Description of the Basin

The Lake Erie Basin covers an area of approximately 2,300 square miles (1.5 million acres) in the far western portion of New York State. The entire Lake Erie Basin includes portions of Ontario, New York, Pennsylvania, Ohio, and Michigan, but in this report the basin is the section of the Lake Erie Basin in New York State. The basin spans 3 ecoregions: Great Lakes, Western Allegheny Plateau, and High Allegheny Plateau. The boundary between these ecoregions is physiographically distinct, with an abrupt escarpment between the Appalachian Plateau to the southeast and the Great Lakes Plain closer to Lake Erie. The largest rivers of the basin, with the exception of rivers in the northern portion like Tonawanda Creek, typically pass through steep-sided gorges in this escarpment. Four sub-watersheds are found in the Lake Erie Basin as defined by the U.S. Geological Survey's hydrologic unit code (HUC) system at the 8-digit scale. They are the Buffalo River in the central portion of the basin; Tonawanda Creek/Niagara River in the north; Cattaraugus Creek in the southeast; and Chautauqua Creek/Lake Erie in the southwest. The Niagara River drains a large part of western New York, and is the conduit for waters exiting the 4 Great Lakes upstream of Lake Ontario. Underlying bedrock geology is primarily calcareous shales and siltstones, while the surficial geology is primarily till in the Appalachian uplands and fine lacustrine sediments in the Lake Plain (NYNHP). Precipitation is high relative to other areas of the state due to lake effects. The major municipalities within the basin are Buffalo, Niagara Falls, and Dunkirk. There are all or part of 6 counties in the basin (Erie, Cattaraugus, Chautauqua, Genesee, Niagara, and Wyoming), and there was an estimated population of 1.4 million people basin-wide in 2000. Buffalo and Niagara Falls account for most of the basin's population and contain the largest concentration of heavy industry in New York. Heavy industry in the basin is no longer as significant as it was in former times, but there is still active industry in the area, and lingering effects from inactive sites are also still present. Both the Buffalo River and the Niagara River are designated as Areas of Concern in the Great Lakes Basin by the International Joint Commission.

The Lake Erie Basin varies from heavily developed areas in the west along the lake to suburban areas in the central portion and rural/agricultural in the east. Urban sprawl, both residential and commercial, is a significant issue in this basin. Fragmented forests are the primary land cover in the southeastern portion of the basin. The predominant land cover classifications are agricultural lands (46%) and deciduous and mixed forest (42% combined) lands, according to the U.S. Environmental Protection Agency's multi-resolution land classification (MRLC) map information (Lake Erie Table 1, Lake Erie Figure 1). Agricultural lands are classified as row crops or pasture/hay lands based on MRLC interpreted data. The MLRC national data distinguishes between natural grassland and old fields, hay, pasture, and row crops. There are no lands classified as natural grasslands in the basin. In NY, our pasture/hay lands and row crops are often referred to as grasslands by many management agencies, including DEC. Over 10% of the basin is classified as developed land. As land use changes, urban areas are expected to develop primarily on agricultural land (Ohio River Basin Commission, 1980). The data provided here relates to the entire Lake Erie basin. However, where available, more detailed information is provided below for the lake itself, and the 4 sub-watersheds mentioned above.

Lake Erie is the smallest of the Great Lakes and has the second smallest surface area. The New York portion of the lake consists of 380,000 acres and is the shallowest of the Great Lakes. Compared to the rest of the Great Lakes, Lake Erie warms quickly in the spring and summer and cools quickly in the fall. However, compared to most other lakes in New York, Lake Erie actually warms and cools slowly. The shallowness and warmer temperatures of Lake Erie make it the most biologically productive of the Great Lakes. Lake Erie also has the fastest flushing rate of any of the Great Lakes (2.6 years), compared to Lake Ontario which is estimated at 6.0 years and Lake Superior which is estimated at 191 years. Lake Erie is naturally divided into 3 basins, eastern, western and central, with the NY portion of the lake being in the eastern basin. The eastern basin is the deepest, with an average depth of 82 feet, and a maximum depth of 210 feet. Because of this depth, the eastern basin provides cold-water habitat which supports a cold-water fish community. In comparison, the western basin is very shallow; average depth is 24 feet and maximum depth is 62 feet. The central basin is fairly uniform in depth, with the average being 60 feet and the maximum being 82 feet. The central and eastern basins thermally stratify every year, while stratification in the shallow western basin is very rare and very brief if it does occur. Stratification affects the dynamics and physical characteristics of the lake, which cause it to function as virtually 3 separate lakes. Lake Erie's long, narrow orientation parallels the direction of the prevailing southwest winds. These strong winds cause extreme seiches, or oscillation of the water surface, creating a difference in water depth as high as 14 feet between Toledo and Buffalo. Overall, current and wave patterns are complex and highly variable in Lake Erie, and as a result of such wave action and ice scouring, the NY side of Lake Erie is a very high energy shoreline.

Eighty percent of the Lake's total water inflow comes from the Detroit River; 11% is from precipitation; and the remaining 9% comes from direct tributaries to the lake from Michigan, Ohio, Pennsylvania, New York, and Ontario. Approximately 1/3rd of the total population of the Great Lakes basin resides within the Lake Erie watershed. This equals 11.6 million people and 17 large metropolitan areas. The lake provides drinking water for 11 million people. Obviously, with such urbanization, industrialization, and agricultural lands, Lake Erie is the most highly stressed of the Great Lakes.

The following descriptions of the sub-watersheds or portions thereof were taken from the 2002 NYNHP document *Lake Erie Gorges Biodiversity Inventory and Landscape Integrity Analysis* summarizing the study.

The northwest portion of the Buffalo River sub-watershed includes much of the Buffalo metropolitan area, while the southern and eastern portions are dominated by agricultural and forested lands. The study area was focused on the less developed southeastern portion of the sub-watershed, which accounts for approximately 70% of its total land area. The study area was further refined into 5 separate 11-digit resolution HUC sub-watersheds from west to east; Big Sister Creek; Little Sister Creek; Eighteenmile Creek; Cazenovia Creek; and Buffalo Creek. Big Sister Creek is approximately 32,000 acres with moderate forest cover (45%). The main stem has low water quality. The middle reaches are shallow, rocky streams with a bordering shale cliff and talus community. Other tributaries in the middle to upper portions of the watershed include marsh headwater streams in fair condition and with little to no forest buffer. A beech-maple mesic

forest in fairly good condition and Great Lakes dunes are found at the mouth of the creek. Little Sister Creek watershed is only about 6,000 acres with 52% forest cover. It flows through a suburban setting within a successional southern hardwood forest matrix. The main stem is of low quality and a short, rocky, headwater stream. Eighteenmile Creek watershed is large (77,000 acres), with 49% forest cover. It is heavily logged and cleared for agriculture, with many residential and urban areas throughout. Dominant second-growth forest types include beech-maple mesic forest, maple-basswood rich mesic forest, and successional northern and southern hardwoods. Good quality is found in headwater streams, the middle sections are in residential and commercial areas, and the lower sections are of moderate to low quality. Cazenovia Creek is large (89,000 acres) with 56% forest cover. Fair to good examples of headwater streams are present due to several contiguous forest areas of moderate size. The lower reaches are small, moderately deep midreach streams, and the main stem is of moderate quality. Buffalo Creek is large (93,000 acres) with 42% forest cover. Rocky headwater streams of high quality are found in the more heavily forested upper portions of the watershed. The lower reaches are wide, shallow midreach streams with an adjacent floodplain forest.

The Cattaraugus Creek sub-watershed was studied as a whole at the 8-digit HUC scale. It encompasses about 358,000 acres, or 550 square miles, in the southeast portion of the Lake Erie basin. It has moderately high (56%) natural cover, including forests, wetlands, and open water. The remainder of the sub-watershed is primarily agricultural lands with scattered rural residential sites and small villages. The main matrix forests include both climax (hemlock-northern hardwood forest; beech-maple mesic forest; maple-basswood forest) and successional (mix of northern and southern hardwoods) forest types. There are a large number of intermittent and perennial streams flowing into the main stem of the Cattaraugus Creek. This main stem is about 50 miles long, the largest river in the gorge study area. There are high quality riverine communities in small headwater streams with intact forests, and more affected larger streams from upstream agricultural runoff in the lower part of the watershed.

The Chautauqua Creek sub-watershed is located in the southwestern portion of the Lake Erie basin. The study area was focused on the less developed eastern portion of the sub-watershed, which accounts for approximately 50% of the total land area. There are several small metropolitan areas along Lake Erie, but the rest of the sub-watershed is comprised mostly of agricultural and forested lands. The study area was further refined into 8 separate 11-digit HUC watersheds from south to north: Twentymile Creek; Belson Creek; Chautauqua Creek; Little Chautauqua Creek; Little Canadaway Creek; Canadaway Creek; Walnut Creek; and Silver Creek. The Twentymile Creek-Belson Creek sub-watershed is fairly small, covering an area of 21,000 acres with relatively high forest cover (68%). The watershed is primarily comprised of agricultural lands and successional forests, with residential areas prevalent in the lower half. The Chautauqua Creek - Little Chautauqua Creek watershed, with about 23,000 acres, is of moderate size. It has relatively high forest cover (73%), which is a mix of selectively-logged climax forests and successional hardwoods. Agricultural fields are primarily located in the western portion of the sub-watershed, adjacent to Lake Erie. Chautauqua Creek is about 15 miles long, while the Little Chautauqua Creek is approximately 7 miles in length. Little Canadaway watershed is small with 4,300

acres, 68% of which are forest cover. The upper reaches are fair to good quality shallow rocky headwater streams with primarily bedrock reaches and good forest buffer. Fifty-six percent of the 26,000 acres comprising the Canadaway Creek Watershed are in forest cover. The middle reaches consist of shallow rocky headwater streams with cobble or bedrock substrate. The upper portion of the watershed is of good quality; the main stem of Canadaway Creek is of moderate quality. Walnut Creek Watershed covers 17,000 acres with 57% forest cover. The main stem is a rocky headwater stream. The lower reaches contain shale cliff and talus communities bordered by a narrow forest buffer and surrounded by agricultural lands. Silver Creek Watershed is also 17,000 acres with about 50% forest cover. Like Walnut Creek, the main stem is a rocky headwater stream, but with uncertain quality. The middle and lower reaches contain shale cliff and talus communities bordered by a narrow forest buffer.

The Tonawanda Creek/Niagara River sub-watershed, which was not included in the gorge study, is in the northeastern part of the basin and has several unique features and an interesting geological history. Tonawanda Creek, which flows into the Niagara River to the east of Grand Island, runs through relatively flat and poorly drained lowland, the site of the former Glacial Lake Tonawanda. This area contains significant wetland habitat, including large areas of emergent marsh habitat at the Tonawanda WMA (the majority of which is within the sub-watershed), which are used by SGCN freshwater marsh nesting birds and other species. A portion of the sub-watershed has also been designated as “grassland wildlife zone” by a consortium of the agencies and organizations active in grassland conservation in New York, led by Audubon New York. These zones are being developed to focus conservation efforts and spending for grassland bird populations and their habitat. At 102 miles in length, Tonawanda Creek has a main channel longer than Cattaraugus Creek (67 miles long), the other large tributary in the basin. Even though the streambed characteristics are similar to those in the Buffalo River sub-watershed, the zoogeographic history is quite different, and as a result, several unique fish and mussel species occur here. For example, one of the smallest sub-watersheds north of Tonawanda Creek (Cayuga/Bergholtz Creek - 11 miles long), has historically served as a refugium for some Midwestern species that have not been found elsewhere in the basin. The Erie Canal, which runs from the Niagara River to the Hudson River, follows the path of the Tonawanda Creek until the town of Pendleton, where it breaks off and heads north to Lockport before continuing eastward. The canal provides water to certain basin tributaries, thereby affecting water quantity and quality. The Tonawanda plain lies between two east-west ridges, the Niagara Escarpment to the north and the Onondaga Escarpment to the south. These escarpments provide unique rocky wooded forest habitat, and the associated vernal pools at the base of the escarpments provide critical habitat for blue spotted complex and spotted salamanders. The former species and its associated hybrids are listed as one of the most critical SGCN in the basin. The Onondaga Escarpment runs along the northern shoreline of Lake Erie and then travels east in the basin through the towns of Amherst, Clarence, and Newstead. In western NY, the Niagara Escarpment is primarily located in the SW Lake Ontario Basin, but in the Erie Basin the Niagara Escarpment is the cliff over which the Niagara River flows to create Niagara Falls. Over time, the falls have eroded the escarpment south toward Lake Erie, resulting in the formation of the 7 mile long Niagara Gorge downstream of the falls. The Niagara River upstream of Niagara Falls is 32 miles

long, and contains some weedy and shallow habitat, and has extensive shoreline because the large Grand Island is entirely on the American side of the international border with Canada. The approximately 15 mile section downstream of Niagara Falls is swifter and deeper. The Niagara Power Project, which generates large amounts of hydroelectric power, results in significant daily water level fluctuations with effects to the habitat along the upper and lower Niagara River. The Lewiston Reservoir, which is a component of the Niagara Power Project, is a large body of water in the sub-watershed, but because of large water level fluctuations on a daily basis, the reservoir provides minimal habitat value. Niagara Falls serves as a major natural barrier to fish passage and prevents fish from traveling upstream from Lake Ontario to Lake Erie via the Niagara River (the artificial Welland Canal in Ontario, however, connects the two great lakes). On portions of the Niagara River and in the Buffalo Harbor, common tern, one of the most critical SGCN in the Lake Erie Basin, nest on manmade structures such as breakwalls and water intake structures.

There are 16 state parks in the basin, all in DEC region 9 (Lake Erie Table 2). Buckhorn Island, Joseph Davis, and Knox Farm State parks provide upland habitats for many SGCN. Buckhorn Island and Knox Farm provide important wetland habitat. Knox Farm State Park also provides grassland habitat. Acreage estimates were only provided for Buckhorn Island and Knox Farm.

There are approximately 8,353 acres in 5 DEC wildlife management areas (WMA) in the basin (Lake Erie Table 3). They range in size from 56 acres to over 5,700 acres, and are located in DEC Region 9. These WMAs provide multiple habitats for fish and wildlife, including upland and wetland systems. These lands should include habitat management regimes for SCGN. There are 10 state forests in the Lake Erie basin that total 24,841 acres; prime areas for protection and management of multiple species.

There are also some county, city or town properties in the basin that provide significant habitat for species of greatest conservation need (SGCN); for example, several of the Erie County Parks provide potential habitat, and Tift Nature Preserve, which was originally purchased by the City of a Buffalo for a landfill and is now a department of the Buffalo Museum of Science, contains 246 acres of wildlife habitat near downtown Buffalo. SGCN habitat can also be found on land governed by the Seneca Nation of Indians, including the Cattaraugus Reservation and the Tonawanda Reservation (a portion of the Tonawanda reservation is in the basin), and on Tuscarora Nation reservation land. Protected lands owned by non-governmental organizations (NGO) such as the Nature Conservancy, which owns lands in the Zoar Valley Area, and the Western NY Land Conservancy, are also key SGCN habitat areas.

There are also other areas of land in the basin that are protected by means other than ownership by a government agency or NGO. For example, some privately owned lands are protected by a conservation easement or are under a formal cooperative agreement through programs offered by organizations like the USDA, NRCS and FWS.

There are 5 state designated critical environmental areas (CEA) in the basin, all in DEC Region 9 (Lake Erie Table 4). CEAs are traditionally designated by DEC to protect drinking water supplies. These may be either surface waters or ground

water aquifers. Other government bodies may designate CEAs for other reasons, such as to protect wetlands, wooded properties, steeply sloped areas, designated open space, and lands within 100 feet of major waterways. In the Lake Erie Basin, 2 CEAs are designated to preserve wildlife and green areas (Cayuga Creek and John Stiglmeier Park), while 18 Mile Creek protects exceptional or unique character. Approved criteria for the other 2 CEAs in the basin were not provided.

There are 17 areas designated as significant coastal fish and wildlife habitat by the New York Department of State in the Lake Erie Basin (Lake Erie Table 5). Together, they comprise over 8,000 acres that provide habitat to SGCN found in the basin.

Five areas have been designated within the Lake Erie Basin as draft Important Bird Areas (IBA) by Audubon (Lake Erie Table 6), totaling over 115,000 acres. The Dunkirk Harbor/Point Gratiot IBA is located in Chautauqua County. It was designated for the common tern, a species at risk, and congregation of gulls, waterfowl, and red-breasted merganser. It is located on Lake Erie's southeastern shoreline with beaches and bluffs. The harbor is kept ice-free during winter by a power plant that discharges warm water. This proves attractive for gulls, ducks, and other waterbirds. It is also a well-known migratory stopover site for a great diversity of land bird species.

The Niagara River Corridor IBA is located in Niagara and Erie counties, and was designated for species at risk (common tern), waterfowl congregation areas and shrub/scrub habitat. This corridor includes 32 miles of the Niagara River from Lake Erie to Lake Ontario. The Niagara River annually supports one of the world's highest concentrations of gulls. The habitats along the river edge support an exceptional diversity of migratory songbirds during spring and fall migrations. This site is listed in the 2002 New York State Open Space Conservation Plan (OSP) as a priority acquisition. Protection of the remaining wetland, forest, and shrub habitats along the shoreline is a priority to protect SGCN.

The Ripley Hawk Watch IBA is located in Chautauqua County, and was designated for spring congregations of raptors. It is a mosaic of generally lowland forests, pastures, agricultural fields, and vineyards. Regular and more comprehensive monitoring of spring hawk numbers should continue. The Tifft Nature Preserve IBA is located in Erie County. It was designated for species at risk (least bittern, pied-billed grebe). Once a landfill, this site now includes a 75-acre cattail marsh with open water ponds, and a 50-acre upland mound with grasslands. This site represents exceptional bird diversity for its size. This site is listed in the 2002 OSP as a priority acquisition. The focus of the preserve is research and education to ensure biological integrity of the site.

Wheeler's Gulf IBA is located in Chautauqua County. It was designated because it provides habitat for the cerulean warbler, a species at risk. Mature forests on both sides of a steep valley with a beaver pond dominate the site. Beech-hemlock forests are on the south-facing slope, while oak-hickory forests occur on the north-facing slope. This site supports an unusual diversity of breeding birds for the region. Efforts should be made to acquire conservation easements or fee titles for the land.

There are 117 state classified inactive hazardous waste sites in the basin, the second highest concentration of waste sites in the state. Most of these sites are in Buffalo, Niagara Falls, and Tonawanda. All the sites range in classification from Class 2 to Class 5, with 39% being Class 4, those that are properly closed but require continued management. Thirty-eight percent are Class 2 sites that pose a significant threat to the public health or environment and require action. Class 3 sites (18%) do not present a significant threat to public health or the environment. One of the more highly publicized hazardous waste sites in New York history was Love Canal near Niagara Falls in the Cayuga/Bergholtz Creek sub-watershed.

Critical Habitats of the Basin and the Species That Use Them

DEC staff members who compiled the SGCN information in the State Wildlife Grants 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 subsystem level was extracted from the database. The resulting aquatic and terrestrial habitats are summarized in Lake Erie Tables 7 and 8. The last column of the table indicates the number of species that indicated the System-Subsystem as critical habitat. 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". There are 4 aquatic habitat systems that support 99 species in the Lake Erie basin (lacustrine, palustrine, riverine, and subterranean), which are further refined into 16 subsystems. Within the terrestrial habitat system are 4 subsystems that support 87 SGCN in this 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 be found in Appendix B. These critical habitats are not a comprehensive listing of all the habitat associations found in the basin, rather it is a subset of the habitats deemed critical to SGCN that occur in the basin (Lake Erie Tables 7 and 8). In addition, a single species may require multiple habitats throughout its life cycle, so total of the final columns may exceed the 142 SGCN that presently or historically occurred in the basin.

According to the NYNHP Lake Erie Gorge study, the matrix forests in the basin before settlement are thought to have had flat to rolling topography and deep soils. There are maple-basswood rich mesic forests in the lake plain of the Great Lakes ecoregion, beech-maple mesic forest and hemlock-northern hardwood forest in the High Allegheny Plateau ecoregion, and rich mesophytic forest and hemlock-northern hardwood forest in the Western Allegheny Plateau ecoregion. Based on original survey records, up to 14 distinct forest community types may have occurred in the Lake Erie basin. Today, remnants of these matrix communities can be found in about 30,000 acres of contiguous forested areas unbounded by roads. Patches of other forest types characteristic of local conditions are also found in contiguous forested areas.

Numerous streams drain the Lake Erie Basin. The most intact are those in less agriculturally productive, more acidic, and hilly upper parts of the basin. The most degraded streams tend to be in high agricultural areas in the lower portions of the basin, especially near population centers.

Overall trends in the basin

The Nature Conservancy recently assessed the landscape condition of New York via a watershed approach. Six indicators of watershed condition were used in the analysis: population density; road density; protected lands; dam density; natural land cover; and interior forest cover (Stratton and Seleen, 2003). The landscape condition of the Lake Erie Basin is rated as quite poor, second only to western Long Island. Landscape condition tends to be better in the Cattaraugus Creek and Chautauqua Creek sub-watersheds, with condition declining in the highly developed Buffalo and Niagara Falls metropolitan areas. Correspondingly, the predicted water quality of the basin, based on percent forest cover and impervious surface, is rated as heavily impacted near Buffalo, and somewhat impacted to good in the eastern basin, when compared to the rest of the state. This is directly correlated to the high percentage of developed land (11%) and relatively high human population.

As noted previously, agricultural lands constitute an average of 46% of the Lake Erie Basin. The Tonawanda/Niagara River sub-watershed contains a major grassland wildlife zone as defined by the U.S. Department of Agriculture, and is contiguous to one of the most important grassland areas of the state in the Southwest Lake Ontario basin. Also, the NYNHP considers the Tonawanda/Niagara sub-watershed and most of the Chautauqua Creek sub-watershed as having high grassland related biodiversity areas.

According to DEC data, wetland types of the Appalachian highlands (a portion of which is in the basin) during the 1990s were 59% forested, 22% shrub, 11% emergent, and 8% open water. These wetland areas, totaling 446,000 acres, provide critical habitat for many SGCN in the basin. Wetland types of the Great Lakes plain (a portion of which is in the basin) during the 1990s were 67% forested, 21% shrub, 8% emergent, and 3% open water. The total acreage of wetlands in the lake plain is 942,000. Though there has been an overall gain in total wetland area in both the Appalachian Highlands and the lake plain, there have been losses of shrub and emergent marsh systems. This area of the state contains a high amount of wetlands when compared to the rest of New York. Therefore, wetland conservation in this basin should be considered a priority.

NYNHP's database indicates the Lake Erie basin is biologically diverse for a number of taxa groups that are tracked by the program: mollusks, crustacea, insects, and fish. Lake Erie Table 9 provides a summary of species diversity by comparing the number of SGCN found in the Lake Erie basin to the total number of SGCN statewide: herpetofauna and birds are particularly noted. Studies of biodiversity should continue in the basin in order to assess SGCN and their habitats and recommend appropriate conservation actions.

As mentioned previously, the goal of the NYNHP Lake Erie Gorges study was to prioritize large scale sites surrounding gorges based on the best chance for conserving biodiversity. The primary focus was on large-scale functional landscapes with relatively high integrity. The secondary focus was an assessment of the quality of large streams in the gorges. As a result of the preliminary watershed analysis, 4 priority watersheds were chosen for community inventory efforts, out of the 14 11-digit HUC watersheds previously mentioned. The priority

watersheds were: Cattaraugus Creek, Chautauqua Creek, Twentymile Creek, and Eighteenmile Creek. These watersheds appear to have the most intact terrestrial and aquatic landscapes, which are described below.

The forest matrix in portions of Cattaraugus Creek, Chautauqua Creek, and Twentymile Creek consists of hemlock-northern hardwood and rich mesophytic forests on the slopes and shoulders of the gorges. Patches of mature forests with trees up to 525 years old and 150 feet tall were also found at all 3 sites. The hemlock-northern hardwood areas have high tree species diversity (19 species) and 78 native species in the herb layer. The rich mesophytic forests are characterized by a canopy with a large number of co-dominant trees (up to 18 species) and a sparse but diverse herb layer. The Cattaraugus Creek area contains the largest stands of mature forests, followed by Chautauqua Creek Gorge, then Twentymile Creek Gulf. Open Canopy Riverside and Valley Slope Communities support a good diversity of plant and animal species, especially herbaceous plants and insects. The diversity in these communities is a function of the orientation of the gorges, including variations in moisture and shading, water levels in the main rivers, and the presence of seeps and waterfalls. Large, high quality shale cliff and talus communities are found in all 4 gorge sites surveyed. The substrate is a mix of pebble-gravel size shale and bedrock, and slopes average 75 degrees. Vegetation is sparse on dry cliff faces. Riverside sand/gravel bars are found in Cattaraugus Creek and Chautauqua Creek Gorges. Trees and shrubs are very sparse, while herbs are more prevalent. This community type has both wet and dry zones due to variable water flows. Cobble shores and Calcareous Shoreline Outcrop communities have similar definitions. Palustrine communities in the study area are globally rare rich fens. These fens are relatively small compared to others in New York, but they have good landscape condition. If their hydrology is maintained and invasive species controlled, it is expected that these fens will remain in good condition.

Riverine aquatic communities in the study area include large streams, headwater streams, rocky headwater streams, intermittent streams, and springs. Large streams are primarily midreach streams from 3rd to 6th order in this area, with good to excellent species diversity and few local effects. They are somewhat cool, slightly to moderately turbid, slightly basic, and low gradient streams with patterns of riffle, run, and pool sections. Headwater streams are both perennial and intermittent. Little is known about these streams, but the intact forest areas and relatively few road crossings suggest good condition.

Rocky headwater streams are the rocky portions of headwater streams, characterized by alternating riffle and pool sections. These streams are generally 1st to 3rd order, flashy, and have low flows. Intermittent streams tend to have excellent landscape position, tend to have excellent conditions, and may be fairly diverse. They are generally very shallow, very narrow, cool, slightly to moderately turbid, and flashy. Springs are typically on steep slopes, at a consistent source of water, and have uniform cool temperatures year round.

There are 104 SGCN that currently occur in the basin and 38 species that historically occurred in the basin but are now believed to be extirpated (Lake Erie Tables 10-11). Of those 104 SGCN currently occurring in the basin, it is believed that the populations of 34 species are decreasing, 8 are increasing, 8 are stable, and 54 are of unknown status. Given the fact that 30% of the species have been

lost in this basin, priority must be given to conserving the remaining species in the Lake Erie Basin.

According to the CWCS Planning Database, 17 mollusks, 5 birds, 8 fish, 5 mammals, 1 herp, and 6 insects of greatest conservation need that historically occurred in the basin are no longer found there. There are some species, such as bigeye chub, black redhorse, redfin shiner, longear sunfish, cobblestone tiger beetle, devil crawfish, slippershell mussel, Wabash pigtoe, and threeridge that are found in very limited distribution statewide. One of these species, slippershell, only occurs in the Lake Erie basin, and the rest are found only in 1 other basin statewide.

Lake Erie and the upper Niagara River historically contained 98 fish taxa, of which 84 are native. Eight of these have since become extirpated in this watershed. The excessive eutrophication of 50 years ago has been moderated, and summertime die offs of fish and blue-green algae are no longer annual events. The human population of the Lake Erie basin has declined since the 1950s, and this trend is expected to continue. The basin currently is 11% developed, primarily in the Buffalo and Niagara Falls area. Development over 10% is considered high enough to cause effects on aquatic habitat, which is what we are seeing in the Lake Erie basin. A remnant of the heavy period of industrialization is the second heaviest concentration of inactive hazardous waste sites in New York.

Land use in the basin has shifted from predominantly agricultural before 1900 (86%) to a period of intense industrialization beginning in the early 1900s. Today the basin is 45% agricultural, primarily in the Tonawanda Creek sub-watershed. Reduction of agricultural land results in loss of grasslands used for haying and pasture. The nature of the remaining agriculture has changed as well. Cropland diversity has decreased as row crop monocultures have become the dominant agricultural land use practice. As smaller farms have been consolidated into larger units, monocultures have become more expansive. 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 Erie basin is 42% deciduous and mixed forest especially in the Cattaraugus Creek sub-watershed. Increases in mature secondary growth forest cover have been accompanying the decline in agricultural acreage in this basin and statewide. Not surprisingly, early successional forest/shrubland birds are declining across the state. Approximately half of forest breeding birds are either stable or increasing, as forests mature in this basin. Zoar Valley, within the Cattaraugus sub-watershed, has a fairly large area of late-successional forest, as do Chautauqua Creek Gorge and Twentymile Creek Gulf, though to a lesser extent. These forests provide unique habitat that is not common across the state.

Emergent marshes in the Appalachian Highlands have declined significantly since the 1900s. Wetlands in the entire region increased by 3,000 acres between the 1980s and 1990s according to DEC Bureau of Habitat information on statewide wetland trends. However, the acreage of shrub swamp decreased by 5,000 acres and the acreage of emergent marsh decreased by 16,000 acres in that same

period. The net gain in total acreage in that decade came from increases in open water and forested wetland, which increased by 7,000 and 17,000 acres, respectively. This trend is also obvious in the Lake Plains. A 67% increase in forested wetlands and a 3% increase in open water wetlands accompanied a 21% and 8% decrease in shrub and emergent marsh wetlands, respectively. Not surprisingly, populations of freshwater marsh nesting birds, grassland birds, lizards, and salamanders in the Lake Erie basin are generally in decline.

Aquatic habitats in Lake Erie and the Niagara River have improved significantly due to pollution abatement. Water quality in Lake Erie is no longer hyper-eutrophic. However, daily water level fluctuations resulting from the operation of the Niagara Power Project have had effects on the habitat along the upper and lower Niagara River. Potential effects range from dewatering of fish and amphibian spawning and nursery areas, desiccation of benthic macroinvertebrates and an increase in predation during low water periods.

Water quality in inland aquatic and riparian habitats has improved due to a reduction in point-source municipal and industrial pollutants by the construction of better waste water treatment systems. However, non-point sources (NPS) of pollution, altered hydrology from storm water management, riparian corridor degradation, river/stream channel manipulation and exotic species invasions are now a larger component of the threats to water and aquatic habitat quality.

Threats

General Discussion

Of all the Great Lakes, Lake Erie is exposed to the greatest stress from urbanization, industrialization, and agriculture. It receives the largest amount of effluent from sewage treatment plants, and is most subjected to sediment loading. It was also the first Great Lake to have a serious eutrophication problem. Contaminants from industry such as mercury, polychlorinated biphenyls (PCB), chlordane, polycyclic aromatic hydrocarbons (PAH), and lead cause impairments across the basin. Approximately 132 non-native invasive species (NIS) are found in the Lake Erie basin, including: algae (20 species), submerged plants (8 species), marsh plants (39 species), trees/shrubs (5 species), disease pathogens (3 species), mollusks (12 species), oligochaetes (9 species), crustaceans (9 species) other invertebrates (4 species), and fishes (23 species). The 20th century saw an increase in NIS due to the shift from solid to water ballast in cargo ships and the opening of the St. Lawrence Seaway in 1959. The corridor between Lake Huron and Lake Erie is known as 1 of the 4 invasion "hot spots." These areas constitute less than 6% of the total Great Lakes water surface area, but account for more than 2 of the NIS (LaMP, 2004).

The above stressors affect the basin in many ways. In the more densely populated areas of the basin, degraded water quality from nutrients and toxic substances and habitat destruction are of greater magnitude and are related to residential, commercial and industrial development. Critical pollutants have been discovered in high concentrations in fish tissues and sediments. The diversity of invertebrates has markedly decreased in the wave-washed zone of the shoreline since the 1970s. The average water temperature of the Lake has risen over the past 18 years and is expected to continue rising, affecting the aquatic ecosystem. Blue-green algae, some of which are toxic to wildlife, are blooming in certain places at different times of the year. Since 1999 there have been annual die-offs of fish, fish-eating birds, and mudpuppies, most of which were caused by type-E botulism (LaMP, 2004).

The Lake Erie LaMP identifies habitat loss and degradation as one of the top three stressors in the Basin. Human alteration of the landscape, as evidenced by loss of forests, wetlands, grasslands, and changing hydrology, has significantly affected fish and wildlife populations, biotic processes, and ecological function. Fish habitat in tributaries to the lake, coastal wetlands, and nearshore areas are impaired, but are still surprisingly diverse. More than 80% of coastal wetlands have been lost; and those that remain are degraded. Aquatic and benthic habitats are also degraded.

The New York Natural Heritage Program identifies threats and disturbances to the 3 dominant ecosystems in the gorge study area: matrix forests, stream systems, and wetland complexes. Poor forestry practices are the primary threat to matrix forests. Other disturbances are caused by fragmentation of forests by second home development, expanding road networks, and tree diseases. Siltation, chemical pollutants, and geomorphologic changes, due to human land use, are the major threats to stream systems. Removal of riparian buffer strips, all terrain vehicle (ATV) use, invasive species, fragmentation of forest buffers, and new dams

or road crossings further degrade streams in the Lake Erie basin. In areas of the basin dominated by agriculture, fertilizer, pesticide, herbicide runoff, and soil erosion are of significant threats. Wetlands are affected by loss of forest buffers, exotic plants, and altered hydrology.

Specific Threats to SGCN

The most frequently cited threat to both aquatic and terrestrial species groups occurring in the Lake Erie Basin was outright loss of habitat via conversion to a human dominated land use. This threat includes hardening of the landscape with buildings and roads, but can also include activities like land clearing and wetland draining for agriculture and mining. Complicating the picture is habitat function that is provided by agricultural lands in the northern basin at this time. Pasture and hay lands provide a surrogate for natural grasslands in the Great Lakes Plateau ecoregion. When managed appropriately, these agricultural uses may actually be beneficial to wildlife. But when agricultural management activities like mowing of hayfields occurs at the wrong time of year, grassland nesting species may be disturbed or killed. Mature forests in the southern portions of the basin provide a unique habitat complex for SGCN. Such areas are rare throughout the state, and tend to be fairly small. The mature forest complex in the Cattaraugus Creek sub-watershed is considered to be the second largest contiguous mature forest area in western New York, behind Allegany State Park.

Toxic contaminants were listed as the second most common threat to terrestrial and aquatic species in the basin. Degradation of water quality, which may include contaminants, was the third most common threat listed to aquatic species groups in the basin. Fish consumption advisories are in effect for several major water bodies, including the Barge Canal and lower Tonawanda Creek, the Buffalo River and Harbor, and the Niagara River (DEC, 2002).

Pesticide use on agricultural lands is of concern to herpetofauna, insects, mussels and freshwater crustacea. Agricultural pesticides are generally non-specific in their action, meaning that they can kill off benign and beneficial invertebrate species as well as the target pests. Amphibians are also particularly susceptible to pesticides and other toxins.

Degradation of water quality also comes from soil erosion and runoff, nutrient-induced algal blooms, and reduced dissolved oxygen caused by excessive algae decay or increased temperatures. On-site septic systems were a major source of water quality impairment cited in the 1996 DEC Priority Waterbodies List for the Niagara River and Tonawanda Creek sub-watersheds, respectively. Due to the highly industrialized Buffalo and Niagara Falls area, mercury, PCBs, chlordane, total PAHs, and lead are affecting the fish and wildlife resources of the Basin.

Atmospheric deposition is a significant statewide issue because NY State is downwind from major mid-western sources of airborne pollution. Atmospheric deposition results in mercury increases in waters of the basin, and has serious implications for forest health.

Human disturbance is considered a significant threat to both aquatic and terrestrial species in the Lake Erie basin. The development of roads and utility rights-of-way directly affects the number of species struck by cars on roads and colliding with power lines, cell towers, and wind towers. In the aquatic arena,

collisions can also occur with boats and personal water craft, and entrainment and impingement of aquatic species can occur at hydroelectric plants. Both terrestrial and aquatic SGCN are affected by illegal or unregulated harvest by humans.

Daily water level fluctuations resulting from the operation of the Niagara Power Project up to 1.5 feet per day on the upper river and up to 12 feet per day on the lower river have had effects on the habitat along the upper and lower Niagara River. Water fluctuations have the greatest effect in the 0 to 15 foot depth zone. Potential effects range are dewatering of fish and amphibian spawning and nursery areas, desiccation of benthic macroinvertebrates, desiccation and exposure of submerged and emergent aquatic plants, flooding of turtle and bird nests and increased exposure to predation during low water periods.

Exotic species have threatened the Great Lakes since Europeans first settled in the region. Since the 1800s, more than 140 exotic aquatic organisms of all types, including plants, fish, algae and mollusks, have become established in the Great Lakes. As human activity has increased in the Great Lakes watershed, the rate of introduction of exotic species has increased. More than one-third of the organisms have been introduced in the past 30 years, a surge coinciding with the opening of the St. Lawrence Seaway.

Several exotic and/or invasive species are a significant concern to SGCN in the basin. In addition, diseases, in particular type E botulism in Lakes Erie and Ontario, are another potential threat to certain SGCN. Exotic/invasive species and diseases in the basin that pose a significant threat to SGCN include:

CRUSTACEANS:

- Exotic Spiny water flea (*Bythotrephes cederstroemi*) and fish hook water flea (*Cercopagis pengoi*) compete with and prey on native zooplankton species. Its sharp spine makes it extremely hard for fish to eat. These species have induced changes at all trophic levels where found.
- Rusty crayfish (*Orconectes rusticus*) are prolific and can severely reduce lake and stream vegetation, depriving native fish and their prey of cover and food. They also reduce native crayfish populations.

FISH:

- Common carp (*Cyprinus carpio*) degrade shallow lakes by causing excessive turbidity, which can lead to declines in waterfowl and important native fish species.
- Ruffe (*Gymnocephalus cernuus*) can displace other species in newly invaded areas is due to its high reproductive rate, its feeding efficiency across a wide range of environmental conditions, and characteristics such as sharp spines on their gill covers, dorsal and anal fins that may discourage would be predators.
- White perch (*Morone americana*) are native to Atlantic coastal regions and invaded the Great Lakes through the Erie and Welland canals in 1950. Prolific competitors of native Great Lakes fish species, white perch are believed to have the potential to cause declines of Great Lakes walleye populations.
- Sea lamprey (*Petromyzon marinus*) is a predaceous, eel-like fish that has contributed greatly to the decline of whitefish and lake trout in the Great Lakes. Since 1956, the governments of the United States and Canada, working jointly through the Great Lakes Fishery Commission, have implemented a successful sea lamprey control program.

- Alewife (*Alosa pseudoharengus*) reduces zooplankton biomass due to grazing and competes with native forage fish, which in turn appears to induce thiamine deficiencies in salmonids.
- Round goby (*Neogobius melanostomus*) is a bottom-dwelling fish that competes for spawning sites and other habitat with native fish like mottled sculpin, logperch and darters. Round goby thrive in the Great Lakes Basin because they are aggressive, voracious feeders which can forage in total darkness. Goby can survive in degraded water conditions, and spawn more often and over a longer period than native fish. Round goby have shown a rapid range expansion through the Great Lakes.

MOLLUSKS:

- Zebra mussels (*Dreissena polymorpha*) and (*Dreissena bugensis*) have spread to all of the Great Lakes and waterways in many states, as well as Ontario and Quebec. Zebra mussels compete with native mussels and reduce phytoplankton biomass. This has induced changes at all trophic levels in Lake Erie. Diving ducks and freshwater drum eat zebra mussels, but will not significantly control them.

PLANTS:

- Purple loosestrife (*Lythrum salicaria*) can form dense, impenetrable stands that are unsuitable as cover, food or nesting sites for a wide range of native wetland animals, including ducks, geese, rails, bitterns, muskrats, frogs, toads and turtles. Adults can disperse 2 million seeds annually and there is a lack of effective predators in North America. Recently, however, several host specific European insects have been released as a long-term biological control in North America.
- Common reed (*Phragmites australis*) can in some circumstances, particularly in disturbed areas, become invasive and out-compete other plant species resulting in a degraded system with negative effects on some wildlife species, including several SGCN.
  Curly-leaf pondweed (*Potamogeton crispus*) is an exotic plant that forms surface mats that interfere with aquatic recreation. The plant usually drops to the lake bottom by early July. Curly-leaf pondweed was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. It was accidentally introduced along with the common carp.
- Eurasian watermilfoil (*Myriophyllum spicatum*) was accidentally introduced from Europe. In nutrient-rich lakes it can form thick underwater stands and vast mats at the water's surface. In shallow areas the plant can interfere with boating, fishing, and swimming. The plant's floating canopy can crowd out important native water plants. A key factor in the plant's success is its ability to reproduce through stem fragmentation and underground runners. In some lakes the plant appears to coexist with native flora but little is known how these plants affect fish and other aquatic animals.
- Flowering rush (*Butomus umbellatus*) is a perennial plant from Europe and Asia that was introduced as an ornamental plant. It grows in shallow areas of lakes as an emergent, and as a submersed form in water up to 10 feet deep. Its dense stands crowd out native species like bulrush. The emergent form has pink, umbellate-shaped flowers, and is three feet tall with triangular-shaped stems.

BIRDS:
Mute swan (*Cygnus olor*) displaces other waterbirds, including SGCN, with its aggressive behavior and reduces the amount of submerged aquatic vegetation available for native wildlife.

DISEASE:
Type E botulism, a disease caused by *Clostridium botulinum* bacteria, has been recognized as a major cause of mortality in migratory birds since the 1900s. Although type C botulism has caused the die-off of thousands of waterfowl (especially ducks) across the western United States, type E botulism has been mainly restricted to fish-eating birds in the Great Lakes. Other outbreaks of type E have sporadically occurred in Alaska, Florida and California, and periodic outbreaks have occurred in Lake Michigan and Lake Huron over a 20-year period beginning in 1964. From 1999 through 2004, a large die-off of waterbirds occurred in Lake Erie. In 2001, a large die-off of benthic fishes like sheepshead occurred along the shores, followed in the fall by another die-off of fish-eating birds. Fish and waterbird mortality events were documented on Lake Ontario in 2002 through 2004. Type E botulism was isolated in each of these outbreaks.

Priority Issues in basin

The priority issues in this basin have been discussed in the sections above.

Vision, Goals and Objectives for the Basin

Vision

The Lake Erie Basin will continue to have unique habitat types that support healthy populations of SGCN. The urban areas of this basin have suffered negative environmental effects of a similar magnitude as Long Island and New York City, as evidenced by landscape condition and predicted water quality. Yet the basin has unique habitat types not found in other areas of the state which support many SGCN. Therefore, the primary goal for the Lake Erie Basin is to ensure the quantity and quality of essential habitats via the following:

Goals and Objectives

- Determine the current and historical extent of grasslands, mature forests, early successional forest and shrub, deciduous/mixed forest cover, and wetlands in the basin. Conduct habitat mosaic planning and set target goals for these habitat types (e.g.; protect X acres of mature forest, double the amount of early successional forest and shrub habitat; maintain X acres of wetlands).

- Assess the current condition of these habitat types in the Tonawanda/Niagara River sub-watershed and near-shore areas of Lake Erie. This will complement the biodiversity assessment done the NYNHP in the gorge areas of the basin.

- Determine locations and monitor trends of SGCN in the basin.

- Protect and maintain existing, functional core areas of mature forests.

- Maintain stream systems by protecting intact gorge landscapes and riparian buffers.

- Reduce pollution and siltation runoff into streams and tributaries.

- Protect and maintain Lake Erie and Niagara River near shore habitat and natural shoreline habitat, including beds of submerged and emergent aquatic vegetation.

- Improve connectivity and habitat function of protected areas in the basin.

- Restore priority habitats affected by land use practices.

- Prevent further introductions of aquatic and terrestrial non-native invasive species.

- Monitor the quality and quantity of habitats on a 10-year rotational cycle.

- Identify specific threats to SGCN in order to prioritize habitat protection and restoration efforts.

- Pursue opportunities to acquire and/or protect habitat for SGCN.

- Explore opportunities for restoration of extirpated species.

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 Habitats

AGRICULTURE AND GRASSLANDS

In some parts of the basin, trends in modern farm operations toward increased field size and loss of adjacent edge habitat negatively affect some wildlife species, but can actually benefit some grassland songbird species that require large areas of contiguous grassland. Additionally, farm management practices such as conventional tillage, may have negative consequences such as loss of food source, like waste grain and wheat seeds from post-harvest fields, and increased soil erosion and loss of cover. Large row-crop monocultures and decreased crop diversity negatively affect wildlife and their habitats in agriculturally dominated ecosystems. Agriculture also has possible effects on freshwater fish and bivalves through pesticide runoff and loss of riparian areas.

- Specific recommendations for grassland birds include a recommendation to evaluate the effects of specific farming and management practices on productivity of grassland birds. Specific investigations should include: timing and frequency of mowing; intensity of grazing; comparative effects of management regimes like mowing, haying, and prescribed fire; and buffer strip characteristics. The highest priority species are Henslow's sparrow, upland sandpiper, Northern harrier, sedge wren and short-eared owl.

- Specific recommendations for freshwater bivalves include a recommendation to evaluate the effects of specific farming and management practices on the survival of freshwater bivalves. Specific investigations should include the effects of intensity of grazing, buffer strip characteristics and siltation on productivity and survival. The highest priority species are Wabash pigtoe, threeridge and slippershell mussel.

FOREST AND RIPARIAN HABITAT

Sustainable timber harvest is a way to manage habitat for forest dwelling species. With proper forest management, such as proper erosion control, detrimental effects on other wildlife can be minimized. Specific management techniques for many SGCN do not yet exist.

- Specific recommendations for forest breeding raptors include a recommendation to experiment with different management techniques in order to provide the critical habitat needs of this suite of species. Investigations may include different cutting regimes, different buffer

distances, and fire management for forest breeding raptors. The highest priority species is long-eared owl.

- Specific recommendations for freshwater fish and bivalves include a recommendation to experiment with different management techniques in order to provide the critical habitat needs of this suite of species. Investigations may include different cutting regimes, different buffer distances, and adherence to best management techniques. The highest priority species are Wabash pigtoe, threeridge and slippershell mussel and redfin shiner.

FRAGMENTATION

Fragmentation and loss of habitats in the basin is a common threat to several species groups. There are many issues that influence the effects and severity of fragmentation on given species groups. These include patch size and shape, edge effects, and connectivity of remaining habitat patches.

Juxtaposition of wetland and grassland habitats has been shown to positively influence wildlife species diversity. Portions of this basin contain significant amounts of both habitat types and provide opportunities for landscape management of species that depend on these systems.

Fragmentation is a threat to aquatic species as well. Altered hydrology in the watershed prevents or affects migration and dispersal of a variety of aquatic species including freshwater fish and bivalves. Isolated populations are more vulnerable to extirpation by both natural and anthropogenic events.

- Specific recommendation for freshwater fish and bivalves is to locate dams and other hydrological alterations in order to identify areas for possible restoration activities.

- Specific recommendations for freshwater marsh nesting birds and grassland birds include demographic studies to identify source and sink populations, and metapopulation dynamics, focusing on survival, age at first breeding, recruitment, and dispersal. Controlled experiments to identify management actions effective in producing suitable habitat and nest selection should also be conducted, including artificial nest platforms to increase nest success or densities of black tern. Invasive species that may affect marsh birds need to be identified. The most critical species for freshwater marsh nesting birds are pied-billed grebe, American bittern, black tern, king rail, and least bittern. The most critical species for grassland birds are Henslow's sparrow, sedge wren, upland sandpiper, northern harrier, and short-eared owl.

- Specific recommendations for freshwater bivalves include investigations into the flow requirements of freshwater bivalves and modeling the effects of flow changes both in volume and timing. Additional research is needed on population dynamics of listed mussel species (including connectivity and genetic distinctiveness of populations and subpopulations) and controlling exotic bivalve species. The most critical species within this group are slippershell mussel and threeridge.

- A specific recommendation for early successional forest/shrubland birds is to monitor status and trends of golden-winged warbler and blue-winged warbler in areas common to both species and in areas along the front of the blue-winged warbler invasion. Also, develop guidelines for habitat management for golden-winged warbler, and research into causes for declines of Canada warbler and potential for forestry practices to be beneficial by opening up the canopy and promoting ground growth and thickets. The effects of viburnum leaf beetle on applicable habitats and species utilizing them also need to be determined. The most critical species within this group are golden-winged warbler, whip-poor-will, and Canada warbler. The ruffed-grouse, also a SGCN early successional forest/shrubland bird, can also be monitored, with well established methods, as a good indicator of early forest succession.

- Specific recommendations for beach and island ground-nesting birds include recommendations to explore opportunities for future habitat creation and maintenance. The most critical (and only) species within this group is the common tern. Currently, in the Lake Erie Basin the only nesting habitat for common tern is on manmade structures (breakwalls, water intake structures, and other), and these structures require labor intensive annual maintenance activities (replacement of gravel, chick shelters and fencing).

  - Investigate the use of man made anchored rafts for use as common tern nesting habitat.

  - Explore the possibility of making permanent improvements to existing structures currently used as nesting habitat for common tern.

- A specific recommendation for riparian tiger beetles is to research invasion by non-native plants, such as *Polygonum cuspidatum* and *Lythrum salicaria*, in riparian areas, and to determine where barrier mitigation could be undertaken to restore suitable habitat. The most critical species within this group is a tiger beetle (*Cicindela ancocisconensis*) and a cobblestone tiger beetle (*Cicindela marginipennis*).

- A specific recommendation for other butterflies is to determine precise habitat needs of all life stages, ascertain food plants, and determine the relationship between food availability and species numbers. The most critical species within this group is southern grizzled skipper.

HUMAN-WILDLIFE INTERACTIONS

Human effects on species and their habitats is a threat to 4 species groups in the basin. Human disturbance may be caused by collisions with structures, illegal or unregulated harvest, entanglement, entrainment, and impingement.

- A specific recommendation for forest breeding raptors is to monitor wind farms for mortality. The most critical species within this group is long-eared owl. Also see related recommendation in the planning section of the report.

- A specific recommendation for riparian tiger beetles is to research threats due to development. The most critical (and only) species within this group is a tiger beetle (*Cicindela ancocisconensis*) and a cobblestone tiger beetle (*Cicindela marginipennis*).

- A specific recommendation for beach and island ground-nesting birds includes assessing degree and location of human disturbance. The most critical (and only) species within this group is common tern.

- A specific recommendation for freshwater fish is to research threats due to entrainment and impingement at hydroelectric plants. The most critical species within this group are lake sturgeon and mooneye.

INTERSPECIFIC INTERACTIONS

Interspecific interactions are a common threat to 4 species groups in a number of taxa. Such interactions result in loss of host species, disrupted predator/prey cycles, competition for life support from non-natives species or species in places or numbers not historically found, detrimental hybridization, and parasites.

- A specific recommendation for freshwater marsh nesting birds is to investigate diet and nutrition in relation to breeding habitat quality and prey populations. The most critical species within this group are pied-billed grebe and American bittern.

- A specific recommendation for lake/river reptiles is to document life history parameters, including predator/prey relationships. The most critical species within the lake/river reptiles group are Eastern ribbonsnake, queen snake, and wood turtle.

- Specific recommendations for early successional forest/shrubland birds are to monitor status and trends and develop habitat management guidelines for golden-winged warblers, including those techniques that can favor golden-wings over blue-wings. The most critical species within this group are Canada warbler, golden-winged warbler, and whip-poor-will.

- A specific recommendation for other butterflies is to identify exotic competitor species and determine how best to control these exotics without harming butterfly populations. The most critical species within this group is southern grizzled skipper.

- A specific recommendation for freshwater fish and bivalves is to document predator/prey relationships with invasive species and habitat loss resulting from invasive species expansion. The most critical species within this group are lake sturgeon, Wabash pigtoe, and slippershell mussel.

- A specific recommendation is to support research into the Type E botulism cycle in Lake Erie and effects from botulism on populations of SGCN that use the lake, including common loon, long-tailed duck, and lake sturgeon.

Data Collection Recommendations for SGCN

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 most critical species. Only those most critical species not yet identified in text will be listed here within each group; the reader can refer to previous sections for most

critical species already identified. The research items are listed below by species group. This type of data collection will address multiple threats to many species.

CONTAMINANTS

Contaminant monitoring in fauna is recommended for 8 species in 3 taxa. As outlined in the Threats section above, contaminants (pathogens, metals, PCBs) and pesticides are of concern in this basin. Due to the high agricultural land use in this basin, monitoring the effects of pesticides on sensitive species is warranted, especially since these species may occur adjacent to or near agricultural lands.

- Specific recommendations for freshwater marsh nesting birds include a recommendation to periodically monitor the levels of contaminants in marsh birds and their eggs to assess trends and determine effects on eggshell thinning, behavioral modification, chick development, nesting success, and juvenile survival. One possible way to gather this information is to sample more common species, such as American coot and red-winged blackbird, which use the same habitats as SGCN marsh birds. The highest priority species within this group are pied-billed grebe, American bittern, black tern, king rail, and least bittern.

- Specific recommendations for freshwater bivalves and freshwater fish include a recommendation to research effects of pesticides and other chemicals, including ammonia, on all life stages of freshwater bivalves: sperm/egg, glochidia, larva, and adults. The highest priority species within this group are slippershell mussel and threeridge.

- Specific recommendations for other butterflies include a recommendation to determine the sensitivity of species to chemical formulations, particularly diflubenzuron and other common agricultural pesticides, and the effect of BTK used in Gypsy moth spraying on butterflies. The highest priority species within this group is southern grizzled skipper.

- A specific recommendation for freshwater fish is to review current fish sampling programs to ensure they are adequate for contaminant monitoring for SGCN freshwater fish.

BEACH AND ISLAND GROUND-NESTING BIRDS

- Survey population status of common tern annually at known breeding locations.

EARLY SUCCESSIONAL FOREST/SHRUBLAND BIRDS

- Complete an inventory and analysis for most critical species that identifies core habitats within the basin.

- Monitor trends of all species.

- Develop a long term monitoring program for golden-winged warblers.

- Encourage full completion of Breeding Bird Survey routes.

FRESHWATER MARSH NESTING BIRDS

- Initiate a baseline population survey to determine abundance and distribution. Refine monitoring techniques to better detect population trends.

- Inventory breeding sites and map at a coarse scale to select key monitoring locations. Analyze habitats at multiple scales to better understand characteristic important to nest site selection. Identify key migratory staging, molting, and wintering areas.

- Investigate aspects of life history such as mate selection, coloniality, dispersal, and foraging habits.

- Conduct studies of habitat use, prey availability, and diet at migratory staging, molting, and wintering areas to assess threats and limiting factors.

GRASSLAND BIRDS

- Complete an inventory of potential grassland habitat including species present, distribution, and relative abundance of priority species. Develop and implement monitoring program to supplement BBS for grassland bird species to determine population trends and evaluate effectiveness of conservation efforts in the basin. This effort has already been initiated by a New York State grassland bird group led by Audubon New York.

LONGEAR SUNFISH, MOONEYE, REDFIN SHINER, EASTERN SAND DARTER, LAKE STURGEON AND PIRATE PERCH

- Continue surveys to understand current distributions.

- Evaluate Lake Erie and Cattaraugus Creek mooneye populations and critical habitats.

- Determine the status of redfin shiner in New York, especially in the Tonawanda Creek and Niagara River area. Research threats to habitats and populations.

- Determine if habitat for pirate perch in Cayuga/Bergholtz Creeks is suitable.

- Evaluate Lake Erie lake sturgeon populations and critical habitats and lake sturgeon spawning downstream of Niagara Falls.

LAKE/RIVER REPTILES

- Document life history parameters specific to this species in NY including age and sex ratios, longevity, age at sexual maturity, survivorship of young, predator-prey relationships, and wetland-upland habitat requirements.

- Periodically resurvey areas of known occurrence to detect population trends.

- Develop standardized habitat and population survey protocols to document the character, quality, and extent of occupied habitat.

UNCOMMON TURTLES OF WETLANDS (THE MOST CRITICAL SPECIES ARE BLANDING'S TURTLE AND SPOTTED TURTLE)

- Develop standardized habitat and population survey protocols to document the character, quality, and extent of occupied habitat
- Determine significance of specific threats to populations of uncommon turtles of wetlands and develop management recommendations to address significant threats
- Periodically resurvey areas of known occurrence to detect population trends.

VERNAL POOL SALAMANDERS (THE MOST CRITICAL SPECIES ARE BLUE SPOTTED SALAMANDER AND JEFFERSON SALAMANDER)

- Conduct research to document the extent of upland habitat required by vernal pool breeding salamanders.
- Develop standardized habitat and population survey protocols to document the character, quality, and extent of occupied habitat.
- Document life history parameters specific to this species in NY including age and sex ratios, longevity, age at sexual maturity, survivorship of young, predator-prey relationships, and wetland-upland habitat requirements.
- Determine significance of specific threats to populations of vernal pool salamanders and develop management recommendations to address significant threats.

OTHER BUTTERFLIES

- Determine best management regimes for species in each locality.
- Determine the duration of all life stages and conduct taxonomic research for related species.
- Conduct an inventory of species within historical range and define the list of species that need to be addressed.

RIPARIAN TIGER BEETLES

- Compile baseline data on existing threats, including gravel mining, high ATV use, and hydrologic flow alterations, and encourage research to determine the effect of these threats.
- Conduct baseline population surveys to determine extent of occupied habitat.
- Determine where larval habitat is for *Cicindela marginipennis*, and determine adult beetle dispersal. Determine habitat characteristics such as vegetation density, cobble size and sand/cobble interspersion for these species.

FRESHWATER BIVALVES

- Evaluate threats to mussels and prioritize areas within the basin for remedial action.

- Develop standard survey protocols for development projects in the basin to prevent further decline of these species.

- Investigate the best survey methods to detect rare species and evaluate status and trends of all species that occur in the basin. Determine population distribution and abundance of freshwater bivalve species-at-risk in this basin. Consider listing as a species at risk.

- Conduct research to determine the habitat parameters necessary to sustain populations of at risk mussel species including temperature, substrate, flow, fish hosts, and forage base.

- Determine breeding phenology necessary for successful mussel reproduction including mussel density, abundance and diversity of fish hosts, water temperature, and flow.

- Determine fish hosts for species.

TREE BATS (THE MOST CRITICAL SPECIES ARE EASTERN RED AND HOARY BATS)

- Research threats to critical habitats and populations.

- Conduct surveys of migrants to determine timing, distribution, species composition, and elevation of migrating bats.

Planning Recommendations

Several existing management plans address natural resource conservation issues within the Lake Erie Basin (Table 14). The goals and objectives of these plans vary in their focus (e.g., water quality, biodiversity, restoration) and cooperating partners; however, they all provide valuable information on conservation threats and strategies in this region of New York State and should be consulted prior to implementation.

There is a clear need for a habitat mosaic management plan for grassland, early successional forests, shrub habitat, mature forest stands, and wetlands in this basin. Of the 99 SGCN occurring in the basin, 42 depend on grasslands, 8 depend on barrens and woodlands, 34 depend on forested habitat, and 27 depend on 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. The balance and active cooperative management of all of these habitat types is the key to the health and abundance of many of the SGCN currently living in this basin.

It is very important to consider both public and private lands in planning efforts and to incorporate both strategies that focus on land protection and management on public lands and strategies that deal with partnerships with private landowners. The management of public lands needs to be carried out with the cooperation of many agencies. Key partners to include are DEC, NYS OPRHP, USFWS, NPS, NRCS, DOT, Trust for Public Land, and local governments. Private lands comprise 85% of the total land area of the state. Use of cooperative management programs like the Landowner Incentive Program, Wildlife Habitat Improvement Program, and others will be important to achieve effective habitat protection and enhancement for many SGCN. Partners in these efforts should include: NY Audubon, TNC and the Natural Heritage Program, local land trusts, New York Forest Owners Association, Ducks Unlimited, Inc, Pheasants Forever, National Wild Turkey Federation, Ruffed Grouse Association, watershed groups, partners in the forestry industry, The American Farmland Trust, and others.

Part of this habitat mosaic management planning effort should involve the development of a protected lands GIS data layer as a powerful tool for conservation planning and determining measures of success at the regional scale. Such a data layer would incorporate all the protected lands in public and private ownership and assign each site to a category reflecting its protection status (easement, fee ownership, etc.). Combining this data layer with SGCN occurrences and other landscape features would provide an excellent and unique analysis of the conservation status of each SGCN and the role played by each priority site in achieving goals at the regional basin and statewide scales.

The Cattaraugus Creek sub-watershed is primarily deciduous and mixed forest cover. This is an opportunity to integrate the needs of early successional forest/shrubland birds, forest breeding raptors, tree bats, woodland snakes, and vernal pool salamanders. These species often need heterogeneous forest structure during different life stages. Herpetofauna also need wetlands within the forest to breed.

The most critical bird species mentioned previously all require varying types of vertical forest structure. 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. Specific planning recommendations for this sub-watershed include:

- Develop a management plan that provides guidance on maintaining, enhancing, and restoring early successional forest/shrub habitat for Canada warbler and golden-winged warbler. Identify the causes for decline in Canada warblers.

The Tonawanda Creek/Niagara River sub-watersheds are dominated by grasslands with several large wetland complexes interspersed in the landscape. The Buffalo River sub-watershed also contains grasslands in the eastern portion, and the Lake Erie sub-watershed contains grasslands along the lake shore. This is an opportunity to integrate the needs of wetland and grassland-dependant species into a holistic management plan for the basin. Components of this larger picture are:

- Develop a management plan for the basin that includes land acquisition and management targets for all wetland and grassland-dependent species of greatest conservation need. Minimum management area sizes for various animal classes should be determined, targets for acquisition, and temporal and spatial targets for management actions (mowing, water control) should be set. This should be a component of the above mentioned mosaic management plan, and incorporate basin specific objectives from a statewide grassland bird management plan (already being developed by a consortium of agencies and organizations active in grassland conservation in New York led by Audubon NY) and existing wetland planning efforts including North American Waterbird Plan, Bird Conservation Regional Plans, and others. Specific tasks associated with this planning include:
  - Develop habitat management guidelines and actions for high priority grassland bird species in the Erie basin (Henslow's sparrow, upland sandpiper, Northern harrier, short-eared owl, and sedge wren) for incorporation in the above mosaic management plan and the NYS Open Space Plan in order to better coordinate conservation actions. Identify opportunities in the plan for directing federal funds to grassland habitat.
  - Investigate the feasibility to manage grasslands in the basin with controlled burning. Draft a fire management plan in accordance with these findings.
  - Work with USDA and other partners to develop grassland management incentives that benefit SGCN in this basin.
  - Protect nesting and foraging habitat, including artificial nesting structures and associated upland buffers for beach and island ground-nesting birds (common tern).
  - Develop a long term plan that establishes population objectives for beach and island ground-nesting birds (common tern) and recommends appropriate management options. Secure funding to initiate programs.

- Review existing planning documents and participate in ongoing planning efforts to take advantage of opportunities to protect and manage lands for SGCN in this basin.
  - Review state park master plans, DEC Unit Management Plans and Wildlife Management Area plans for opportunities to better manage state lands for SGCN in the basin.
  - Continue participation in North American waterbird planning. Focus on and refine recommendations for American bittern, black tern, king rail, least bittern, and pied-billed grebe
  - Participate in other planning efforts in the basin (such as watershed plans, lake plans, etc.). As these plans are developed and revised, incorporate information about SGCN and opportunities to benefit SGCN in the basin.
- Continue to develop recovery plans for all fish SGCN and review opportunities to better manage for aquatic SGCN in the basin, including opportunities for control of invasive species.
  - Develop a monitoring and control plan that includes measures to detect invasive bivalves and actions to control them before they become threats.
  - Incorporate freshwater mussel goals and objectives into regional and state water quality and fish management plans and policies.
  - Develop and carry out a recovery plan for longear sunfish and lake sturgeon.
- Develop an avian and bat migration route map using advanced radar imaging and other methodology, and also investigate the effects of landform factors on travel routes. The development of this map and other related information for use as a planning tool is a high priority as new wind power proposals are developed for areas within the Lake Erie Basin.

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.

WATER QUALITY DEGRADATION

A common threat to many SGCN in this basin is the degradation of water quality in aquatic habitats. This can be a result of siltation, nutrient runoff, temperature increases, toxics, and lowered dissolved oxygen. Land acquisition can be used to prevent or remediate these effects. The specific recommendation for water quality is:

- In key locations, acquire development rights to protect water quality for listed mussel and freshwater fish populations. The high priority species groups that will benefit from this recommendation are freshwater bivalves and freshwater fish.

HABITAT LOSS

A common threat to many SGCN in this basin is the loss of habitat due to anthropogenic changes like development, dredging, wetland draining, river/stream channel manipulation, and shoreline hardening. These changes result in loss of habitat quantity and often disrupt the function of remaining habitat. Connections between patches of similar or different, yet complementary habitats are needed for migration and dispersal. Isolated 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, predation, reduction in population, and reduction in the types of species the patch can support. Habitats fragmented by roads and power lines increase direct mortality of animals due to collisions. Smaller dams affect SGCN by being a physical barrier to dispersal and migration of young and adult aquatic species. Larger hydropower dams also cause impingement and entrainment mortality of fish and wildlife at various life stages. Dams affect water quality downstream by altering temperature, sediment, debris and nutrient transport. Specific recommendations related to habitat loss are:

- The lands owned by the state government in the basin are primarily forest and wetland. There is a need to acquire, through fee title or easements, grasslands, especially adjacent to existing public forest stands. This will enable better management and protection of these habitats for grassland species. Acquisitions should reflect the recommendations of priority grassland focus areas from the NYS grassland bird management plan. Priority species that would benefit from these acquisitions include grassland birds and early successional forest/shrubland birds.
- Acquisition of forested and grassland upland tracts adjacent to wetland properties is critical to protection and restoration of amphibian, reptile, and freshwater marsh nesting bird species in this basin. Ideally these will be parcels where road building has not fragmented the two cover types. Identification of candidate parcels with these characteristics should occur immediately. The most critical species groups that would benefit from these

acquisitions are vernal pool salamanders, freshwater marsh nesting birds, and uncommon turtles of wetlands.

Over 50% of the wetlands of New York State have been lost over the past century. Emergent marsh habitat and lands with wetland restoration potential adjacent to state owned land should be acquired through fee title or easement. Studies have demonstrated that large emergent habitat parcels are more likely to support certain freshwater marsh nesting species such as black tern, bitterns and rails. Other species which benefit from contiguous wetland habitat include various herons, waterfowl and shorebirds. Specific recommendations related to wetlands are:

- Acquire large wetland parcels or purchase wetland parcels adjoining wetlands in public ownership.
- Acquire parcels with wetland restoration potential that adjoin wetlands in public ownership.

RECOMMENDATIONS FROM THE 2002 NYS OPEN SPACE CONSERVATION PLAN

There are a number of priority acquisitions from the 2002 New York State Open Space Plan that will benefit SGCN.

- Coastal areas along Lake Erie and the Niagara River provide unique habitat for beach and island ground-nesting birds and transient shorebirds. Acquisition of coastal areas will enable restoration of beach and dune habitat.
- Eighteen Mile Creek/Hampton Brook Woods corridor in Region 9. This acquisition priority appears in the Open Space Plan of 2002. The site provides habitat for a diverse assemblage of resident plant and animal species.
- Exceptional forest communities (Region 9) in Zoar Valley, Cattaraugus Creek sub-watershed. The acquisition of the remaining mature forest is a priority in the Open Space Plan of 2002.
- Any tributaries that provide habitat for SGCN in the basin. In particular, Lake Erie tributary gorges in Region 9 are identified in the current Open Space Plan. These gorges are unique ecological and geological areas, and provide steep gorge terrain and habitat.
- Shumla Falls/Canadaway Creek Gorge in Region 9. Canadaway Creek enters a steep sided valley with a shale bottom and several talus slopes. There is a wide diversity of habitats that support SGCN, as noted in the Open Space Plan of 2002.

Management and Restoration Recommendations

HABITAT RESTORATION

Overall alteration of the landscape, primarily since European settlement, has disrupted the natural cycle of habitat disturbance (e.g., fire, wind throw, flooding cycles etc.). Although some of the alterations to the landscape provide important habitat, as in the case of hay and pasture lands, in many cases, management actions such as mowing, burning, silviculture, water-level manipulation, and control of exotic/invasive species, are necessary to mimic natural processes and maintain or manipulate habitats to benefit SGCN. In addition, in many areas where habitat has been severely degraded or altered, habitat restoration is often needed to provide habitat for SGCN.

Early Successional Forest/Shrubland Birds

- Conduct sustainable silvicultural operations with the goal of doubling the amount of early successional habitat for wildlife on public and private land.
- Maintain, restore, and enhance early successional habitats through the use of prescribed fire, mowing, and other management tools.

Forest Breeding Raptors

- Maintain appropriate breeding habitat for forest breeding raptors around occupied nest sites with emphasis on long-eared owl.

Freshwater Marsh-Nesting Birds

- Manage water levels in nesting areas to prevent nest loss for freshwater marsh-nesting birds, and optimize water and vegetation cover for waterfowl and uncommon turtles of wetlands.
- Restore emergent marsh to benefit freshwater marsh-nesting birds.
- Manage predators in nesting areas to reduce egg and chick loss.

Grassland Birds

- Use mowing and/or prescribed fire to manage the vegetative structure of established grasslands. This should be incorporated into Landowner Incentive and Farm Bill programs.

Beach and Island Ground-Nesting Birds and Transient Shorebirds

- Expand nesting opportunities for common tern, possibly using man-made tern nesting rafts.
- Reestablish high-quality transient shorebird foraging habitats by manufacturing sand flats, mudflats, or overwash fans.
- Control density and composition of vegetation at breeding sites.
- Create ephemeral pools adjacent to nesting sites.

Lake and River Reptiles

- Manage uplands adjacent to aquatic habitat and restore hardened shoreline areas to provide adequate and secure nesting sites and dispersal routes for migrating animals.
- Restore selected habitat for queen snake, including captive breeding, head starting, and relocation strategies.

Freshwater Fish

- Restore habitat and minimize/mitigate flow fluctuations at the Niagara Power Project for lake sturgeon as part of the facility re-licensing process.
- Research lake sturgeon genetics in Lake Erie.
- Ascertain whether reintroduction of eastern sand darter is feasible in Cattaraugus Creek.
- Restore instream and riparian habitat to benefit SGCN.

Uncommon Turtles of Wetlands

- Conduct a variety of habitat management techniques to preserve wetland quality, including maintaining hydrological regimes and vegetation succession.
- Manage adverse effects of habitat fragmentation.
- Mitigate turtle population losses to egg predators.
- Restore Blanding's turtle at selected sites via captive breeding, head starting, nest protection, and restoration strategies.

Freshwater Mussels

- Restore degraded habitat sites to allow for recolonization or reintroduction of listed mussels.

WATER QUALITY

A common threat to many SGCN in this basin is the degradation of water quality in aquatic habitats. This can be a result of siltation, nutrient runoff, temperature increases, toxics, and lowered dissolved oxygen. Land management can be used to prevent or remediate these effects.

- Implement Best Management Practices for forest management in riparian areas in order to maintain, enhance, and restore early successional forest/shrublands. Identify opportunities in the plan for directing federal funds into such habitats.

Lake and River Reptiles

- Manage water-borne pollutants that adversely affect lake and river reptiles.

Freshwater Bivalves and Freshwater Fish

- Manage or restore areas of important mussel and freshwater fish populations by controlling degradation factors, including livestock access, point and nonpoint source pollution, and flow alterations.

Uncommon Turtles of Wetlands

- Curtail contaminant inputs to wetlands.

INVASIVE SPECIES

Invasive species threaten many SGCN in the Lake Erie Basin. This threat may be through direct competition for nesting sites, prey, and other limited resources, or by alteration of the structure and quality of habitat, as in the case of invasive plants like purple loosestrife. Displacement of native species by invasive species disrupts ecological processes.

Freshwater Marsh Nesting Birds

- Control purple loosestrife and *Phragmites* where they are known to negatively affect marsh-nesting birds. Techniques could include biological controls.

Lake and River Reptiles

- Control invasive aquatic plants where they are negatively affecting salamanders. Techniques could include biological, chemical, and mechanical means.
- Control invasive species such as Japanese knotweed along riparian areas.

Vernal Pool Salamanders

- Control invasive aquatic plants where they negatively affect salamanders. Techniques could include biological, chemical, and mechanical means.
- Limit introductions of fish and other predatory species into habitats critical to vernal pool salamanders.

Uncommon Turtles of Wetlands

- Control invasive species to preserve suitable wetland habitat.

Freshwater Fish and Freshwater Bivalves

- Control invasive species where they negatively affect freshwater fish and bivalves. Techniques could include biological, chemical, and mechanical control methods.
- Monitor the status of eastern sand darter in the areas of Lake Erie they formerly occupied to determine their relationships with the invasive goby now abundant there.

HUMAN-WILDLIFE INTERACTIONS

There are a variety of threats to SGCN in the basin from direct interactions with humans. These include vehicle and structure collisions, illegal and unregulated harvest, and unintentional entanglement. 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. Collection of wild animals for pets and food also may contribute to species declines.

Lake and River Reptiles

- Reduce excessive disturbance by watercraft in habitats critical to lake and river reptiles.
- Reduce incidental take of lake and river reptiles by fishing gear.

Vernal Pool Salamanders

- Reduce habitat destruction and collisions by off-road vehicles in vernal pools occupied by salamanders.

Uncommon Turtles of Wetlands

- Limit human access to sensitive wetland habitat where they provide habitat to these turtles.
- Mitigate population losses to vehicular road kill.

Beach and Island Ground-Nesting Birds (Common Tern)

- Protect nesting sites from human disturbance by posting and fencing.
- Establish and maintain enforcement of no-work windows within breeding habitats.

Riparian Tiger Beetles

- Mitigate detrimental ATV use on cobble bars.

Information Dissemination Recommendations

Sharing of information allows stakeholder groups to make informed decisions about activities that may help or harm SGCN. Sharing of information may take many forms, including best management practices, fact sheets, and educational outreach programs.

Land Management

Traditional agricultural, silvicultural and public and private land-management operations may lack wildlife-based objectives, thus may be detrimental to wildlife. Providing information to public and private land managers may help mitigate detrimental practices.

- Make information available to public and private land managers regarding the benefits and need for early successional habitat, including even-aged forest stand management and sustainable silvicultural practices, for early successional forest/shrubland birds.
- Work with public utilities to manage rights-of-way to provide maximum habitat benefits to early successional forest/shrubland birds.
- Develop an outreach program for public and private land managers to increase awareness of the benefits of grasslands and wildlife-friendly agricultural practices. Species groups that will benefit include freshwater marsh-nesting birds and grassland birds.
- Promote the establishment of vegetated buffers around agricultural fields to protect wetlands and streams from runoff and benefit freshwater marsh-nesting birds, freshwater fish, and bivalves.
- Provide education and outreach to forest managers regarding silvicultural practices compatible with forest breeding raptors, early successional forest/shrubland birds, freshwater fish, and bivalves.

Invasive Species

Introduction and spread of exotic species can often be minimized or prevented through increased awareness of natural resource users to the negative effects of these species on native wildlife. Awareness should be accompanied by specific actions that natural resource users can employ to prevent spread of invasive and exotic species.

- Develop and post educational signs in appropriate languages at markets dealing in live bivalves, fish, and crustacea, explaining the dangers of releasing exotic animals into New York State.
- Provide education and outreach to contractors on best management practices to prevent the spread of invasive species during road and bridge construction and maintenance.

Human-Wildlife Interactions

Human behavior can be altered by education and outreach. Providing information about negative effects of human disturbance on wildlife can help reduce detrimental interactions.

- Enhance public education to curtail collection and translocation of turtles.
- Develop an outreach and educational tool to highlight the possible detrimental effects of human disturbance on wetland dependent wildlife. An example could be off-road vehicle effect on vernal pool and marsh-nesting species.
- Develop outreach material to educate the public about the benefits of grasslands, freshwater mussel life history, and at-risk Lepidoptera.

- Review and respond to projects involving tall structures that may adversely affect tree bats.
- Develop outreach materials on the effects of domestic cats to beach and island ground-nesting birds. Post interpretive signage at all public nesting locations. Update endangered species fact sheets to reflect current status of species.
- Make information available to municipal planners, public land managers, and NGOs regarding the benefits of providing habitat for SGCN and other wildlife, the habitat requirements of different species, and the techniques needed to provide and maintain the habitat.

Regulatory and Legislative Recommendations

Regulatory proposals will likely be made at the statewide level-though local governments have opportunities to modify or create laws and regulations to enhance local protection of SGCN.

HABITAT PROTECTION

Local zoning and taxation policies can be used to discourage sprawl and habitat fragmentation without growth, an issue of particular importance in this basin. Regulatory proposals related to prevention of habitat loss include:

- 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.
- 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.
- Increase regional permit oversight of development and highway projects that may affect freshwater bivalves.
- Mitigate habitat effects to beach and island ground-nesting birds from development and public work projects to meet no net-loss goal.
- Eliminate detrimental ATV use on cobble bars inhabited by riparian tiger beetles.
- Afford protected stream status under ECL §608.2 to Class D non-navigable stream segments that provide habitat for SGCN.

WATER QUALITY PROTECTION

Regulatory proposals related to protection of water quality include:

- Limit the use of pesticides on publicly owned marshes to prevent reduction of insect populations and contamination of wetlands used by SGCN, including freshwater marsh-nesting birds.
- Require testing of all new pesticides, consistent with current DEC and EPA regulations, for effects on all life stages of freshwater bivalves prior to approval for use in the state.
- Improve implementation and enforcement of water quality regulations on stream segments that provide habitat for SGCN.

UNCONTROLLED HARVEST AND COLLECTION

Regulatory proposals related to protection of animals from uncontrolled collection and/or harvest include:

- Implement pending legislation that includes small game protections for uncommon turtles of wetlands, vernal pool salamanders, riparian tiger beetles, and lake and river reptiles. Protection should also be provided for freshwater bivalves.
- Enhance law enforcement to limit collection and translocation of wood turtles.

INVASIVE SPECIES

Regulatory proposals related to the prevention of the introduction and spread of exotic and invasive species include:

- Implement regulatory recommendations of the Governor's Invasive Species Task Force to control the introduction and distribution of exotic and invasive species such as purple loosestrife. This will benefit multiple taxa.
- Ban the importation of fish that feed on native freshwater bivalves.

Incentives

No recommendations at this time

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Tables and Figures

Tables

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Table 14: Existing management plans and agreements within the Lake Erie Basin.

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