff from agriculture and development, and introduction of invasive species. Efforts are on-going to broaden New York State protections to protect isolated wetlands smaller than 12.4 acres.

With its relatively modest human population and large tracts of forest wilderness, water quality in the Lake Champlain Basin is generally good to excellent (DEC Division of Water, 2002). DEC has engaged in extensive surveys of macroinvertebrate communities in rivers and streams in the State in an effort to assess thirty year trends in water quality. Within the Lake Champlain Basin, about 68% of the streams and rivers sampled were classified as non-impacted (very good water quality). About 30% were classified as slightly impacted (good water quality). The slightly impacted sites were generally associated with creeks and streams in close proximity to population centers such as Glens Falls, Plattsburgh, and the Village of Lake George. The remaining 2% of sample sites were classified as moderately impacted (poor water quality). Again, this was associated with a creek in the relatively urban/suburban setting of Glens Falls and is likely due to runoff.

The quality of the water in the second largest water body in the Basin, Lake George, is categorized as good (Lake George Planning for the Future Committee, 2001), however, negative changes in water quality have been reported. The southern portion of the lake is more developed and exhibits lower transparencies, lower dissolved oxygen concentrations, higher phosphorous and chlorophyll-A concentrations, and increased growth of invasive aquatic plants and animals. Non-point source pollution is the greatest threat to water quality in Lake George, emanating from a host of sources including septic systems, unabated storm water runoff, and stream bank erosions caused by poor land use practices in upland sections of the watershed (Lake George Planning for the Future Committee, 2001). Unfortunately, despite the relatively good health of lake systems throughout the Basin, this is a widespread trend. Public and private natural resource managers must take a proactive approach to protect high quality aquatic systems, and to slow or halt the decline of aquatic habitats that have already been degraded by contaminants, sedimentation, and invasive species.

Despite the relatively good health of aquatic systems in this Basin, in general, human effects on stream and riparian habitat have been intense and wide-ranging (Howland et al., 2003). Humans have altered the flow of streams and rivers for flood control, bridges and roads, power generation (dams), agriculture, and development. This alteration has resulted in the loss of floodplains and riparian buffers; increased river channel instability; altered hydrology (decreased water storage, conveyance); decreased water quality (including increased sedimentation); and loss and fragmentation of fish and wildlife habitat (Howland et al., 2003).

The most significant water quality problems in the Lake Champlain Basin affect Lake Champlain itself: fish consumption advisories due to PCB and mercury contamination, excessive nutrient loadings, invasive/exotic plant and animal species, and atmospheric deposition. These issues will be addressed in more detail in the "Threats" section that follows.

Threats

DEC staff members who compiled the SGCN information in the CWCS Planning Database were asked to indicate threats to SGCN and their habitats. During the analysis for the Basin, a listing of threats for each species occurring in the Lake Champlain Basin was extracted from the database. The threats and summary figures compiled here (Lake Champlain Table 12) are not listed in order of importance. The magnitude of a threat is measured by several variables including the species life history traits (i.e., its vulnerability), population trends, specific habitat type and geographic locale, and others. The information provided does not quantify the magnitude of a particular threat. It is intended only to paint a broad picture of the proportion of species/species groups to which a particular threat was assigned, and the frequency with which a particular threat was mentioned in the database. For example, "Climate Change" was identified as a threat for 10% of the SGCN species groups in the Basin; however, it is likely that climate change affects (or will affect in the future) all species and their habitats. Furthermore, the purpose of this information is not to compare the severity of one threat against another.

Rather than go through each of the 38 threats listed in Table 12, some of the more prominent threats to species of greatest conservation need in the Lake Champlain Basin have been combined into a few broad categories and summarized here. The most significant threats were determined by reviewing information from the CWCS database, scientific literature, and conservation plans for the Basin.

Habitat Loss and Fragmentation

Anthropogenic changes like development (residential and commercial, roads, power lines), dredging, and wetland draining, and natural changes such as succession reduce not only habitat quantity, but the quality of habitat as well by disrupting the function of remaining habitat patches. Examples of the loss of habitat function include loss of connectivity to patches of similar habitat (or different yet complementary habitats), loss of metapopulation dynamics in small, isolated patches ("sink" habitats), increased negative edge effects (increased susceptibility to predation), and reduction in the types of species the patch can support ("area sensitive" species).

Almost 14% of the Lake Champlain Basin is comprised of habitats that have been significantly altered by humans [residential and commercial development, agriculture (row crops, hay lands), parks and golf courses, and barren habitats (quarries, strip mines, gravel pits)]. Many of these habitats are maintained by suppressing ecological processes such as vegetative succession and fire; however, the reverse is also true. Late and early successional forest habitats may suffer because of a reluctance of the public to engage in the active management of these habitats. The result is large, homogenous forest tracts with lower structural, vegetative, and species diversity than would be encountered in forests with both natural disturbances (e.g., fire, wind throws) and active management (variable cutting regimes). While a potential goal for this Basin may be to incorporate more structural and vegetative species diversity into forests and other habitats, it is important to maintain the contiguity of large blocks of habitat where they exist, and to increase the size and connectedness of habitat patches where feasible.

Degraded Water Quality, Atmospheric Deposition, and Altered Hydrology

Many of the SGCN in this Basin rely upon aquatic habitats during some stage of their life cycle (e.g., natal sites, foraging sites). Conservation partners have identified the degradation of water quality and the acute and chronic effects of contaminants in aquatic habitats as a significant threat to wildlife. Degraded water quality includes siltation, nutrient runoff, temperature increases, toxics (e.g., pesticides, heavy metals), lowered dissolved oxygen, and altered hydrology (dams, water withdrawal, ground water extraction). Additionally, contaminants enter aquatic and terrestrial systems through atmospheric deposition and have both habitat and population-level effects.

Some of the significant water quality issues in this basin include PCBs in Lake Champlain. PCB contamination negatively affects reproduction and survival of mammals such as river otter and raptors such as bald eagles. One significant source of PCBs is lake sediment in Cumberland Bay; ongoing remediation activities in the Bay are expected to reduce this source (DEC Division of Water, 2002). Other continuing sources of PCBs to the lake have yet to be identified. Recently completed remediation efforts (e.g., Cumberland Bay) should reduce this source.

Mercury contamination is thought to be a result of atmospheric deposition. Mercury is released from anthropogenic sources (coal burning plants, etc.) and is carried via wind currents from sources in the Midwest and deposited onto terrestrial and aquatic habitats through rain, snow, or dust. If mercury is converted to methylmercury, it can be consumed by organisms, move up the food chain, and increase in concentration as it does so (Evers, 2005). Traditionally, high levels of mercury were correlated with decreased productivity and survivorship of common loons (Schoch and Evers, 2002), but recent findings suggest that mercury contamination is a much larger threat to human and ecological health. A recent report by Evers (2005) compiling data from 21 peer-reviewed journal articles shows elevated mercury levels in almost every taxa including fish (e.g., brook trout, yellow perch), crayfish, salamanders, waterbirds (e.g., common loon), forest songbirds (e.g., Bicknell's thrush), and furbearers (mink and otter). The report goes on to state that not only does mercury pose a threat to fish and the humans consuming them, but also to wildlife living in habitats as diverse as mountain tops and small headwater streams. Particularly high mercury levels were observed in the Adirondack Mountains. Mercury can have adverse effects on individual animals living in this region, as well as population-level effects through changes in behavior, reproduction, and body chemistry (Evers, 2005). Mercury concentrations are such that consumption advisories have been expanded within the Lake Champlain Basin, as well as elsewhere in New York.

Elevated phosphorous levels in the basin contribute to excessive algal and vegetative growth, thus exacerbating the spread of aquatic nuisance plants and diminishing the value of aquatic habitats for fish and wildlife. Phosphorous loading is often the result of point and non-point source pollution. The Lake Champlain Basin Program has begun a program to reduce point and non-point sources (Lake Champlain Basin Plan - Opportunities for Action, 1993, 1996, 2003) in Lake Champlain and hopes to reduce excess phosphorous loads by 25% every

five years for a 20-year period. Establishment of total maximum daily loads (TMDL) for streams, and planned improvements to point sources such as sewage treatment facilities, hold hope of further reductions.

Another significant threat in the Lake Champlain Basin that has negative consequences for wildlife is the declining pH of Adirondack water bodies due to acid rain. Utility plant pollution laden with nitric and sulfuric acid from industrial sites in the Midwestern United States (Ohio, Illinois, Indiana, Pennsylvania) is carried northeast via wind currents, and deposited in the form of precipitation onto the Adirondack Mountain range. The thin, acidic soils and the nutrient-poor water bodies in these areas make them particularly susceptible to acidification. Despite the reductions in emissions that have resulted from the Clean Air Act, the Adirondacks are now more sensitive to acid deposition due to the accumulation of acids and the loss of buffering capacity in the soil (Schoch, 2002). The effects of acid rain can be seen in the damaged spruce-fir forests of the high peaks of the Adirondacks, reduced fish numbers and reproductive success in ponds with a pH of <5, and decreased foraging and reproductive success of nesting common loons (Environmental Protection Agency, 2004; Schoch, 2002).

Altering the flow of riparian habitats with dams and bridges, and for flood control, agriculture, and development (roads, residential, commercial) can directly and indirectly affect fish and wildlife. Movement of populations of aquatic species such as fish and freshwater bivalves are inhibited, and habitat for all species dependent on lotic systems is lost outright or degraded through decreased conveyance and increased sedimentation. Stream and road bank erosion of naturally sandy soils are a primary source of sand/sediment. DEC's Division of Water found that, in some areas of the Basin, winter road sanding practices are also thought to be a significant source of sediment loads. Once in the stream, the sand and sediment fills in gravel spawning beds, decreasing salmonid spawning success, limiting macroinvertebrate production, and increasing winter mortality of fish and invertebrates. Excessive sand and sediment loads also contribute to the formation of significant sedimentation deltas at the mouths of many tributary segments. Such deltas can restrict fish migration into the tributaries and present opportunities for the establishment of non-native aquatic vegetation. Effects related to sediment deltas are particularly well-documented in Lake George.

Aquatic and semi-aquatic invasive plants such as purple loosestrife, Eurasian water milfoil, water chestnut, Japanese knotweed, yellow iris, and invasive animals such as zebra mussels and sea lampreys are also an increasing threat to Lake Champlain and other waters of the Basin. This is discussed in more detail in the following section.

Invasive Species

Invasive exotic plants and animals diminish the quality of upland and aquatic habitats throughout the basin. In wetlands and other aquatic habitats, species like purple loosestrife, Eurasian water milfoil, water chestnut, Japanese knotweed, and common reed with little value to wildlife, displace native plant species and disrupt ecological processes. Eurasian water milfoil was first discovered in the Basin in 1962 and now occupies an extensive range throughout Lake Champlain and at least 40 other water bodies in the basin (Howland et al., 2003). This species forms dense mats of vegetation that degrades the structure and function of aquatic habitats. Similarly, dense mats of water chestnut have infested southern

Lake Champlain. While mechanical control of water chestnut has met with some success, water milfoil has been more difficult to control. Japanese knotweed is now forming dense riparian stands of vegetation along the Boquet River, the Ausable River and certain tributaries that flow into Lake George. Knotweed is quickly replacing native vegetation along these waterways with little or no benefit to fish or wildlife resources. Mechanical and/or chemical control of Japanese knotweed has proven to be extremely difficult.

Upland plants such as garlic mustard, bush honeysuckle and others continue to replace native plants. A recently discovered invasive plant in the Champlain Valley, black swallow-wort (a.k.a. "the dog strangling vine"), has the potential to cause major disruptions to upland plant communities. Investigations into chemical and biological control mechanisms for this nuisance plant species are ongoing.

Invasive aquatic animals degrade habitat quality and/or directly affect fish and other aquatic species. Zebra mussel densities have increased dramatically since their discovery in Lake Champlain in 1993 (Howland et al., 2003). Zebra mussels have affected water supplies, crowded out native mussels species, and reduced the biomass of other benthic animals in many areas. Sea lampreys, a parasitic invasive fish that feeds on the body fluids of other fish, have a significant effect on other native fish populations. The Lake Champlain Fish and Wildlife Management Cooperative (DEC, Vermont Fish and Wildlife, USFWS) is currently implementing a sea lamprey management program to combat this threat. White perch became established in Lake Champlain during the 1980s and have substantially affected the fish community of the lake. Finally, alewives have recently been discovered in Lake Champlain. This species poses a threat to larger cold water fish species, but the extent of the threat has yet to be determined. Headwater lakes and ponds in the Lake Champlain watershed historically had simple fish communities consisting of relatively few fish species. Non-native fishes have been widely introduced in those lakes and ponds, causing drastic declines in round whitefish and brook trout. Numerous invasive non-native aquatic organisms are found in adjacent watersheds and have access to Lake Champlain through the Erie and Champlain Canals. Potential measures to restrict or prevent introductions of such invasive species via the canal should be evaluated and, if viable, implemented. The Lake Champlain Aquatic Nuisance Management Plan approved in 1999 by NYS and Vermont was designed to address many of the threats posed by non-native species.

In upland habitats, invasive exotic plants and insects introduced through human activity threaten to reduce biodiversity. For example, exotic insects like viburnum leaf beetle lack any natural predators and threaten to alter the composition of young forest stands. Beech bark disease, a fungal disease of the genus Cryptococcus, is having devastating effects on American beech trees within the Adirondack Park. American beech is the primary source of tree mast for use by wildlife within the Park. Total loss of mast in localized areas may in turn have significant effects on wildlife populations that utilize this food source. There are several forest pathogens and insect pests that may affect forested habitats. Some of these pests have yet to reach the Lake Champlain Basin from southern NYS (e.g., hemlock wooly adelgid, Japanese long-horned beetle), but northward movement of the distribution of these species has been observed.

Native species present in locations or numbers not historically found can de detrimental to some SGCN. These invasive native species can out compete the species of concern for forage or nest sites, can pose a predation threat (e.g., perch preying upon round whitefish), or can reduce habitat quality by altering vegetative composition and structure. A case in point is double-crested cormorants on Lake Champlain. The cormorants found here is a part of the interior Great Lakes population. During the 1960s cormorant populations in the Great Lakes were devastated by the effects of chemical contaminants (primarily pesticides) on reproduction. Pollution control, in addition to the protective status granted by the Migratory Bird Treaty Act, has allowed populations of cormorants to soar to historic highs. Nesting colonies were first observed on islands within Lake Champlain in the 1980s and the population has grown to over 7,000 nesting pairs (USFWS, 2000). The expanding population of double-crested cormorants observed in this Basin may pose a threat to SGCN such as island-nesting waterbirds (e.g., black-crowned night herons, cattle egrets, and great egrets) and the habitats they depend upon. Investigations into this threat were initiated in the late 1990s by DEC, Vermont Fish and Wildlife, USFWS, and USDA APHIS Wildlife Services to quantify the scope, dynamics, and magnitude of the effects of double-crested cormorants on fish and wildlife of Lake Champlain.

Incompatible Silvicultural and Agricultural Practices

Agricultural and silvicultural products are both important to the economy of the Lake Champlain Basin. Unfortunately, traditional agricultural and silvicultural practices may lack ecologically-based objectives, thus may be detrimental to wildlife.

Trends in modern farm operations (increased field size, loss of edge habitats, erosion due to conventional tillage, intensive grazing, poorly timed mowing/haying of fields) can have negative consequences for wildlife and their habitats in regions where agriculture (e.g., row crops, pasture/hay land) makes up a significant portion of the landscape as seen in northern and eastern Clinton County and central Washington County. Additionally, runoff from agricultural operations can increase contaminant, nutrient, and sediment loads in adjacent aquatic habitats negatively affecting the SGCN that reside there. In the forested landscapes that predominate the Lake Champlain Basin, forestry operations that do not comply with best management practices and that are poorly planned and executed can damage habitat function and reduce habitat quality for SGCN that reside there. It is important to develop and implement farm and forestry practices that are both ecologically and economically sustainable.

Human-Wildlife Interactions

There are a variety of threats to SGCN in the Basin from direct interactions with humans and the structures we erect. These include vehicle and structure collisions and illegal and unregulated harvest. Species that are most susceptible to these threats are those that disperse across the landscape like migrating birds and bats, and herpetofauna traversing from the upland to wetlands. Often fragmentation of habitats by structures, such as power lines and roads, are a significant source of mortality.

Anecdotal evidence and preliminary data gathering efforts have suggested that wildlife collisions with human-created structures (e.g., large wind turbines,

communication towers, and power lines) can have significant population-level effects. The U.S. Fish and Wildlife Service (USFWS) is currently investigating the effects of these types of structures on wildlife populations (specifically, migratory birds), but as human populations within the Basin continue to increase, these structures will become a more significant hazard to SGCN.

Many of the amphibian and reptile species of conservation concern have no protected status. Killing, collection/translocation, and the illegal sale of herpetofauna in the pet trade pose a significant threat to rare and declining reptile and amphibian species. Furthermore, public misconceptions about reptiles, particularly snakes, may drive the killing and/or collection of these animals.

Climate Change

The threat with the greatest potential to affect fish and wildlife on a scale much larger than just this Basin is climate change. Large quantities of carbon released into the atmosphere by human activities have increased the amount of carbon dioxide in the air and trapped the Sun's heat. This has resulted in an increase in the global temperature at a rate faster than anything that has been observed for at least 10,000 years (Millennium Ecosystem Assessment Board, 2005). Habitats in the Adirondacks such as the lowland boreal may be particularly susceptible to climate change. Warming trends may affect the distribution patterns of plants and animals that inhabit boreal habitats and may extirpate some plants and animals that cannot adapt or move to more suitable areas. However, researchers studying this issue in the Adirondacks have not been able to reach consensus on the methods used to study climate change at a local scale, thus making predictions about future effects difficult (Jenkins, in review; Stager and Martin, 2002).

Priority Issues in the Basin

The stressors described above vary in their significance across different regions within the basin. For the purposes of summarizing threats, the prominent hazards for three different regions within the basin are listed here:

Adirondacks

- Atmospheric deposition
- Habitat loss and fragmentation
- Incompatible forestry practices
- Invasive species
- Human disturbance (illegal animal collection, recreation)
- Climate change

Champlain Valley

- Habitat loss and fragmentation
- Degraded water quality and altered hydrology
- Incompatible agricultural and forestry practices
- Invasive species
- Human disturbance (illegal animal collection, recreation)
- Climate change

Taconic Highlands

- Habitat loss and fragmentation
- Degraded water quality and altered hydrology
- Invasive species
- Human disturbance (illegal animal collection)
- Climate change

Vision, Goals and Objectives for the Basin

Vision

The Lake Champlain Basin will be part of a healthy and sustainable ecosystem.

Traditional and non-traditional public and private conservation partners will work in a coordinated fashion to gather the most accurate, comprehensive data on Species of Greatest Conservation Need within the basin in a format that can easily be shared among natural resource managers and disseminated to the public to raise awareness of the issues facing species of concern and their habitats.

These conservation partners will also work in a coordinated manner to manage populations and habitats over a large spatial and temporal scale. This will be done through comprehensive planning, land protection, adaptive management, and rigorous evaluation.

The result of these efforts will be healthier and more secure animal populations, habitats, and communities. Loss of Species of Greatest Conservation Need to extinction will be slowed or halted. Species that currently are common will remain common and populations of threatened/endangered/special concern species will improve to the point where they can eventually be de-listed.

Goals and Objectives

- Establish a conservation framework within the Lake Champlain Basin through which public and private stakeholders interested in wildlife conservation can work cooperatively towards the management, enhancement, and protection of the basin's biodiversity, focusing on at-risk species.

- Ensure that no at-risk (threatened/endangered) species becomes extirpated from the basin. Furthermore, ensure that common species remain common.

- Manage animals, fish, mussels, invertebrates, their habitats, and land use practices to produce sustainable benefits for species of conservation concern.

- Maintain knowledge of species and their habitats in sufficient detail to recognize long-term population shifts.

- Fill "data gaps" for those species where population status, distribution, and habitat needs are unknown.

- Identify, manage, protect, maintain, and restore habitat/natural communities over as broad a spatial scale as possible. Work to keep large forest and wetland complexes unfragmented, and to restore fragmented wetlands and forests where feasible to increase patch size and connectivity. Quality grassland habitats should be maintained where they occur and increased in size only if it does not fragment adjacent habitats. Similarly, within this basin, the restoration and management of early successional forest habitats must be evaluated relative to the effects on other communities of significance.

- Reduce the effects of dams, culverts and other human-made obstructions to the movement of fish and wildlife dependent upon aquatic habitats.

- Work with land managers to incorporate wildlife-based objectives into traditional land management activities such as forestry and agriculture that still allow these activities to be economically sustainable.

- For species that migrate beyond state borders, conservation actions must be evaluated for consistency with regional, national, and international management plans for those species. Furthermore, actions for all SGCN should be consistent with management goals and objectives of the Lake Champlain Fish and Wildlife Management Cooperative (includes DEC, VT Fish and Wildlife, US Fish and Wildlife Service, and Quebec Wildlife and Parks).

- Develop a "stepped down", more targeted plan for the Basin that expands upon the recommendations made here. This plan may focus on specific species and habitats, where and when management actions will occur, who will execute those actions, and how they will be implemented "on the ground".

Priority Strategies/Actions for Basin-wide Implementation

The following recommendations do not appear in any priority order. All of these recommendations are intended to be of high priority to implement in this basin in the coming 5 to 10 years for the benefit of the most critical SGCN in the state. See the discussion of "*Development of Conservation Recommendations for Species of Greatest Conservation Need and their Habitats*" and their prioritization in the Introduction. All of the recommendations for SGCN found in this basin can be viewed in Appendix A.

Data collection recommendations for SGCN

Data collection (research, surveys, and inventories) is a crucial first step for the majority of SGCN in the Lake Champlain Basin. Many of the conservation actions in the following categories (e.g., Planning, Land Acquisition, etc.) should not or cannot be done until critical data gaps are addressed for particular species and their habitats, unless immediate action is needed to secure populations or habitats in severe decline. Once we know more about a species' abundance, distribution, life history, and habitat needs we can begin to decide where, when, and how conservation actions can be implemented.

There are a number of priority species and groups that need population, habitat, and life history research to address critical data gaps. This information will help more clearly identify threats and establish baseline information for these species. This type of data collection will address multiple threats to many species. They are listed below alphabetically by taxonomic group and species group.

BIRDS

General recommendations

- Monitor freshwater marsh nesting birds, peregrine falcon, common loon for contaminants in their eggs, in juveniles, and adults. Contaminants of particular concern are heavy metals including mercury, pesticides, and PCBs.
- Investigations initiated in the late 1990's by DEC, Vermont Fish and Wildlife, USFWS, and USDA APHIS Wildlife Services to quantify the scope, dynamics, and magnitude of the effects of double-crested cormorants on fish and wildlife of Lake Champlain should continue.
- Federal, state, and local agencies should work to monitor the status of island-nesting colonial waterbirds and native fish species relative to the abundance and distribution of double-crested cormorants, and determine if there is any correlation to observed changes.

Boreal forest birds

- Develop a long-term monitoring program to determine population and habitat trends of boreal forest birds, and to determine threats to these species. The highest priority species in the group are the New York State endangered spruce grouse, and the declining olive-sided flycatcher and bay-breasted warbler. The status of the following species is unknown: Cape May warbler, rusty blackbird, Tennessee warbler, and three-toed woodpecker.

- ❖ Incorporate the results of the State Wildlife Grant study on boreal forest birds into future monitoring efforts and data analyses.

Breeding waterfowl

- Conduct more intensive surveys for common goldeneye in the Adirondacks and Champlain Valley (particularly Clinton County and northern Essex County) to estimate overall abundance, document habitat use, and design a long-term monitoring program (e.g., every 5 years).

Common loon

- ❖ Support research that addresses threats to the long term viability and survival of loons in the basin, including atmospheric pollution (mercury) and shoreline development.

- ❖ Continue to support research of migration routes, nesting and wintering sites, and general ecology and life history of the Adirondack common loon population.

Common Nighthawk

- ❖ Develop survey methodology to determine population trends for this species. Breeding Bird Atlas (BBA; 2000-04) records indicate that this species was observed in several blocks throughout the Basin, from Franklin through Washington counties.

Deciduous/mixed forest breeding birds

- ❖ Initiate research to investigate factors affecting habitat use and productivity of red-headed woodpecker.

- ❖ Determine the population status of cerulean warbler and Louisiana waterthrush in this Basin.

Early successional forest/shrubland birds

- ❖ Complete an inventory and analysis for high priority focus species that identifies core habitats (highest abundance) and geographic areas (where appropriate). For this Basin this includes golden-winged warbler, Canada warbler, and whip-poor-will.

- ❖ Develop a long term monitoring program for golden-winged warblers. In particular, monitor status and trends of golden-winged warblers along the "front" of blue-winged warbler invasion northward.

- ❖ Incorporate the results of the 2003 and 2004 State Wildlife Grant studies on golden-winged warbler population status and habitat needs into future monitoring efforts and data analyses.

Forest breeding raptors

- ❖ Determine the population status of long-eared owls in this Basin. Surveys should initially focus on sites in Essex County in the northern part of the Basin (Breeding Bird Atlas, 2000-04).

- Determine the presence of golden eagle within this Basin, and if observed, document habitat use (i.e., migration, breeding, wintering, etc.).

Freshwater marsh nesting birds

- Initiate baseline population surveys to determine abundance and distribution of high priority species, and periodically re-survey to detect trends. Refine monitoring techniques to better detect population trends and determine the cause of observed changes. Focus species include American bittern, pied-billed grebe, and black tern. Initially, surveys efforts should focus on marsh habitats in Clinton County (BBA 2000-04), then expanded throughout the Basin.

- Prepare a catalog, where possible, of migratory and breeding sites, identifying and mapping sites at a coarse scale to select sites worthy of monitoring. Evaluate these habitats by a variety of techniques at multiple scales to better understand the micro- and macro habitat features important to nest site selection.

- Conduct studies of habitat use, prey availability, and diet at migratory staging and molting areas and wintering grounds to assess possible threats and limiting factors for high priority species.

- Further evaluate the effectiveness of artificial nest platforms for increasing nest success or densities of black tern, emphasizing placement of platforms where nest substrates appear to be limiting or where terns may be encouraged to nest in areas of low disturbance.

- Investigate aspects of behavioral ecology, such as mate selection, mate fidelity, spacing behavior, coloniality, dispersal, and post fledging parental care.

- Incorporate the results of the 2004 State Wildlife Grant study on marsh birds into future monitoring efforts and data analyses.

Grassland birds

- Complete an inventory of potential grassland habitat for species present, distribution, and relative abundance of priority species within this Basin. These include northern harrier, sedge wren, short-eared owl, and upland sandpiper. Survey efforts should focus on grassland habitats in the Champlain Valley (eastern Clinton County, eastern Essex County) and the northern extent of the Hudson Valley in central Washington County.

- Develop and implement supplemental monitoring programs for grassland bird species that are not adequately sampled by the Breeding Bird Survey to determine precise population trends and evaluate effectiveness of conservation efforts. Use long term trend data to determine effectiveness of grassland conservation efforts.

- Incorporate the data generated by tasks above into the New York State Grassland Bird Management Plan currently being developed under the 2003 State Wildlife Grant.

High altitude conifer forest birds

- ❖ Continue the Mountain Birdwatch monitoring protocol on all Adirondack peaks where Bicknell's thrush is known to occur. Implement other long-term monitoring if needed to determine population trend.

- ❖ Evaluate the long term viability of Bicknell's thrush as a part of New York State's breeding avifauna.

Osprey

- ❖ Annually or periodically monitor the population (or certain regions of the population) to determine the number of territorial pairs and reproductive outcome. Record notable new aspects of the species' ecology, especially pertaining to any local declines. This task should focus on the Adirondacks.

- ❖ Ensure that information on all new osprey nests are submitted to the Natural Heritage Program.

Peregrine falcon

- ❖ Annually monitor and determine the number of territorial peregrine falcons and their reproductive outcome at nest sites in the Champlain Valley and the Adirondacks.

- ❖ Conduct radio-telemetry studies as well as field observations to determine essential peregrine falcon habitat. Through population monitoring and banding, determine site-fidelity, turnover, migration and wintering movements, home-ranges, mortality, longevity, etc. of peregrine falcons.

- ❖ Conduct research on the interaction of rock and ice climbers with falcon nest site selection, nest site abandonment, and nesting success.

Freshwater Fish

Lake Sturgeon

- Before re-introductions efforts can occur (in habitats where it is appropriate and necessary), fisheries managers should conduct a genetic evaluation of lake sturgeon stocks. Some preliminary comparisons of lake sturgeon genetics in the St. Lawrence River have been completed (McQuown et al., 1999). Additional studies are needed to determine if there are differences between lake sturgeon genetic stocks in the St. Lawrence River and stocks in Lakes Erie and Champlain.
- Work by Vermont Fish and Wildlife staff has identified a small population of sturgeon in Lake Champlain and has documented limited natural reproduction by that population. Any efforts to restore lake sturgeon in Lake Champlain will be coordinated with Vermont.

Mooneye

- Monitor the status of this species in waters where it is found in the Lake Champlain Basin and identify critical habitats.

Sauger

- Determine the abundance and distribution of this species in the Lake Champlain watershed (including the Poultney River).

- Monitor newly discovered and existing sauger populations to determine population trends.
- Research habitat requirements for sauger in this Basin.

Round Whitefish

- Survey remote Adirondack waters to detect presence of or absence of round whitefish.

Herpetofauna

The herptile species in this basin all have similar research needs. The highest priority species for these data collection recommendations are:

- Western chorus frog
- Eastern ribbon snake
- Common five-lined skink
- Spotted turtle
- Blue-spotted salamander
- Jefferson salamander
- Timber rattlesnake

❖ Develop standardized habitat survey protocols, and implement survey protocols at all known and potentially suitable sites, to document the character, quality and extent of occupied habitat for all high priority herp species.

❖ Document life history parameters specific to New York populations of these species, including age and sex ratios, longevity, age at sexual maturity, survivorship of young, predator-prey relationships, and wetland/upland habitat requirements.

❖ Incorporate the results of the 2003 and 2004 State Wildlife Grant studies on high priority amphibian species into future monitoring efforts and data analyses.

❖ Conduct a periodic re-survey of known sites of occurrence for wood turtle and Eastern ribbonsnake in order to detect population trends. New York State Herpetile Atlas (DEC, 2005a) records for wood turtles indicate that this species is distributed throughout the Basin, with the concentrations in Essex County. The Eastern ribbonsnake was observed scattered throughout the basin with the majority of observations in Clinton County.

❖ Spiny softshells have been found in the Vermont and Quebec portion of Lake Champlain, but have not yet been observed in NYS waters; however, they are a highly mobile species (research has indicated that animals tagged in Vermont swam 10-miles straight line distance in one season) and may be found in the western portion of the Lake. It is important to develop population survey protocols and implement protocols at known and potentially suitable sites to determine the extent of occupied habitat in the Basin.

❖ Conduct periodic surveys of known sites of occurrence for western chorus frog in order to detect population trends. The New York State Herpetile Atlas

(DEC, 2005a) effort observed this species in three survey blocks within this Basin (Clinton and Essex counties).

- Conduct periodic re-survey of known sites of common five-lined skink in order to detect population trends. New York State Herpetile Atlas (DEC, 2005a) records for this species indicate that it is found in northeastern Warren County and northern Washington County along Lake George, and between Lake George and Lake Champlain (South Bay).

- Conduct periodic re-survey of known sites of occurrence for blue-spotted and Jefferson salamanders in order to detect population trends. Herpetile Atlas data (DEC, 2005a) show records for these species primarily in Clinton and Essex counties.

- Conduct periodic re-survey of known sites of occurrence for timber rattlesnake in order to detect population trends. New York State Herpetile Atlas (DEC, 2005a) data report the occurrence of timber rattlesnake in several blocks in the Lake Champlain Valley from southern Clinton County through northern Washington County.

Insects

Other Butterflies

- Within this Basin, determine the population status and distribution of high priority butterfly species including mottled duskywing, Persius duskywing, and tawny crescent.
- Determine the best management regimes for species in each locality.
- Establish the duration of all life stages, the precise habitat needs of all life stages, and how this information should be coordinated with management actions.
- Identify important food plants and determine the relationship between food availability and species numbers.

Other moths

- Within this Basin, determine the population status and distribution of high priority moth species including the State endangered pine pinion moth. This noctuid moth is found in rare pitch pine-heath barrens like those formed 12,000 years ago by the receding glacier at the Clintonville Pine Barrens (900 acres, Adirondack Nature Conservancy, Adirondack Land Trust) in the northeastern portion of the Adirondack Park.
- Develop standardized measures of habitat parameters, investigate metapopulation dynamics, and develop standard definition of what is needed for "viable" populations of high priority moth species.

Odonates

- Complete the statewide inventory of odonates and their habitats as outlined in the 2003 State Wildlife Grant. “Hot spots” of odonate diversity within this Basin should be identified and targeted for management action based on species richness, acuteness of threats, and overall value to odonates and other SGCN.

Riparian tiger beetles

- Determine the population status and distribution of Cicindela ancocisconensis within the Lake Champlain Basin. This species is currently known from fewer than 10 streams/rivers statewide.
- Inventory suitable cobble bar habitats throughout the Basin, with focus on the Ausable River.
- Determine vegetation density, cobble size, and sand/cobble interspersion of occupied habitats.
- Compile baseline data on existing threats to these species including existing gravel mine permits, exiting areas of high ATV use, existing hydrological flow alterations.
- Incorporate results from the 2004 State Wildlife Grant study on tiger beetle distribution and abundance into data analysis, monitoring, and management efforts for this species.

Stoneflies/Mayflies of lotic waters

- Survey sites within the historical ranges of *Heptagenia culacantha* and *Rhithrogena uhari*.
- Determine the critical habitat for these species.
- The information generated in tasks (1) and (2) should be coordinated with DEC Division of Water and their on-going effort to document 30-year trends in water quality of rivers and streams of New York State based on macroinvertebrate data.

Mammals

Indiana bat

- Survey winter populations and continue to survey new potential hibernacula in the basin as they are discovered.
- Survey for Indiana bats using vocalization detectors and mist netting at sites that are geographically similar but that have differences in the density of development over large areas.
- Live trap and mark Indiana bats during the fall swarm, fall entry, and spring emergence at one hibernacula to determine the arrival and departure periods of the species by age and sex.
- Complete three years of roost temperature monitoring at all Indiana bat sites in the basin using continually monitoring temperature probes.

Small-footed bat

- Radio-tag, release, and track reproductive female small-footed bats as they exit the hibernacula and track them to their summer range.
- Radio tag and release small-footed bats as they enter the largest hibernacula for the winter. Relocate them within the mine to determine their roost selection.
- Continue to survey hibernating small-footed bats in conjunction with Indiana bat hibernacula surveys.
- Research threats to habitats and populations.

Tree bats

- Conduct surveys of migrants to determine the timing, distribution, species composition and elevation of migrating bats. This is likely to include

combinations of acoustical monitoring, radar, and visual monitoring. High priority species include Eastern red bat and hoary bat.
- ❖ Conduct summer surveys of tree bats that will include capturing individuals and acoustical monitoring.
- ❖ Research threats to critical habitats and populations.

Mollusks

Freshwater bivalves

- ❖ Research the best survey methods both for detection of rare species and evaluation of population status and trends. Conduct surveys to determine the distribution and abundance of mussel species-at-risk in the Lake Champlain Basin. High-priority species in this Basin include black sandshell.
- ❖ Conduct research to determine habitat parameters necessary for good populations of each species of species-at-risk listed mussels.
- ❖ Research all parameters of mussel habitat requirements including temperature, substrate, fish, flow, food, etc.
- ❖ Determine fish hosts for species where this is not known for populations living in the Lake Champlain Basin.
- ❖ Determine or confirm breeding phenology and habitat conditions necessary for successful breeding for listed mussels (e.g. mussel density, pop. level of fish host, temp, flow).
- ❖ Work with the Lake Champlain Ecosystem Team (USFWS, Vermont Fish & Wildlife, Vermont DEC, DEC, USGS-BRD, Vermont TNC, Adirondack TNC, Lake Champlain Basin Program, University of Vermont) on their Native Mussel initiative. This effort involves quantitative surveys of specific river reaches to determine population trends of rare mussel species such as black sandshell, fluted shell, pocketbook, fragile papershell, pink heelsplitter, and giant floater (please note that not all of these species have been observed in the NYS portion of the Lake Champlain watershed).

Data collection recommendations for habitats

HABITAT LOSS AND FRAGMENTATION

Before other conservation actions can be taken to combat the harmful effects of habitat loss and fragmentation, data need to be collected on specific habitat requirements of SGCN (e.g., landscape scale characteristics like patch size and juxtaposition, microhabitat characteristics like stem density and ground cover), population processes (e.g., minimum viable population, metapopulation dynamics, source/sink dynamics), and how, when, and where habitat management and/or restoration should occur. Specific recommendations include:

FORESTED HABITATS

- Research the possible causes for declines of Canada warbler and the effectiveness of forest management regimes in opening up the canopy and promoting ground growth and thickets beneficial to this species. BBA (2000-04) data indicate that, within this Basin, this species is found in the Adirondack Park from Clinton County through Warren County. These may be areas to focus a research effort.

- Determine if active management (creation of habitat, such as regenerating fir waves) can be an effective management tool for Bicknell's thrush. This relatively rare, forest interior species is often associated with the high peaks of the Adirondack Park. BBA (2000-04) data show concentrations of this species in western Essex County. Key habitats include hemlock ravines and high elevation spruce-fir stands within a mosaic of northern hardwood forest types. These may be areas to focus a research effort.

- Assess the threats to Bicknell's Thrush resulting from human disturbance (e.g., wind power projects, and cell phone towers). An amendment to the Whiteface Mountain UMP that included the development of new ski trails, required the completion of a Vermont Institute of Natural Science study of potential impacts to thrush habitat with measures for mitigation prior to any development.

- Early successional forest/shrubland birds - determine effects of viburnum leaf beetle on early successional forest/shrub habitats and species utilizing them. The location will depend upon the intensity and scope of the infestation, life history traits and management objectives for the SGCN to benefit from the action, and logistics (funding, cooperating partners, feasibility of using a particular method in a specific locale). High priority species include golden-winged warbler, Canada warbler, and whip-poor-will.

- Deciduous/mixed forest breeding birds - determine the effects of various cutting regimes (partial harvest, clear cut, etc.), and size and shape of the area harvested on "forest interior" birds including wood thrush.

- Early successional forest/shrubland birds - evaluate which cutting regimes (partial harvest, clear cut, etc.) provide the maximum benefit for the greatest number of early successional bird species. This work should take into account all of the SGCN in this group (American woodcock, black-billed cuckoo, blue-winged warbler, brown thrasher, Canada warbler, golden-winged warbler, prairie warbler, ruffed grouse, whip-poor-will, willow flycatcher).

- Forest breeding raptors - experiment with different timber management techniques in order to find out which are compatible with forest breeding raptors and which methods provide the maximum benefits for forest breeding raptors. This includes trying different cutting regimes (partial harvest, clear cut, etc.), different buffer distances between harvest sites and occupied nests, and fire management, where appropriate. This should be done in both deciduous and coniferous forests and should take into account all of the SGCN in this group (Cooper's hawk, long-eared owl, Northern goshawk, red-shouldered hawk, sharp-shinned hawk).

AQUATIC HABITATS

- Conduct controlled experiments to see which management actions are effective locally in producing habitat suitable for marsh birds.

- Conduct demographic studies at selected sites across the species breeding range to identify "source" and "sink" populations, thus the regions most important for maintaining a breeding population. This research should also document such parameters as survival, age at first breeding, recruitment, dispersal, and the factors that affect them using color-banded or radio-tagged birds.

- Research population dynamics of listed mussel species including connectivity of populations or sub-populations and genetic distinctness of populations or sub-populations. High priority species within this Basin include black sandshell. As stated above, this effort could be combined with that of the Lake Champlain Ecosystem Team's Native Mussel initiative.

- Research flow requirements of freshwater bivalves and model the effects of flow changes both in volume and timing. High priority species for these actions includes black sandshell.

- Investigate diet and nutrition in relation to breeding habitat quality and prey populations (including insects, fish, and herpetofauna of freshwater wetlands) and how this translates into nesting and fledgling success for high priority marsh birds (American bittern, pied-billed grebe, black tern). This could include investigating the effects of pesticides on prey diversity and abundance. As wetlands are scattered throughout the Basin, this study should take place where and when opportunity allows; however, the marsh complexes associated with Lake Champlain may provide excellent opportunities for research.

- Determine the relationship between habitat quality, osprey survivorship, and changes in fisheries populations due to recreational and commercial harvest, changes in water quality, and effects of wildlife such as cormorants. This research should focus on occupied habitats in the Adirondack Park.

- Monitor lake pH levels in lakes within the Adirondack Park, survey forage base, and research the effects of lake acidification on breeding loons, round whitefish, amphibians, and heritage strain brook trout.

- The Lake Champlain Basin is the stronghold within NYS for sauger, so it is important to determine the effects degraded water quality on this species. In particular, conservation partners should monitor habitat for changes in turbidity and determine the effects on the survival of sauger.

- Research effects of pesticides and other chemicals, including ammonia, on all life stages of freshwater bivalves: sperm/egg, glochidia, larva, adults.

- Identify invasive species (including purple loosestrife, water chestnut, Eurasian water milfoil, and common reed) which have the potential to negatively affect marsh habitats and quantify the effect on habitat quality for appropriate SGCN. Additionally, investigate which control methods (biological vs. chemical vs. mechanical) are the most effective based on a particular species' habitat requirements and life history traits. This action should focus on:

  - Freshwater Marsh Nesting birds - American bittern, pied-billed grebe, black tern
  - Freshwater Wetland Amphibians - western chorus frog, four-toed salamander
  - Lake/River Reptiles - eastern ribbon snake, wood turtle
  - Uncommon Turtles of Wetlands - spotted turtle
  - Vernal Pool Salamanders - blue-spotted salamander, Jefferson salamander

- Round whitefish - one of the possible reasons for the decline in round whitefish populations is predation by, and competition from non-native fishes, for example yellow perch. Continue on-going studies to determine the effects of invasive fishes on round whitefish. Monitor yearly the success of reintroduction efforts of round whitefish in suitable habitat.

- Freshwater Bivalves - Conduct research on control of exotic bivalve species (e.g., zebra mussels) that compete with native mussels and exotic crustaceans or fish which may prey on them. High priority species include black sandshell.

- Evaluate cormorant control methods to determine if those actions encourage them to move to and colonize new sites.

GRASSLAND HABITATS

- Conduct demographic studies at selected sites across the species breeding range to identify "source" and "sink" populations, thus the regions most important for maintaining a breeding population. This research should also document such parameters as survival, age at first breeding, recruitment, dispersal, and the factors that affect them using color-banded or radio-tagged birds. These efforts should focus on the regions within the basin with the highest concentrations of grasslands: the Champlain Valley (eastern Clinton County, eastern Essex County) and the northern extent of the Hudson Valley in central Washington County. High priority species include northern harrier, sedge wren, short-eared owl and upland sandpiper. Results of this research should be integrated into the New York State Grassland Bird Management Plan being developed by DEC and others under the 2003 State Wildlife Grant.

- Grassland birds - evaluate the effects of specific farming and management practices, such as: timing of mowing, intensity of grazing, frequency of mowing, mowing versus haying versus prescribed fire, and width of buffer strips on productivity of all SGCN in this group (bobolink, Eastern meadowlark, grasshopper sparrow, horned lark, Northern harrier, sedge wren, short-eared owl, upland sandpiper, and vesper sparrow).

These efforts should focus on the regions within the basin with the highest concentrations of grasslands: the Champlain Valley (eastern Clinton County, eastern Essex County) and the northern extent of the Hudson Valley in central Washington County. High priority species include northern harrier, sedge wren, short-eared owl and upland sandpiper. Results of this research should be integrated into the New York State Grassland Bird Management Plan being developed by DEC and others under the 2003 State Wildlife Grant.

Planning Recommendations

Existing Planning Efforts

The Lake Champlain Basin crosses both state and international boundaries. Conservation decisions regarding the Lake and its basin must include interstate and international cooperation. Fortunately, this region has several on-going planning endeavors that involve a diverse array of public and private partners and that cross both state and international borders. Examples of these efforts include:

- Lake Champlain Fish and Wildlife Management Cooperative (USFWS, DEC, Vermont Fish and Wildlife)
- Lake Champlain Basin Program (an international effort including federal, state, provincial, and local initiatives)
- Lake Champlain Ecosystem Team (USFWS, DEC, Vermont DEC, Vermont Fish and Wildlife, Vermont Nature Conservancy, Adirondack Nature Conservancy, Trout Unlimited)
- US Army Corps of Engineers General Management Plan (GMP) for the Lake Champlain Watershed
- Lake Champlain Research Consortium (universities from New York, Vermont, and Quebec).

Conservation partners interested in engaging in land use planning for this watershed should first consult the work of these entities.

New Planning Recommendations

Expand Basin Components of CWCS

This comprehensive strategic wildlife conservation strategy for the Lake Champlain Basin is intended as a framework for conservation planning in this region of New York State. The next step, within 2-5 years, is to develop a "stepped down", more targeted plan for the Basin that expands upon the recommendations made here. This plan may focus on specific species and habitats, where and when management actions will occur, who will execute those actions, and how they will be implemented "on the ground". Some of the challenges in developing this more specific targeted plan will be to:

- Analyze and apply all of the information generated by the State Wildlife Grant research, survey, and inventory efforts and incorporate them into plans at varying spatial and temporal scales;

- Incorporate many of the on-going planning efforts being conducted by government agencies (e.g., Unit Management Plans, New York State Grassland Bird Management Plan, North American Waterbird Plan) and NGOs such as the "Strategic Plan: Upper Champlain Valley Program" of the Adirondack Nature Conservancy and Adirondack Land Trust; and

- Coordinate the diverse array of stakeholder groups that will need to be involved in land use planning for SGCN, particularly groups that may not have been traditionally involved in a large scale conservation planning process (e.g., economic development groups, town boards, local land trusts, etc.).

Landscape Mosaic Management Planning

There is a clear need for a habitat mosaic management plan for early successional forests/shrub habitat, mature forest stands, grasslands, and wetlands in this basin. Of the 106 SGCN occurring in the basin, 14 depend on barrens and woodlands, 45 depend on forested habitat, 41 depend on grasslands, and 18 depend on mineral soil wetlands. Some species depend on all four of these habitat types at some point in their life cycle. All of these habitats have competing needs and priorities among both wildlife (habitat quality and quantity) and people (timber, agriculture, residential and commercial development, water). The balance and active cooperative management of all of these habitat types among a diverse array of stakeholders is essential to the health and abundance of many of the SGCN currently living in this basin. Maintenance and restoration of wildlife corridors and connectivity of habitats is a key consideration in mosaic planning.

The management of public lands needs to be carried out with the cooperation of many agencies. Key partners to include are DEC, NYS Office of Parks, Recreation and Historic Preservation, USFWS, USGS-BRD, NRCS, and local governments. Private lands comprise 85% of the total land area of the State. Use of cooperative management programs like Farm Bill programs coordinated by USDA and NRCS, USFWS Wildlife Habitat Incentive Program (WHIP) and Partners for Wildlife Program, DEC Landowner Incentive Program (LIP) Northeast Brook Trout Initiative, and various conservation programs administered by non-governmental organizations (e.g., local land trusts such as the Lake Champlain Land Trust and the Adirondack Land Trust, The Nature Conservancy (TNC), Ducks Unlimited, Inc.) will be important to achieve effective habitat protection and enhancement for many SGCN.

Over 75% of the Lake Champlain Basin is forested. There is an opportunity to integrate the needs of many SGCN that rely on a variety of forested habitat types in both large scale management plans and smaller plans that may address only one species, habitat type, or geographic area (e.g., Wildlife Management Area, a private forest tract) . Wildlife biologists and researchers should develop habitat management guidelines for forest stages important to SGCN that include patch size and distribution in the landscape, timing of management actions, and microhabitat characteristics. These guidelines should be considered by forest managers on public lands and made available to private forest owners interested in wildlife management. Some specific planning recommendations for species in forested habitats include:

- Develop a management plan that provides guidance on maintaining, enhancing, and restoring early successional forest/shrub habitat for the suite of early successional forest/shrubland birds. High priority species include Canada warbler, golden-winged warbler, and whip-poor-will.

- Investigate the feasibility to manage forests in the basin with controlled burning. Draft a fire management plan in accordance with these findings. This would benefit many SGCN, including deciduous forest birds, early successional forest/shrubland birds, and forest breeding raptors.

- Develop a management plan for high elevation birds, including high altitude conifer forest birds (i.e., Bicknell's thrush). The results of the State Wildlife Grant study on boreal forest birds should be incorporated into this work.

Aquatic Habitats

About 10% of the Lake Champlain Basin is classified as aquatic habitat. About 2% of this is classified as wetlands, and the remaining 8% is the 5,400 miles of rivers and streams, estimated 2,800 ponds and lakes of the Adirondacks, and of course, Lake Champlain itself. Many SGCN within this watershed rely on these critical aquatic habitats during some stage in their life cycle. It is important that these habitats and the species that depend upon them be incorporated into land use planning on both the landscape and local scale for conservation efforts to succeed. As with forested habitats, wildlife biologists and researchers should develop habitat management guidelines for wetland types important to SGCN that include patch size and distribution in the landscape, timing of management actions, and microhabitat characteristics. These guidelines should be considered by land managers on public lands and made available to private wetland owners interested in wildlife management. Some specific planning recommendations for species in aquatic habitats include:

- Continue participation in the North American Waterbird Plan, Bird Conservation Regional Plan, and other regional planning efforts. Focus on and refine recommendations for common loon and freshwater marsh nesting birds (American bittern, pied-billed grebe, black tern).

- Work with USFWS, USDA APHIS Wildlife Services, and State agencies on the development of the "second phase" of the population management plan for the Interior Great Lakes population of double-crested cormorants, including Lake Champlain. The plan should include the potential effects of cormorants on SGCN such as colonial-nesting herons (e.g., black-crowned night heron, cattle egret, great egret) and other island-nesting waterbirds, and how to alleviate negative effects before they limit populations of at-risk species and the unique wildlife habitats currently found on NYS Forest Preserve islands found in Lake Champlain that are currently unoccupied by cormorants.

- Continue to evaluate and update the goals, objectives, and strategies outlined in the Lake Champlain Basin Aquatic Nuisance Species Management Plan (2000) coordinated by Vermont Department of Environmental Conservation and DEC. The plan currently focuses on the invasive plants purple loosestrife, Eurasian watermilfoil, and water chestnut, and the invasive animals sea lamprey, zebra mussel, and alewife. Ensure that the needs of SGCN affected by these invasive plants and animals are addressed by this plan (e.g., freshwater bivalves).

- Public and private conservation partners should continue to coordinate and expand the development of a monitoring and control plan for invasive exotic species in wetlands (i.e., water chestnut, purple loosestrife, Phragmites australis) in the Adirondacks and Champlain Valley including guidelines for various control methods (e.g., mechanical control, chemical control, biological control), and the compatibility of these control measures with SGCN life history and habitat requirements. This planning effort could be incorporated into , or modeled after, the aforementioned Lake Champlain

Basin Aquatic Nuisance Species Management Plan (2000) or the currently planned development of a and should incorporate the needs of:

- Freshwater Marsh Nesting birds - American bittern, pied-billed grebe, black tern
- Freshwater Wetland Amphibians - western chorus frog
- Lake/River Reptiles - Eastern ribbon snake, wood turtle
- Uncommon Turtles of Wetlands - spotted turtle
- Vernal Pool Salamanders - blue-spotted salamander, Jefferson salamander

❖ Develop and implement a lake sturgeon management plan that continues efforts to return this species back to its full range and abundance. Threats that should be addressed include overexploitation of stocks, construction of dams that cut off spawning and nursery areas, and habitats degraded by run off from development and channelization. Target waters in this Basin would be tributary bays of Lake Champlain.

Open Upland Habitats

Only about 4% of the Lake Champlain Basin is grasslands, but over 11% is classified as open habitat (pasture, hay land, and row crops) that is potentially valuable if managed in a sustainable manner that considers the needs of grassland-dependent wildlife. Planning efforts for grassland habitats should focus on the regions within the basin with the highest concentrations of grasslands: the Champlain Valley (eastern Clinton County, eastern Essex County) and the northern extent of the Hudson Valley in central Washington County. This planning process should focus on both public and private lands and include the benefits of this habitat to grassland birds such as northern harrier, sedge wren, short-eared owl, and upland sandpiper. Results of local planning efforts should be integrated into the New York State Grassland Bird Management Plan being developed by DEC and others under the 2003 State Wildlife Grant.

❖ Complete the New York State Grassland Bird Management Plan currently being developed by DEC and others (State Wildlife Grant, 2003).

❖ As part of the grassland bird plan mentioned above, develop habitat management guidelines and action plans for priority focus grassland bird species. In addition, investigate the feasibility to manage grasslands in the basin with controlled burning. Draft a fire management plan in accordance with these findings.

❖ As part of the grassland bird plan mentioned above, develop a management plan specifically for the common nighthawk that includes potential conservation actions and strategies that address this species' unique dilemmas such as the loss of gravel rooftops for nesting.

❖ Work with public land managers, including NRCS, USFWS, DEC and others, to better direct funding and other resources to the highest priority areas and projects for grassland habitat management. The ability to focus funding sources in core priority grasslands will be of vital importance. If the funding sources from NRCS can not be adequately focused in priority areas, then this will cripple the ability to conserve the most critical grassland areas and will result in continued declines in grassland birds even within these focus areas.

Collisions

Anecdotal evidence and preliminary data gathering efforts have suggested that wildlife collisions with human-created structures (e.g., wind towers, cell towers, and power lines) can have significant population-level effects. The US Fish and Wildlife Service (USFWS) is currently investigating the effects of these types of structures on wildlife populations (specifically, migratory birds), but a more targeted effort should be made in the unique landscapes of the Lake Champlain Basin to determine the magnitude of this threat for SGCN based on land use and development trends (number and distribution of structures), human population distributions, and other characteristics unique to this Basin. Species of Greatest Conservation need that should be included in this action include migratory birds such as the Bicknell's Thrush and other bird species (early successional forest/shrubland birds, deciduous forest birds, forest breeding raptors) and bats (Indiana bat, small-footed bat, tree bats).

Land Protection Recommendations

This category of actions encompasses a variety of protection mechanisms such as easements, cooperative agreements, fee title acquisition, donations, development rights acquisition, and others. The type of protection should be determined by the interested parties based on their means and conservation goals. Interested parties may be one or more government entities or non-governmental organizations. For many of the following species and species groups, the first step will be to gather accurate information on where species are located within the Basin and the location and status of the critical habitats they rely upon.

A common threat to many SGCN in this basin is the loss of habitat due to anthropogenic changes like development (residential and commercial, roads, power lines), dredging, and wetland draining, and natural changes such as succession. These changes result in loss of habitat quantity and often disrupt the function of remaining habitat. Connections between patches of similar habitat types (or different yet complementary habitats) are needed for migration and dispersal. Isolated habitat patches do not allow for effective metapopulation dynamics and make species vulnerable to extirpation from a variety of causes. Reduction of patch size also results in increased negative edge effects, increased susceptibility to predation, reduction in population, and reduction in the types of species the patch can support. In addition, habitats fragmented by roads and power lines increase direct mortality of animals due to collisions.

FORESTED HABITATS

The acquisition of forested habitats in and around the Adirondack Park is a complex issue. DEC has spent extensive effort on the acquisition through fee title or conservation easement of forested habitat in the Adirondack Park. These acquisitions have been funded through annual allocations from the NYS Legislature via the Environmental Protection Fund (EPF). Efforts to continue to protect large, undisturbed tracts of forested habitats should continue.

- ❖ Conservation partners should direct funding for SGCN to the eastern and southern portion of the Lake Champlain Basin where development pressures pose a relatively greater threat to species of concern and their habitats. This includes the Champlain Valley south through the northern extent of the Hudson Valley and the northern Taconic Highlands.

Alternately, there are privately owned sites within the park that are very important to certain SGCN. Public and private organizations looking to protect habitat through acquisition or easement should review acquisition/easement proposals on a case-by-case basis to determine which projects are most beneficial to SGCN and their habitats independent of their relation to Park boundaries.

- ❖ Early Successional Forest/Shrubland Birds - Implement a Landowner Incentive Project for early successional birds that will fund conservation and creation of habitat for early successional forest/shrub birds. Target species include:
  - Golden-winged warbler - primarily second growth, but also brushy hillsides, old fields, and stream edges. Much of the focus on this species has centered on the possible negative consequences for golden-winged warblers when they interact with the more numerous blue-winged

warblers (hybridization, competition). The results of the 2003 and 2004 State Wildlife Grant studies investigating this issue should guide where and when habitat acquisition and/or restoration occur for this species. BBA data (2000-04) indicate confirmed and probable breeding sites for golden-wings throughout the Basin, with concentrations in the Champlain Valley from Washington County northward.

- Canada Warbler - deciduous woodlands and riparian thickets. BBA (2000-04) data indicate that this species is found from the Adirondack Park from Franklin through Warren County.
- Whip-poor-will - open woodlands, from moist lowland deciduous forests to montane forests and pine-oak woodlands. BBA data (200-04) indicate a strong affinity for the northern Hudson River corridor, north through Lake George and South Bay and the Champlain Valley.
- American woodcock - moist woodlands and early second growth, thickets along streams, abandoned fields for courtship. BBA (2000-04) observations for this species are spread throughout the Basin with heavy concentrations in northern Essex County through Clinton County; however, the Champlain Valley is also an important migratory corridor for this species as it heads to breeding grounds in Quebec in the spring and wintering grounds along the Atlantic Coast in the fall. Protecting habitats for this species in the Champlain corridor will also benefit other migratory birds.

❖ Forest Breeding Raptors - Secure habitats critical to species survival by acquisition of easements, or by other land protection mechanisms. Target species include:

- Long-eared Owl - coniferous and mixed coniferous-deciduous forests, especially near water. BBA (2000-04) data show breeding records for this species in central Essex County.

❖ High-altitude Conifer Forest Birds - the sole SGCN in this group is Bicknell's thrush. This relatively rare, forest interior species is often associated with the high peaks of the Adirondack Park (Essex County); however, BBA (2000-04) records exist from Warren County through Clinton and Franklin County. Key habitats include hemlock ravines and high elevation spruce-fir stands within a mosaic of northern hardwood forest types.

❖ Other moths - the noctuid moth, pine pinion moth, is found in rare pitch pine-heath barrens like those formed 12,000 years ago by the receding glacier at the Clintonville Pine Barrens (900 acres, Adirondack Nature Conservancy, Adirondack Land Trust) in the northeastern portion of the Adirondack Park. Pending further surveys, this may be one of the few places in the State that the pine pinion moth occurs. Conservation partners interested in conserving this species and other rare species of moth (e.g., Acadian swordgrass moth) should focus on occupied habitats in this region of the Basin (Clinton-Essex County border).

❖ Lizards - the sole SGCN in this group for this Basin is common five-lined skink. According to the New York State Herpetile Atlas (1990-99) there are two strongholds in this State for this species: the lower Hudson Valley and the southern Champlain Valley (northern Washington County, northeastern

Warren County, and southeastern Essex County). Key habitats include moist forests with abundant leaf litter, downed woody vegetation, and occasionally, rock outcrops.

- Woodland/Grassland Snakes - many of the den sites for snakes of conservation concern are on private lands. Secure habitats critical to species survival by acquisition of easements, or by other land protection mechanisms. The results of the 2003 and 2004 State Wildlife Grant work on high priority reptile and amphibian species should help guide acquisition projects. Target species include:

  - Timber rattlesnake - relatively undisturbed forested habitats (mixed coniferous/deciduous), and open woodlands with talus/rocky outcrops. New York State Herpetile Atlas (1990-99) data report the occurrence of this species in several blocks in northern Washington County, northeastern Warren County, and northeastern Essex County.

- Vernal Pool Salamanders - vernal pools, dotted across the forested landscape, form an extensive system of small, unregulated wetlands that provide critical wildlife habitat. This group serves as a good transition between "forested habitats" and the next habitat affiliation "freshwater wetlands", as vernal pool salamanders use both habitat types - vernal pools within forest stands and mineral soil wetlands. Securing habitats in large blocks that contain both forests and wetlands will be critical to the survival of this species group and many other SGCN. The results of the 2003 and 2004 State Wildlife Grant work on high priority reptile and amphibian species should help guide acquisition projects. Target vernal pool salamanders include:

  - Blue-spotted Salamander & Jefferson Salamander - New York State Herpetile Atlas (1990-99) data show records for these species in the Champlain Valley from Washington County north through Clinton County.

WETLANDS AND OTHER AQUATIC HABITATS

Freshwater wetland habitats are scattered throughout the Basin, with heavy concentrations in Clinton County in the northern Champlain Valley. Conservation partners interested in acquiring wetland habitats should focus their resources on wetlands that support high biodiversity, provide habitat for one or more rare or declining species, are under immediate threat of development/conversion, or have some other unique ecological characteristics. An example of a rare wetland ecotype within this Basin is the boreal peatland complex near Lake Clear in Franklin County. Spring Pond Bog Preserve, a 4,200-acre parcel acquired by The Nature Conservancy, contains the second largest expanse of peatland in New York State.

A possible mechanism for those looking to acquire wetlands in this Basin is the Lake Champlain Wetlands Acquisition Strategy. The Wetlands Acquisition Strategy is a four phase, multi-year strategy to permanently protect almost 9,000 acres of wetlands in the Basin. Phase 1 of the acquisition strategy was completed in 1997, and protected 3,500 acres. It was funded, in part by the North American Wetlands Conservation Act (NAWCA). Phase II of the strategy began in 1998, again funded by NAWCA and others. The Vermont Chapter of the Nature

Conservancy is coordinating the acquisition project. Partners include DEC, Lake Champlain Basin Program, the Adirondack and Eastern New York Chapters of the Nature Conservancy, Vermont Fish and Wildlife, VT ANR, other organizations such as Ducks Unlimited, and willing landowners. Specific recommendations for SGCN include:

- Freshwater Marsh Nesting Birds - Secure habitats critical to species survival by acquisition of easements, or by other land protection mechanisms. The results of the 2004 State Wildlife Grant work on marsh birds should help guide acquisition projects. Target species include:
  - American bittern - freshwater and brackish marshes with emergent vegetation. BBA (2000-04) data show concentrations of observations of this species in the Adirondacks (northern Warren and southern Essex counties) and the wetland complexes of Clinton County.
  - Pied-billed grebe - well vegetated lakes, ponds, and marshes. BBA (2000-04) observations for this species are spread throughout the Basin with several observations in eastern Clinton County.
  - Black tern - freshwater marshes, slough, wet meadows. BBA (2000-04) records are limited to the marshes of eastern Clinton County. Initially, acquisitions should focus on suitable habitats around Kings Bay Wildlife Management Area.

- Osprey - Pursue conservation easements or purchase of essential osprey habitat. Key habitats include wooded areas along lakes and rivers. BBA (2000-04) observations for this species are spread throughout the Basin from the lakes and ponds of the Adirondacks to the Champlain Valley

- Freshwater Wetland Amphibians - Secure habitats critical to species survival by acquisition of easements, or by other land protection mechanisms. The results of the 2003 and 2004 State Wildlife Grant work on high priority reptile and amphibian species should help guide acquisition projects. Target species include:

  - Western chorus frog - this species can be found in a variety of habitats including marshes, wet meadows, and other relatively open wetland habitats. Less frequently they can be found in fallow agricultural fields and wooded swamps. The New York State Herpetile Atlas (1990-99) effort observed this species in only three survey blocks in this Basin, two of these from the marshes of eastern Essex County.

- Uncommon Turtles of Wetlands - Secure habitats critical to species survival by acquisition of conservation easements for wetlands and adjacent uplands. The results of the 2003 and 2004 State Wildlife Grant work on high priority reptile and amphibian species should help guide acquisition projects. Target species include:
  - Spotted Turtle - marshy meadows, small bogs and swamps. This species was not observed in this Basin during the New York State Herpetile Atlas (1990-99), so land acquisitions for spotted turtles are contingent upon locating this species and its critical habitats following State Wildlife Grant and other survey efforts.

- Freshwater Bivalves - In key locations acquire development rights to protect water quality for listed mussel populations such as tributaries of Lake George

and Lake Champlain. High priority species in this Basin include the black sandshell. Acquisition efforts should coincide with zebra mussel monitoring efforts to protect critical habitats under threat from invasive exotic species.

GRASSLANDS

The lands owned by public agencies in the Basin are primarily forest and wetland. There is a need to acquire, through fee title or easements, grasslands, especially adjacent to existing protected grasslands. This will enable better management and protection of these habitats for grassland birds. Acquisitions should reflect the recommendations of priority grassland focus areas being developed by the New York State Grassland Bird Management Plan (State Wildlife Grant, 2003). Specific recommendations for SGCN include:

- Grassland Birds - Acquisitions focusing on grassland bird habitat should be directed toward protecting existing grasslands or acquiring and restoring grassland habitats within relatively close proximity to existing grasslands to avoid creating sink habitats. These efforts should focus on the regions within the basin with the highest concentrations of grasslands: the Champlain Valley (eastern Clinton County, eastern Essex County) and the northern extent of the Hudson Valley in central Washington County. Target species include:
  - Northern Harrier - open grasslands and grasslands adjacent to wetlands. BBA (2000-04) data indicate that this species is closely associated with the open habitat of the Champlain Valley from Washington through Clinton County.
  - Sedge Wren - grasslands and grassy uplands adjacent to wetlands with sedges. BBA (2000-04) observations for this species are limited to open habitats in central and northeastern Clinton County.
  - Short-eared owl - grasslands, meadows, and grassy uplands adjacent to marshes. During the BBA (2000-04) effort, this species was observed in only 16 blocks statewide, four of which were in this Basin. Short-eared owls were observed in the open habitats of eastern Clinton and Essex County (three blocks) and south-central Clinton County (one block).
  - Upland Sandpiper - grasslands, dry meadows and old fields with little woody vegetation. BBA (2000-04) observations for this species are restricted to the open habitats of northeastern Clinton County.

LIST OF POTENTIAL PROTECTION PRIORITIES

- Kings Bay WMA expansion (grasslands)
- Monty's Bay WMA expansion (emergent and forested wetlands, grasslands)
- Ausable Marsh and Wickham Marsh WMA expansion (Pine Barrens)
- Bulwagga Bay (emergent wetlands, forested wetlands)
- Gadway Sandstone Pavement Barrens*
- The Vly, Clinton County* (northern cedar swamp, grasslands)
- Lake Alice WMA expansion (forested wetlands, forested lands, grasslands)
- Cannon Corners Flat Rock* (black-spruce tamarack bog)
- Plains Road Barrens* (Pitch pine heath barrens)
- Trembleau Mountain *(Pitch pine heath barrens, pitch pine oak heath)
- Willsboro Bay Cliffs * (Peregrine Falcon protection)
- Champlain Valley-Essex * (red cedar woodland)
- Essex Station Sedge Marsh* (open grassland)

- Fort Ticonderoga Marsh and Lachute River Mouth (silver maple swamp, emergent marsh)
- Split Rock Wildway (a.k.a. Boquet Mountain Matrix Area; includes the Champlain Valley-Essex and Essex Station Sedge Marsh priority sites) (wetlands and forest)
- Westport Woods (forest)
- Altona Flatrock
- Fort Montgomery Wetlands
- Southern Lake Champlain Wetlands
- Mt. Discovery
- Boquet River
- Great Chazy River

* These items identified in the Adirondack Nature Conservancy & Land Trust's "Strategic Plan: Upper Champlain Valley Program" (December 3, 2003). Other listed items may have also been identified in both this plan and other documents of the DEC.

Management and Restoration Recommendations

Successful management and restoration activities will require a large scale cooperative effort among public and private stakeholders, where each organization contributes its strength to the management system. Partners must contribute a range of services from coordination to data collection, implementation, and monitoring/evaluation - so that habitat and species management goals can be achieved at the Basin level. DEC, the government entity tasked with conservation of the State's fish and wildlife resources, should take the lead in coordinating such an endeavor; however, stakeholders in this basin are fortunate to have several organizations that can partner with DEC to orchestrate such a large-scale effort. These organizations include the Lake Champlain Basin Program, Lake Champlain Fish and Wildlife Management Cooperative (New York, Vermont, and federal agencies), and USFWS Lake Champlain Ecosystem Team.

Human-Wildlife Interactions

- Uncommon turtles of wetlands - conduct a variety of habitat management activities where needed to preserve wetland suitability for spotted turtles. This species experiences significant road mortality when migrating from over-wintering to egg-laying locations. Develop and implement mitigation measures to manage turtle population losses to vehicular road kill.

- Vernal pool salamanders - Develop and implement measures to manage reductions of wetland habitat quality caused by off-road vehicles by restricting or prohibiting their use in sensitive habitats. High-priority species include blue-spotted and Jefferson salamanders.

- Continue to manage at-risk peregrine falcon nest sites by closing rock climbing routes during critical nesting periods.

- Indiana bat - work with public and private landowners to erect gates to regulate access at selected existing and newly discovered Indiana bat hibernacula.

Habitat Loss and Degradation

Forested Habitats

- Boreal forest birds - work with private landowners to implement land management strategies that favor spruce grouse, olive-sided flycatcher, bay-breasted warbler, and other species dependent on early successional boreal forests. Within this Basin this action should focus on high elevation areas of the Adirondack Park (portions of Essex County).
- Early successional forest/shrubland birds - increase the amount of early successional forest and shrub habitat on public and private land throughout the Basin through sound planned timber management. High priority species include golden-winged warbler, Canada warbler, and whip-poor-will.
- Forest breeding raptors - maintain appropriate breeding habitat for long-eared owls around occupied nest sites. BBA (2000-04) data show breeding records for this species in central Essex County.
- Lizards – Carefully manage timber stands in areas occupied by common five-lined skink. According to the New York State Herpetile Atlas records (DEC, 2005a) there are two strongholds in this State for this species: the lower Hudson Valley and the southern Champlain Valley (northern Washington

County, northeastern Warren County, and southeastern Essex County). Key habitats include moist forests with abundant leaf litter, downed woody vegetation, and occasionally, rock outcrops.

- Woodland/Grassland snakes - timber rattlesnakes prefer relatively undisturbed forested habitats (mixed coniferous/deciduous), and open woodlands with talus/rocky outcrops, so it is important to develop and implement mitigation measures to manage the adverse effects of habitat fragmentation. New York State Herpetile Atlas (1990-99) data report the occurrence of this species in several blocks in northern Washington County, northeastern Warren County, and northeastern Essex County.

Wetlands and Other Aquatic Habitats

There are thousands of lakes, ponds, creeks, and streams distributed across the Adirondacks. Management actions should focus on public and private lands that support high biodiversity, provide habitat for one or more rare or declining species, are under immediate threat of development or conversion, or have some other unique ecological characteristics.

A potential mechanism for those interested in restoring wetland habitats is the Lake Champlain Wetlands Restoration Project. This pilot project to restore drained wetlands in the Basin began in 1993. The program is administered through the USFWS Partners for Wildlife Program in partnership with the DEC, VT ANR, US EPA, and willing private landowners. The project provides funding and technical assistance to landowners for wetland restoration on their property. Specific recommendations to benefit SGCN include:

- Breeding waterfowl - install nest boxes to increase populations or productivity of common goldeneye in appropriate locations in the Adirondacks and the Champlain Valley. Also, maintain or increase abundance and suitability of emergent marsh habitats for breeding black ducks in the Adirondacks.

- Common loon - use artificial nesting platforms to improve nesting success on lakes that have no loons currently nesting and that lack natural islands, have poor shoreline nesting habitat, or fluctuating water levels. Where water-level control structures exist seek to maintain constant water levels during peak nesting period. Where they do not exist, prohibit water extraction from critical nesting habitats for anthropogenic activities. This should focus on nesting locations in the Adirondack Park.

- Freshwater marsh nesting birds - use the Farm Bill, USFWS Wildlife Habitat Incentives Program (WHIP) and Partners for Wildlife Programs, and DEC's Landowner Incentive Program to manage and restore marsh habitats on private lands. It is crucial to adapt wetland management practices throughout the Basin so they can simultaneously benefit waterfowl (common goldeneye, blue-winged teal, American black duck), marsh birds (American bitterns, pied-billed grebe, black tern), and other water birds. Also, where water-level control structures exist (typically on publicly- owned lands), maintain constant water levels during peak nesting period. Where they do not exist, prohibit water extraction from critical nesting habitats for anthropogenic activities.

- Osprey - nest platforms should be maintained and new ones placed on nesting locations in the Adirondack Park and Champlain Valley.

- Eastern sand darter - habitat losses and recommendations for restoration in the Poultney River, as studied in Vermont, should be applied as appropriate. The ultimate goal is to maintain and monitor secure, healthy, and self-sustaining populations of eastern sand darters in at least five separate systems.

- Lake Sturgeon - spawning habitat should be restored, where appropriate, in Lake Champlain tributaries.

- Atlantic salmon (landlocked) - restore access to historic spawning habitat in tributaries to Lake Champlain. Protect spawning habitat from sedimentation. Control the effects of sea lamprey on Lake Champlain's salmon population. Evaluate available strains for their potential for re-establishing salmon in Lake Champlain.

- Freshwater wetland amphibians - manage the variety of factors which might be limiting wetland habitat suitability for high priority amphibian species (western chorus frog). As with marsh birds, use the Farm Bill, USFWS Wildlife Habitat Incentives Program (WHIP) and Partners for Wildlife Programs, and DEC's Landowner Incentive Program to manage and restore marsh habitats on private lands in the eastern part of the Basin with the highest amphibian diversity and the direst threats.

- Lake/river reptiles - manage uplands adjacent to aquatic habitat in order to provide adequate and secure nesting habitat sites and to provide dispersal routes for migrating animals. High priority species include Eastern ribbonsnake and wood turtles.

- Uncommon turtles of wetlands - develop and implement mitigation strategies to manage adverse effects of habitat fragmentation. This includes conducting a variety of habitat management activities where needed, including management of vegetation succession in order to preserve wetland suitability for spotted turtles. Management actions should focus on occupied (and adjacent) habitats in the Basin.

- Freshwater bivalves - develop an outreach program to private landowners through DEC's Landowner Incentive Program to initiate projects to prevent or repair negative effects from land use on mussels and to restore degraded habitat areas to allow for recolonization or reintroduction of listed mussels.

Grasslands

Most of the grasslands in the Lake Champlain Basin are in private ownership. If management of this habitat type is to be successful, public and private agencies are going to have to work closely with private landowners to protect, restore and manage grassland habitats. Management and restoration actions should reflect the recommendations of priority grassland focus areas being developed by the

New York State Grassland Bird Management Plan (State Wildlife Grant, 2003). Specific recommendations for SGCN include:

- Grassland birds - increase the amount of grassland habitat on public and private land in regions within the basin with the highest concentrations of grasslands (Champlain Valley, portions of Washington County). As mentioned above, use the Farm Bill, USFWS Wildlife Habitat Incentives Program (WHIP) and Partners for Wildlife Programs, and DEC's Landowner Incentive Program to aid in this effort. High priority species include northern harrier, sedge wren, short-eared owl, and upland sandpiper.

- Common nighthawk - increase use of prescribed fire in natural fire-adapted communities. Where this species is found in human-altered habitats (e.g., suburban, urban environments), evaluate feasibility of artificial nest structures on roof tops.

INVASIVE SPECIES

- Reduce the spread and colonization of new sites by invasive exotic species (e.g., purple loosestrife), and where feasible, control invasive species which are known to have detrimental affects on aquatic wildlife through biological, chemical, or mechanical means. The location and method (biological vs. chemical vs. mechanical) will depend upon the exotic species being targeted, life history traits and management objectives for the SGCN to benefit from the action, scale of the infestation, and logistics (funding, cooperating partners, feasibility of using a particular method in a specific locale). This action should focus on:
  - Freshwater Marsh Nesting birds - American bittern, pied-billed grebe, black tern
  - Freshwater Wetland Amphibians - western chorus frog
  - Lake/River Reptiles - eastern ribbon snake, wood turtle
  - Uncommon Turtles of Wetlands - spotted turtle
  - Vernal Pool Salamanders - blue-spotted salamander, Jefferson salamander
  - Heritage strain brook trout - Native Adirondack strains of brook trout, referred to as Heritage strains, were historically abundant in head water lakes and ponds in the Champlain watershed. Competing and predacious non-native fishes have caused severe declines in their abundances. Where feasible and consistent with state land unit management plans, pond reclamations should be conducted to eliminate non-native fishes and restore brook trout. Natural barriers should be enhanced or man-made barriers constructed, at appropriate locations to prevent the spread/reintroduction of non-native fishes.
  - Round whitefish - competition and predation by non-native fishes is believed to be an important cause of the decline in round whitefish in the Adirondacks. Where feasible, pond reclamations should be conducted to eliminate non-native fishes. Natural barriers should be enhanced or man-made barriers constructed, at appropriate locations to prevent the spread of non-native fishes.
  - Champlain Canal - The Champlain Canal (and by extension, the Erie Canal) are vectors for introducing additional aquatic invasive species to the Champlain watershed. If viable techniques are identified to reduce or

prevent the spread of aquatic non-natives via the canals, they should be pursued.

- Based on the research and the monitoring/control plan to address the effects of exotic bivalves and crustaceans on freshwater bivalves (see "Data Collection" and "Planning" above), implement a management program for invasive species such as zebra mussel and other invasive mussel species.

DISRUPTED ECOLOGICAL PROCESSES

- Common loon - reduce predator caused breeding failure, where problematic, by increasing hunting or trapping opportunities. Evaluate the extent to which management actions can reduce nest and chick losses. This action should focus on nest sites in the Adirondack Park and will depend upon the ability of trained personnel to access important loon habitats, many of which may be on private lands or in remote wilderness areas.

- Deciduous/Mixed Forest Breeding Birds - manipulate habitat structure and composition through restoration and/or management (e.g., forest patch size, shape) to reduce nest losses to predators. Evaluate the extent to which management actions can reduce nest losses. This action should focus on areas within the Basin with highly fragmented forests and forest tracts under strong development pressures such as the southern Champlain Valley.

- Grassland Birds - manipulate habitat structure and composition through restoration and/or management (e.g., grassland patch size, shape) to reduce nest losses to predators. Evaluate the extent to which management actions can reduce nest losses. This action should focus on areas within the Basin with the highest concentration of grasslands under strong development pressures (the Champlain Valley, northern extent of the Hudson Valley). Highlight species include northern harrier, sedge wren, short-eared owl, and upland sandpiper.

- Freshwater marsh nesting birds - reduce predator caused breeding failure, where problematic, by increasing hunting or trapping opportunities and by manipulating habitat structure and composition through restoration and/or management (e.g., wetland size, shape) where feasible. Evaluate the extent to which management actions can reduce nest and chick losses. This action may be most easily accomplished on publicly owned wetlands, where appropriate, but if successful, should be expanded to private lands throughout the Basin. Highlight species include American bittern, pied-billed grebe, and black tern.

- Uncommon turtles of wetlands - reduce predator caused breeding failure, where problematic, by manipulating habitat structure and composition through restoration and/or management (e.g., wetland size, shape) where feasible. Evaluate the extent to which management actions can reduce egg losses. This action may be most easily accomplished on protected wetlands (publicly and privately owned wetlands in the Adirondacks and WMAs in the Champlain Valley), where appropriate, but if successful, should be expanded to private wetlands where species occur (e.g., spotted turtles).

- Vernal pool salamanders - develop and implement measures to manage reductions of wetland habitat quality and increased predation on adults,

young, and eggs caused by introductions of fish and other predatory species. Management actions should focus on habitats occupied by blue-spotted and Jefferson salamanders, primarily in the Champlain Valley.

HABITAT LOSS AND DEGRADATION

- Boreal forest birds - review DEC's wildfire management for Forest Preserve Lands. Determine if these guidelines can be applied to other lands. If they can, work with public and private land managers to execute fire management for boreal forest bird species such as spruce grouse, olive-sided flycatcher, bay-breasted warbler, and other species dependent on boreal forests. Within this Basin this action should focus on high elevation areas of the Adirondack Park (portions of Essex County).

- Early successional forest/shrubland birds - Maintain, restore, and enhance fire-adapted early successional ecosystems through the use of prescribed fire. This habitat type exists throughout the basin. Highlight species include golden-winged warbler, Canada warbler, and whip-poor-will.

- Grassland birds - restore habitat function and manipulate habitat structure and composition through mowing and prescribed fire. This action should focus on areas within the Basin with the highest concentration of grasslands under strong development pressures (Champlain Valley, northern extent of the Hudson Valley). Highlight species include northern harrier, sedge wren, short-eared owl, and upland sandpiper.

WATER QUALITY

- Freshwater marsh nesting birds - improve the quality of existing wetlands by minimizing draw downs during peak nesting periods and by installing vegetated buffers between developed sites (housing, commercial, agriculture, etc.) and adjacent marsh habitats to minimize the effects of runoff from these sites. Management actions should focus on occupied (and adjacent) habitats in the parts of the Basin with the highest concentrations of wetlands and/or that contain the highlight species American bittern, pied-billed grebe, and black tern.

- Freshwater wetland amphibians - manage the variety of factors which might be limiting wetland habitat suitability for resident amphibian species including management of toxicants, adverse hydrological alterations, and anthropogenic inputs of sediments. Highlight species includes western chorus frog. Management actions should focus on occupied (and adjacent) habitats in the parts of the Basin with the highest amphibian diversity and the direst threats (the northern Champlain Valley in wetlands along the Lake, and the southern Champlain Valley in northern Washington County and northeastern Warren County).

- Lake/river reptiles - Manage the variety of adverse influences which might reduce lake/river habitat suitability for reptiles of concern (eastern ribbonsnake and wood turtle) including management of toxicants and adverse

hydrological alterations. Management actions should focus on occupied (and adjacent) habitats in northern Washington and east-central Essex counties.

- Uncommon turtles of wetlands - Conduct a variety of habitat management activities where needed, including maintenance of hydrological regimes and curtailment of contaminant inputs in order to preserve wetland suitability for these species (e.g., spotted turtles). Management actions should focus on occupied (and adjacent) habitats in the Champlain Valley (Clinton through Washington County) and the Adirondacks.

- Freshwater bivalves - manage areas of important mussel populations, where identified, by controlling degradation factors (e.g. controlling livestock access, point source or non-point source pollution, flow alteration).

POPULATION RESTORATION

- Lake/river reptiles - pending the results of surveys for the presence of this species within the Lake Champlain Basin (see "Data Collection" above), employ restoration techniques for the spiny softshell at selected sites as needed, including captive breeding, head starting, nest protection, and repatriation/relocation strategies. Restoration efforts, if needed, should focus on suitable habitats in close proximity to locations where this species is observed.

- Woodland/grassland snakes - employ restoration techniques for timber rattlesnakes at selected sites as needed, including head starting and repatriation/relocation strategies. New York State Herpetile Atlas (1990-99) data report the occurrence of this species in several blocks in far eastern Essex County, northeastern Warren County, and northern Washington County. Restoration efforts should focus on suitable habitats in these areas.

- Round whitefish - pending the results of the 2003 State Wildlife Grant study on round whitefish in the Adirondacks, enhance remnant stocks of this species through artificial propagation and stocking of young in selected habitat appropriate waters.

- Freshwater bivalves - where appropriate, reintroduce listed mussels into appropriate habitat within their historic range. NYNHP element occurrence records for this species group in this Basin are found in the Champlain Valley (eastern Clinton and Essex counties through northern Washington County). Restoration efforts should focus on suitable aquatic habitats in these areas.

Information Dissemination Recommendations

The sharing of information between natural resource managers and public and private groups is one of the most powerful tools in wildlife conservation. It allows people to make informed decisions about activities that may help or harm SGCN. For example, land use objectives may conflict with the needs of wildlife. By providing accurate, complete information to stakeholders on a species (or a species group) and its critical habitats, we can begin to institute land use practices that have ecological objectives that are compatible with traditional economic and social objectives.

Information dissemination may take many forms including education and outreach programs, development of fact sheets, web site design and delivery, development and dissemination of best management practices, and technical guidance for land managers.

HUMAN-WILDLIFE INTERACTIONS

Human behavior that directly affects wildlife (e.g., direct or indirect harassment, uncontrolled collection and/or harvest, collisions, entanglement/impingement) can be mitigated through education and outreach. An informational campaign directed at a particular natural resource user group may be a more cost-effective and efficient method for exacting change than implementing a regulatory, legislative, or management action. Specific recommendations include:

- To reduce the detrimental affects of human disturbance on freshwater marsh nesting birds (i.e., American bittern, pied-billed grebe, and black tern), osprey, and peregrine falcons, develop signs and/or displays informing the public of the presence of these species, their respective threats and critical conservation issues, and the need for protection, and post where appropriate.

- Continue current efforts to improve public understanding of common loon conservation issues, including the effect of human disturbance on loon nesting success. Install, maintain, and repair interpretive signs at boat ramps, beaches, campgrounds and other public access points, particularly in the Adirondack Park. Produce and distribute informational brochures, posters, press releases and other educational materials. Provide educational programs to schools, lake associations and other groups.

- Provide technical guidance to State and private entities planning the siting and installation of tall structures (e.g., wind towers, cell towers, and power lines) that are likely to adversely effect populations of migrating birds and bats. The US Fish and Wildlife Service (USFWS) is currently investigating the effects of these types of structures on wildlife. Final guidelines developed by USFWS should be consulted when considering the placement and installation of wind towers, cell towers, etc. In addition, a pilot study funded by the 2004 State Wildlife Program will focus on landscape scale pathways of migratory birds and bats. This study currently focuses on western and central New York State, but when completed, could be expanded throughout the State. Ultimately, when key migratory pathways are discovered, this information should be disseminated to State and private planning groups and incorporated into the siting and installation of tall structures. Species of Greatest Conservation need that will benefit from this action include various migratory birds (early

successional forest/shrubland birds, deciduous forest birds, etc.) and bats (tree bats, Indiana bat).

- ❖ Enhance public education to limit killing, collection/translocation, and the (illegal) sale of herpetofauna in the pet trade. High priority species include:
  - Uncommon Turtles of Wetlands - spotted turtle, stinkpot, wood turtle
  - Woodland/Grassland Snakes - black ratsnake, northern black racer, smooth greensnake, timber rattlesnake

- ❖ Public misconceptions about reptiles, particularly snakes, may drive the killing and/or collection of these animals. Develop and educational campaign about the ecological benefits of snakes in an effort to encourage the public to abandon misconceptions about the menace/threat of woodland/grassland snakes. This could take the form of fact sheets, web-based educational modules geared to both adults and children, and popular magazine articles (e.g., DEC's *Conservationist* magazine). High priority species include black ratsnake, northern black racer, smooth greensnake, and timber rattlesnake.

INVASIVE SPECIES

- ❖ Address the negative effects of invasive exotic species on freshwater bivalves by developing signs for markets dealing in live bivalves, fish, and crustacea explaining the dangers of releasing exotic invasive animals into New York State.

- ❖ Support Federal and State legislation to control hazards of invasive species introduction as a result of ocean-going shipping entering and transiting New York State waters.

HABITAT LOSS

- ❖ In an effort to reduce habitat loss, develop a series of geographic information system (GIS)-based modules that help provide the public with the knowledge to appreciate and understand species of greatest conservation need and their habitats. The modules, with interactive maps embedded in appropriate sections of text, would focus on the fish, wildlife, and natural resources associated with the diverse landscapes and water bodies of the Lake Champlain Basin and the opportunities to observe and learn about them and the network of public lands owned and managed for natural resource conservation. Information on the natural history and ecology of SGCN and on management concerns for these species and their habitats should be included along with an efficient means to identify specific lands where New York State residents could participate in wildlife conservation opportunities.

- ❖ As the forests in New York are now predominantly even-aged northern hardwoods, an in the absence of natural disturbances, public reluctance to practice forestry may result in a homogenous forested landscape with relatively little structural and vegetative species diversity. This may be exacerbated by the tendency of landowners that do harvest trees to favor the same species. It is important to educate the public to the benefits and need for early successional forest management and restoration including even-aged forest stand management and the development of multiple seral stages across

a forested landscape. This educational program should focus on both public and private lands and include the benefits of this habitat to early successional forest/shrubland birds such as golden-winged warbler, Canada warbler, and whip-poor-will. Information should also be made available to public and private landowners to encourage land management strategies that favor boreal forest birds such as spruce grouse, olive-sided flycatcher, and other species dependent on early successional boreal forests.

- Provide information and technical guidance to utilities agencies to manage rights-of-way in a manner that will provide maximum benefit to early successional forest/shrubland birds such as those mentioned above.

INCOMPATIBLE AGRICULTURAL AND SILVICULTURAL PRACTICES

- Promote the establishment of buffer areas around agricultural fields and developments adjacent to marsh habitats. Species that would benefit from this action include freshwater wetland amphibians (i.e., northern cricket frog, Fowler's toad), freshwater marsh nesting birds (i.e., American bittern, pied-billed grebe, black tern), and various odonates.

- There are several SGCN that reside in forested habitats. When selecting a forest management regime (e.g., light thinning, partial harvest, clear cut, etc.) it may be difficult for public and private forest managers to coordinate the wide array of habitat needs of these species with their timber management goals. It is important that informational materials be developed for forest managers that explain the habitat needs of species that rely on various forested habitats (i.e., varying seral stages, vertical structure, tree and shrub species composition, etc.) and how to accommodate SGCN with seemingly competing habitat requirements. This information should then be available to land management partners developing/modifying best management practices (BMPs) in an effort to minimize the potential negative effects of traditional forestry practices on wildlife. A number of private NGO's and organizations are working on development of BMPs that would meet these needs. Funding should be directed toward the development of forest management BMPs for the following high-priority species:
  - Deciduous/Mixed Forest Breeding Birds - wood thrush
  - Early Successional Forest/Shrubland Birds - golden-winged warbler, Canada warbler, whip-poor-will
  - Forest Breeding Raptors - long-eared owl
  - Vernal Pool Salamanders - blue-spotted salamander, Jefferson's salamander
  - Woodland Snakes - timber rattlesnake
  - Tree Bats - Eastern red bat, hoary bat

- Provide information to farmers and grassland owners about the benefits of grasslands, threats to this habitat type, and species of conservation concern that use grasslands. Furthermore, provide information and technical guidance on how to incorporate wildlife management objectives into farming practices to maximize the benefits for wildlife (e.g., timing and frequency of mowing/haying, use of prescribed fire, Integrated Pest Management, etc.) while still allowing farmers to accomplish their harvest goals. These efforts

should focus on the regions within the basin with the highest concentrations of grasslands: the Champlain Valley (eastern Clinton County, eastern Essex County) and the northern extent of the Hudson Valley in central Washington County. This educational program should focus on both public and private lands and include the benefits of this habitat to grassland birds such as northern harrier, sedge wren, short-eared owl, and upland sandpiper, and other birds of open habitats such as common nighthawk.

Regulatory and Legislative Recommendations

Regulatory and legislative proposals will likely be made at the statewide level, although local governments may have opportunities to modify or create laws and regulations to enhance local protection of SGCN. For example, local zoning and land use policies can be used to discourage sprawl and habitat fragmentation.

HABITAT LOSS

- Pursue protection of wetlands less than 12.4 acres that provide habitat for herpetofauna of greatest conservation need through existing provisions for wetlands of 'unique local significance' under Article 24 of the Environmental Conservation Law (ECL). Upland buffers associated with these wetlands should reflect actual usage by foraging herpetofauna species. Priority species that will benefit from this action include freshwater wetland amphibians (i.e., western chorus frog), uncommon turtles of wetlands (i.e., spotted turtles), and vernal pool salamanders (i.e., Jefferson and blue-spotted salamanders). All water-dependent species and overall water quality would benefit from this protection.

- Review all wetland sites currently or historically used by endangered, threatened, or rapidly declining freshwater marsh nesting birds, regardless of wetland size. Wetlands locally important for these species need expanded protection either under Article 24 of the ECL or by local ordinance. Priority species include pied-billed grebe, king rail, least bittern, and American bittern.

- Identify and protect known common loon nesting areas with focus on the Adirondacks.

- Increase regional permit oversight of development and highway projects that may affect native freshwater bivalves.

HUMAN-WILDLIFE INTERACTIONS

- The best strategy for minimizing illegal collection of herpetofauna of conservation concern may be to designate them as protected species. Implement pending legislation which designates the following as protected game species:
  - Freshwater Wetland Amphibians - four-toed salamander
  - Lake/River Reptiles - eastern ribbonsnake, spiny softshell
  - Lizards - common five-lined skink
  - Uncommon Turtles of Wetlands - spotted turtle, stinkpot, wood turtle
  - Vernal Pool Salamanders - blue-spotted salamander, Jefferson salamander
  - Woodland/Grassland Snakes - black ratsnake, northern black racer, smooth greensnake, timber rattlesnake

INVASIVE SPECIES

- Implement the regulatory recommendations of the Governor's Invasive Species Task Force to control the introduction and distribution of invasive exotic species. Species that would benefit from this action include freshwater marsh nesting birds (i.e., American bittern, pied-billed grebe, black tern).

- Review existing regulations that control the importation of invasive species. Evaluate whether regulatory "gaps" exist relative to species which should be prohibited. Also assess the appropriateness of the penalties and the enforceability of the regulations.

- Develop a coordinated policy between DEC and other land use agencies, such as the APA, to plan and implement comprehensive sampling, inventory and reclamation of appropriate waters within the Adirondack Park.

DATA GAPS

For many SGCN, particularly invertebrate species, there is a lack of information on abundance, distribution, and population trends; however, preliminary data suggest that these species may warrant protective status. It is important to complete more thorough investigations into the population status, trends, and threats to these species to determine if regulatory action is needed.

- A comprehensive statewide inventory of odonates (dragonflies and damselflies) was selected for State Wildlife Grant funding in 2003. This project will document the current distribution of odonate species in New York State and direct more intensive sampling in selected habitats, areas with expected high odonate diversity, or habitats of rare species. The project will include general surveys conducted by volunteers as well as directed surveys that target specific species, habitats, or poorly known areas of the state. Recommendations for official state endangered, threatened, and special concern listing are an anticipated result of the statewide inventory. High priority species include:
  - Odonates of Rivers and Streams - American rubyspot, arrow clubtail, boreal snaketail, brook snaketail, rapids clubtail

Incentives

An incentive program geared towards private landowners will be a key first step in engaging the public about the importance of their lands to SGCN. So much of the critical habitats for these species exists on private lands that landowner cooperation will be the ultimate deciding factor on whether species declines can be halted. Their cooperation at the level needed for meaningful change will probably hinge on some form of enrollment process and financial and/or logistical support similar to that used in Farm Bill programs coordinated by USDA and NRCS, USFWS Wildlife Habitat Incentive Program (WHIP) and Partners for Wildlife Program, DEC Landowner Incentive Program, and various conservation programs administered by non-governmental organizations (e.g., local land trusts, The Nature Conservancy, Ducks Unlimited, Inc. etc.). Specific recommendations include:

- Cooperate with NYS farmers and grassland owners to establish the best possible nesting and foraging opportunities for grassland birds (i.e., northern harrier, sedge wren, short-eared owl, and upland sandpiper) and common nighthawk.

- Incentives focusing on grassland bird habitat should be directed toward protecting existing grasslands or restoring grassland habitats within relatively close proximity to existing grasslands to avoid creating sink habitats. These efforts should focus on the regions within the basin with the highest concentrations of grasslands.

- Conservation efforts to benefit common nighthawks should concentrate on areas where they are already known to breed. Breeding Bird Atlas (2000-04) breeding records are spread throughout the Basin, with probable breeding in several blocks from central Clinton County.

- Incentive-based programs are often associated with agricultural habitats, but they may be a valuable mechanism for addressing conservation concerns in other ecotypes. Conservation partners should cooperate with private landowners to encourage land management strategies that favor spruce grouse, olive-sided flycatcher, and other boreal forest birds.

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Tables and Figures

Tables

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Table 13: Approved State Wildlife Grant studies relevant to the Lake Camplain Basin.

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Figure 1: Multi-Resolution Land Classification map of the Lake Champlain Basin.