IV. LACUSTRINE SYSTEM

The lacustrine system consists of ponded waters situated in topographic depressions or dammed river channels, with persistent emergent vegetation sparse or lacking, but including any areas with abundant submerged or floating-leaved aquatic vegetation. The lacustrine communities in this classification are distinguished primarily by trophic state, alkalinity, annual cycles of thermal stratification, circulation, morphometry (size and shape of the lake basin and drainage area; water permanence), and water chemistry (including salinity).

The communities are described in terms of the free-floating organisms of the open water, or the limnetic or pelagic zone (including plankton and fish), the aquatic macrophytes and fish near the shore or littoral zone, and the bottom-dwelling organisms or benthos. The limnetic (pelagic) zone may be divided into the epilimnion (upper lake zone), which is sunny, mixed by the wind, and comparatively rich in oxygen, and the hypolimnion (lower lake zone), which is darker, and comparatively rich in carbon dioxide from respiration and decay. The transition between the epilimnion and hypolimnion is called the thermocline (or the metalimnion). The lake bottom or benthic zone may be divided into the peripheral, well-lit shallows or littoral zone, the slightly deeper and darker sublittoral zone, and (in summer-stratified lakes) the deep, cold region where currents are minimal and light is much reduced, called the profundal zone. Benthic zones may each have a distinctive resident biota; however, many of the plankton and fish move between pelagic zones on a regular basis. Deep lakes have an average depth greater than about 60 m (200 ft), moderately deep lakes are from about 6 to 60 m (20 ft to 200 ft) deep, and shallow lakes have an average depth less than about 6 m(20 ft). Large lakes are greater than about 80 ha (200 acres) and small lakes are less than this size.

This classification of lacustrine communities is based on a combination of NYNHP field surveys, literature review, and discussions with aquatic scientists. To date about 42 plots have been sampled statewide by NYNHP in lacustrine communities. Although the Heritage Program has focused inventory work on lakes since 1995; we do not currently have sufficient field data for confidently undertaking any major restructuring of the 1990 lacustrine classification. However, field work has suggested that this classification works well for representing the coarsest scale distinctions between both biotic and abiotic features of lacustrine community types.

The classification is intended to represent entire lake "macrohabitats." Although physically based, it is meant to serve as a coarse filter emphasizing resident lake biota. It is recognized that lakes may contain numerous pelagic and benthic associations and that there is often much overlap in association distribution across lake macrohabitat types. For now, NYNHP is maintaining this macrohabitat classification while evaluating the utility and feasibility of replacing or supplementing this classification with an association classification. Further evaluation of the macrohabitat classification is underway to compare trophic state versus alkalinity as a factor more important in driving the distribution of biota and more resistent to human alteration of water chemistry. Tentatively, it is thought that alkalinity is a stronger driving force, thus suggesting a switch of the 1990 classification of common pond types from oligotrophic and eutrophic to acidic and alkaline, and common dimictic lake types from oligotrophic, mesotrophic, and eutrophic to acidic and alkaline, perhaps with trophic state as a secondary modifier.

Lastly, addition of three "intermittent pond" types to the 1990 classification is also recommended: vernal pool and pine barrens vernal pond (both previously treated under the palustrine system) and sinkhole pond (split from sinkhole wetland in the palustrine system). Other types under evaluation include "flow-through" or "fluvial pond," a potential split from the currently recognized oligotrophic pond and eutrophic pond, closely associated with riverine complexes rather than in the typical isolated basin setting.

Further refinement of the lacustrine classification to distinguish regional variants will likely be based on additional field surveys and analysis of data collected by various aquatic scientists and agencies statewide. Regional variation in many of the designated lacustrine communities is evident, but we do not currently have in our files enough information or have undertaken analyses to confidently split common and widespread lake types into more specific regional variants. A finer scale classification of lakes that distinguishes types according to ecoregion and/or watershed is being evaluated. Preliminary conclusions suggest that vascular plant, bryophyte, algae, fish, mollusk, insect, and plankton assemblages may follow different distribution patterns, some more closely correlated with ecoregion boundaries, some more closely with major ecological drainage units.

A. NATURAL LAKES AND PONDS

This subsystem includes the Great Lakes, and inland lakes and ponds in which the trophic state, morphometry, and water chemistry have not been substantially modified by human activities, or the native biota are dominant. The biota may include some introduced species (for example, non-native macrophytes, stock or accidentally introduced fishes), however the introduced species are not usually

dominant in the lake or pond community as a whole.

1. Great Lakes deepwater community: the open water community in any of the Great Lakes. In general, the Great Lakes are summer-stratified monomictic lakes: they usually do not freeze over in winter, they are mixed and isothermal in winter, and stratified in summer. One exception is that portions of eastern Lake Erie, along the New York shores, freeze over quite frequently. These lakes are primarily mesotrophic with eutrophic nearshore areas. Specialized habitats include nearshore fluvial deposits, deepwater reefs and trenches. The Great Lakes are distinguished from inland summer-stratified monomictic lakes because of their size and access to estuarine biota through the St. Lawrence River and Welland Canal. Lake Champlain is similar to this lake type, however, is classified as a summer-stratified monomictic lake.

Characteristic fishes of the epilimnion include alewife (*Alosa pseudoharengus*), rainbow smelt (*Osmerus mordax*), yellow perch (*Perca flavescens*), white sucker (*Catostomus commersoni*), lake chub (Couesius plumbeus), lake trout (*Salvelinus namaycush*), Atlantic salmon (*Salmo salar*), lake sturgeon (*Acipenser fulvescens*), lake herring (*Coregonus artedii*), deepwater sculpin (*Myxocephalus thompsoni*), and walleye (*Stizostedion vitreum*).

Characteristic fishes of the hypolimnion also include slimy sculpin (*Cottus cognatus*), and round whitefish (*Prosopium cylindraceum*). Other characteristic fishes include cisco (*Coregonus artedii*), lake whitefish (*Coregonus clupeaformis*), sea lamprey (*Petromyzon marinus*), quillback (*Carpiodes cyprinus*), white bass (*Morone chrysops*), burbot (*Lota lota*), emerald shiner (*Notropis atherinoides*), mooneye (*Hiodon tergisus*), and silver chub (*Hybopsis storeriana*). Two introduced salmonids that are now common in Lake Ontario are coho salmon (*Oncorhynchus kisutch*), and chinook salmon (*O. tshawytscha*).

A diverse set of diving birds use this community as a staging area during fall migration, and include oldsquaw (*Clangula hyemalis*), common goldeneye (*Bucephala clangula*), scaup (*Aythya* sp.), redhead (*Aythya americana*), bufflehead (*Bucephala albeola*), canvasbacks (*Aythya valisneria*), and scoters (*Melanitta* spp.).

Characteristic invertebrates include the oligochaetes *Potamothrix* sp., and *Aulodrilus* sp. Characteristic plankton include diatoms, green algae, dinoflagellates, flagellates, cladocerans, and, in the profundal zone, the zooplankton *Pontoporeia hoyi* and *Mysis relicta.*

New York's share of the Great Lakes has been significantly polluted and modified by introductions of non-native species; some introductions have resulted from migrations through the Welland and Erie canals. Exotic fishes of Lake Ontario include rudd (*Scardinus erythrophthalmus*), bluebacked herring (*Alosa aeativalis*), and round goby (*Negobius melanostomus*). Many of the formerly common native fish have apparently disappeared from Lake Erie or Lake Ontario including blue pike (*Stizostedion vitreum glaucum*), bloater (*Coregonus hoyi*), kiyi (*C. kiyi*), shortnose cisco (*C. reighardi*), shortjaw cisco (*C. zenithicus*), and spoonhead sculpin (*Cottus ricei*).

Distribution: restricted to the Great Lakes Plain ecozone.

Rank: G2G3 S1S2 *Revised:* 2001

Examples: Lake Ontario; Lake Erie.

Sources: Berg 1963; Croskery 1995; C. L. Smith 1985; U.S. Fish and Wildlife Service 1992.

2. Great Lakes aquatic bed: the aquatic community of the protected shoals of the Great Lakes or Lake Champlain that occur in quiet bays that are protected from extreme wave action by islands, shoals or barrier bars, and typically support large areas of "weeds" or aquatic macrophytes. These bays may freeze over in winter and become inversely stratified. They are warm, mesotrophic and alkaline. Substrate can vary among sand, silt, muck, and rock. Two variants are known: classical “aquatic beds” with abundant macrophytes and sparsely-vegetated or unvegetated bays.

This community serves as a spawning and nursery habitat for a wide variety of warmwater fishes. Characteristic fishes in the aquatic bed include pickerel (*Esox americanus*), threespine stickleback (*Gasterosteus aculeatus*), longnose gar (*Lepisosteus osseus*), bluegill (*Lepomis macrochirus*), largemouth bass (*Micropterus salmoides*), Iowa darter (*Etheostoma exile*), tadpole madtom (*Noturus gyrinus*), muskellunge (*Esox masquinongy*), white perch (*Morone americana*), white sucker (*Catostomus commersoni*), smallmouth bass (*Micropterus dolomieu*), brown bullhead (*Ameiurus nebulosus*), northern pike (*Esox lucius*), and common carp (*Cyprinus carpio*). Goldfish (*Carassius auratus*) is an introduced fish that is well-established in Great Lakes aquatic beds.

This community serves as feeding and resting habitat for dabbling ducks and other waterfowl during spring and fall migration, and also as an overwintering ground. Other characteristic fauna include a diverse mollusk assemblage, bryozoans, ostrocods, and cyclopoid copepods.

Characteristic macrophytes include the algae

Cladophora and *Chara*, tape grass (*Vallisneria americana*), pondweeds (*Potamogeton richardsonii, P. pectinatus, P. gramineus, P. pusillus, P. freisii*), naiad (*Najas flexilis*), horned pondweed (*Zannichellia palustris*), water stargrass (*Heteranthera dubia*), coontail (*Ceratophyllum demersum*), waterweed (*Elodea canadensis*), duckweed (*Lemna trisulca*), and bladderwort (*Utricularia vulgaris*). Additional species in Lake Champlain examples include water-plantain (*Alisma gramineum*), pondweeds (*Potamogeton zosteriformis, P. natans, P. perfoliatus, P. spirillus*), white water-crowfoot (*Ranunculus trichophyllus*), and quillwort (*Isoetes tuckermannii*). Common exotic plants include Eurasian water milfoil (*Myriophyllum spicatum*) and curly pondweed (*Potamogeton crispus*). Growth of *Cladophora* has been related to point sources of nutrient enrichment, especially phosphorus enrichment.

Distribution: restricted to the Great Lakes Plain ecozone and Lake Champlain Valley of the Adirondack ecozone, in direct association with the Great Lakes (including downstream along the Saint Lawrence River to Chippewa Bay) and Lake Champlain.

Rank: G4 S3

Examples: Irondequoit Bay, Monroe County; North Pond, Oswego County; Chippewa Bay, St. Lawrence County; Braddock Bay, Monroe County; Sodus Bay, Wayne County; Kings Bay, Clinton County.

Sources: Clausen 1940; NYNHP field surveys.

3. Great Lakes exposed shoal: the aquatic community of the shallow littoral zone of the Great Lakes that occurs along windswept shores that are exposed to wave action, typically associated with islands and points. The lake substrate may be sandy, gravelly, cobbly, bouldery, or with submerged bedrock outcrops.

Characteristic fishes include stonecat (*Noturus flavus*), freshwater drum (*Aplodinotus grunniens*), mottled sculpin (*Cottus bairdi*), lake chub (*Couesius plumbeus*), muskellunge (*Esox masquinongy*), and a diversity of minnows and small fish such as river redhorse (*Moxostoma carinatum*), greater redhorse (*M. valenciennesi*), channel darter (*Perca copelandi*), and pugnose shiner (*Notropis anogenus*). Lake sturgeon (*Acipenser fulvescens*) was once abundant in shoal waters in the Great Lakes, has declined sharply, but should recover.

Cormorant (*Phalacrocorax* sp.) is a characteristic bird. Zebra mussels (*Dreissena polymorpha*) have become abundant in this community.

Aquatic macrophytes are uncommon and include milfoil (*Myriophyllum* sp.) and coontail (*Ceratophyllum* sp.). The alga *Cladophora* grows on rocks in the wave zone; growth of *Cladophora* has been related to point sources of nutrient enrichment, especially phosphorus enrichment. More data on this community are needed.

Distribution: restricted to the Great Lakes Plain ecozone in direct association with the Great Lakes (including downstream along the Saint Lawrence River to about American Island).

Rank: G4 S4 *Revised:* 2001

Examples: Indian Chief Shoal, St. Lawrence County; Dana Point Shoals, St. Lawrence County; Gull Shoal, Jefferson County; Upper Shoal, Jefferson County.

Sources: Knutson et al. 1990; C. L. Smith 1985; NYNHP field surveys.

4. Bog lake: the aquatic community of a dystrophic lake that typically occurs in a small, shallow basin (e.g., a kettehole) that is protected from wind and is poorly drained. These lakes occur in areas with non-calcareous bedrock or glacial till; many are fringed or surrounded by a floating mat of vegetation (in New York usually either bog or poor fen). Characteristic features of a dystrophic lake include the following: murky water that is stained brown, with low transparency; water that is low in plant nutrients (especially low in calcium), with naturally low pH (less than 5.4); and the lake may have oxygen deficiencies in deeper water (the profundal zone). The lack of calcium blocks bacterial action, reducing the rate of decay of organic matter with subsequent accumulation of peat or muck sediments. Colloidal and dissolved humus material reduces transparency and increases acidity of the water.

Species diversity in bog lakes is low in all types of aquatic organisms (phytoplankton, macrophytes, zooplankton, zoobenthos, and fish); many bog lakes have no fish at all. The abundance of each species present is also low in all types of organisms, except for aquatic macrophytes and peat mosses (*Sphagnum* spp.) along the edge of the bog mat.

A characteristic fish is brown bullhead (*Ameiurus nebulosus*). Characteristic invertebrates include larvae of midges (*Chironomus* spp.) and phantom midges (*Chaoborus* spp.) in the benthos. Other characteristic invertebrates may include the amphipod *Hyallela azteca*, the mollusks *Musculium* sp. and *Ferresia californica*, and the midges *Tribelos* sp., *Phaenopsectra* sp., and *Zalutschia* sp.

Characteristic macrophytes include water-shield (*Brasenia schreberi*), white water-lily (*Nymphaea*

odorata), yellow pond-lily (*Nuphar luteum* ssp. *pumilum*, and *N. luteum* ssp. *variegatum*), bladderworts (*Utricularia vulgaris, U. geminiscapa, U. purpurea*), pondweeds (*Potamogeton epihydrus, P. oakesianus*), burreeds (*Sparganium fluctuans, S. angustifolium*), and clubrush (*Scirpus subterminalis*). Characteristic zooplankton may include the rotifers Keratella sp. and Brachionus sp.

A common feature of bog lakes is the development of a false bottom at a depth of about 0.3 to 0.9 m (1 to 3 ft) below the surface. The false bottom is composed of colloidal material and dissolved humus held in suspension that appears to be a more or less continuous bottom. When disturbed, the suspended material quickly clouds the upper layer of clear water, then slowly settles when the water becomes quiet again. Occasionally bog lakes become meromictic or chemically stratified; the chemical gradient supercedes the usual stratification by temperature. Up to four ecoregional variants (Northern Appalachian, Alleghany Plateau, Great Lakes and Lower New England types) are suspected to differ in dominant and characteristic vascular plants and insects. More data on ecoregional variants are needed.

Distribution: sparsely scattered throughout New York State north of the coastal lowlands ecozone; especially common in the Adirondacks.

Rank: G4 S3 *Revised:* 2001

Examples: Spring Pond, Franklin County; Pink Pond, Franklin County; Rolley Pond, Franklin County; Mud Lake, Rensselaer County; Hosford Pond, Rensselaer County; Joyce Bog, Oneida County; Louisa Pond, Ulster County; Emmons Pond, Delaware County.

Sources: Clausen 1940; Cole 1975; Maitland 1978; NYNHP field surveys.

5. Oligotrophic dimictic lake: the aquatic community of a nutrient-poor lake that typically occurs in a deep, steeply-banked basin. These lakes are dimictic: they have two periods of mixing or turnover (spring and fall), they are thermally stratified in the summer, and they freeze over and become inversely stratified in the winter. A name change and slight conceptual change to acidic dimictic lake is being evaluated.

Characteristic features of an oligotrophic lake include the following: blue or green water that is clear, with high transparency (Secchi disk depths of 4 to 8 m); water low in plant nutrients (especially low in nitrogen, also low in calcium); low primary productivity (inorganic carbon fixed = 7 to 25 g/m^2/yr); lake sediments that are low in organic matter (usually consisting of stones and inorganic silt); epilimnion volume that is relatively small compared with hypolimnion; and an abundance of oxygen all year, in all strata. Alkalinity is typically low (less than 12.5 mg/l calcium carbonate).

Profundal and pelagic species assemblages are usually well developed. The profundal benthos includes many species, but the abundance of each species is very low. Characteristic fishes are warmwater species such as smallmouth bass (*Micropterus dolomieui*), redbreast sunfish (*Lepomis auritus*), pumpkinseed (*Lepomis gibbosus*), rock bass (*Ambloplites rupestris*), and yellow perch (*Perca flavescens*) in shallow areas, and coldwater species such as lake trout (*Salvelinus namaycush*) and round whitefish (*Prosopium cylindraceum*) in deep water, and either slimy sculpin (*Cottus cognatus*) or mottled sculpin (*C. bairdi*). Shiners and minnows are often diverse. Brown trout (*Salmo trutta*) and rainbow trout (*S. gairdneri*) are commonly introduced.

Characteristic mollusks may include the clams eastern lampmussel (*Lampsilis radiata*), eastern elliptio (*Elliptio complanata*), and eastern floater (*Pyganodon cataracta*), and the snails ramshorn snail (*Heliosoma trivolvis*), physid snail (*Physa heterostropha*), amnicolas (*Amnicola* spp.), and mystery snail (*Campeloma decisum*).

Characteristic profundal invertebrates include midge larvae such as *Tanytarsus*; in contrast to bog lakes, oligotrophic lakes usually lack phantom midges (*Chaoborus* spp.). Other characteristic and dominant invertebrates may include alderfly (*Sialis* sp.), the midges *Procladious* sp. and *Heterotrissocladius* sp., the mayfly *Stenonoma* sp., caddisflies (Trichoptera), and oligochaetes (Oligochaeta).

Phytoplankton and zooplankton also have many species, with low abundance; characteristic phytoplankton include desmids (*Staurastrum* spp.), chrysophytes (*Dinobryum* spp.), the diatoms *Tabellaria, Cyclotella,* and *Asterionella.* Characteristic zooplankton may include cladocerans, rotifers, copepods, scuds, cyclopoids, and *Daphnia* spp.

In the Adirondacks, this community provides habitat for the common loon (*Gavia immer*).

Characteristic macrophytes include small rosette-leaved aquatics that are restricted to shallow bottoms from 1 to 3 m (3 to 10 ft) deep. Characteristic rosette-leaved aquatics include pipewort (*Eriocaulon aquaticum*), water lobelia (*Lobelia dortmanna*), and quillworts (*Isoetes echinospora* ssp. m*uricata, I. lacustris*). Other characteristic vascular plants include milfoils (*Myriophyllum alterniflorum, M. tenellum*), bladderworts (*Utricularia purpurea, U. resupinata*), mud purslane (Elatine minima), creeping buttercup (*Ranunculus reptans*), pondweeds (*Potamogeton robbinsii, P. gramineus, P. perfoliatus*), and tapegrass

(*Vallisneria americana*). The macroalgae Nitella flexilis may be abundant in the sublittoral zone.

This lake type may contain numerous habitat features including underwater cliffs, talus slopes, boulder fields, pavement, sand flats, as well as differing vegetation associations at different depths and on different substrates. Four to seven ecoregional variants are suspected to differ in dominant and characteristic vascular plants, fishes, mollusks, and insects. More data on regional variants are needed.

Distribution: throughout New York State, usually at high elevations, especially common in the Adirondacks.

Rank: G4 S3

Examples: Lake George, Warren and Essex Counties; Schroon Lake, Essex and Warren Counties; Wolf Pond, Essex County; Lake Lila, Hamilton County; Pine Pond, Franklin County; Chubb Lake, St. Lawrence County; Shaver Pond, Rensselaer County; Skaneateles Lake, Onondaga and Cayuga Counties.

Sources: Bloomfield 1978a; Cole 1975; Ferris et al. 1980; Maitland 1978; Roberts et al. 1985; NYNHP field surveys.

6. Mesotrophic dimictic lake: the aquatic community of a lake that is intermediate between an oligotrophic lake and a eutrophic lake. These lakes are dimictic: they have two periods of mixing or turnover (spring and fall); they are thermally stratified in the summer, and they freeze over and become inversely stratified in the winter. A conceptual change is being evaluated, splitting this lake type into acidic versus alkaline dimictic lakes.

Characteristic features of a mesotrophic lake include the following: water that is moderately clear, with medium transparency (Secchi disk depths of 2 to 4 m); water with moderate amounts of plants nutrients; moderate primary productivity (inorganic carbon fixed = 25 to 75 g/m^2/yr); lake sediments with moderate amounts of organic matter; and moderately well-oxygenated water. Alkalinity is typically moderate (slightly greater than 12.5 mg/l calcium carbonate).

Profundal and pelagic species assemblages are usually well developed. Characteristic fishes are warmwater fishes such as yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), smallmouth bass (Micropterus dolomieui), northern pike (*Esox lucius*), bluegill (*Lepomis macrochirus*), and pumpkinseed (*L. gibbosus*).

Characteristic invertebrates may include the clam *Pisidium* sp. and the mayfly Hexagenia sp..

These lakes typically have a diverse mixture of submerged macrophytes, such as several species of pondweeds (*Potamogeton amplifolius, P. praelongus, P. robbinsii*), tapegrass (*Vallisneria americana*), and bladderworts (*Utricularia* spp.).

Characteristic plankton may include the phytoplankton *Asterionella* and the zooplankton *Daphnia dubia.* More data on this community are needed.

Distribution: throughout New York State.

Rank: G4 S3S4 *Revised:* 2001

Examples: Hemlock Lake, Livingston and Ontario Counties; Lower St. Regis Lake, Franklin County; Rich Lake, Essex County; Yellow Lake, St. Lawrence County.

Sources: Bloomfield 1978a; Cole 1975; Maitland 1978; NYNHP field surveys.

7. Eutrophic dimictic lake: the aquatic community of a nutrient-rich lake that occurs in a broad, shallow basin. These lakes are dimictic: they have two periods of mixing or turnover (spring and fall); they are thermally stratified in the summer, and they freeze over and become inversely stratified in the winter. A name change and slight conceptual change to alkaline dimictic lake is being evaluated.

Characteristic features of a eutrophic lake include the following: yellow, green, or brownish-green water that is murky, with low transparency (Secchi disk depths typically less than 2.5 m, but up to 4 m in some cases); water rich in plant nutrients (especially high in phosphorus, nitrogen and calcium), high primary productivity (inorganic carbon fixed = 75 to 250 g/m^2/yr); lake sediments that are rich in organic matter (usually consisting of a fine organic silt or copropel), water that is well-oxygenated above the summer thermocline, but oxygen-depleted below the summer thermocline or under ice; epilimnion volume that is relatively large compared with hypolimnion; and a weedy shoreline. Alkalinity is typically high (greater than 12.5 mg/l calcium carbonate).

Profundal and pelagic species assemblages are usually well developed. Usually there are many species of fish, especially minnows (*Cyprinidae*). Characteristic fishes are warmwater fishes such as yellow perch (*Perca flavescens*), largemouth bass (*Micropterus salmoides*), chain pickerel (*Esox niger*), bluegill (*Lepomis macrochirus*), pumpkinseed (*L. gibbosus*), yellow bullhead (*Ictalurus natalis*), brown bullhead (*I. nebulosus*), white sucker (Catostomus commersoni), golden shiner (*Notemigonus crysoleucas*), common shiner (*Luxilus cornutus*),

northern redbelly dace (*Phoxinus eos*) and stocked white perch (*Morone americana*). Two additional species that are characteristic of eutrophic lakes on Long Island are eastern mudminnow (*Umbra pygmaea*) and pirate perch (*Aphredoderus sayanus*).

The abundant profundal benthos is poor in species, including only species tolerant of low oxygen; characteristic profundal invertebrates are oligochaetes (Oligochaeta), larvae of midges (*Chironomus* spp.), and phantom midges (*Chaoborus* spp.). Phytoplankton and zooplankton are usually abundant, but there are only a few species present; characteristic phytoplankton are cyanobacteria (blue-green algae); other characteristic plankton may include the phytoplankton *Ceolosphaerium, Dinobryon,* and *Asterionella,* and the zooplankton *Bosmina*, *Keratella*, *Diaptomus,* and *Daphnia dubia.*

Aquatic macrophytes are abundant in shallow water, and there are many species present, but species diversity is generally lower than in mesotrophic lakes. Characteristic plants include tapegrass (*Vallisneria americana*), pondweeds (*Potamogeton* spp.), burreeds (*Sparganium* spp.), and the floating aquatic plants white water-lily (*Nymphaea* sp.), yellow pond-lily (*Nuphar luteum*), and water-shield (*Brasenia schreberi*). Typically these are the lakes with nuisance problems of exotic plants such as Eurasian water milfoil (*Myriophyllum spicatum*), water chestnut (*Trapa natans*), and pondweed (*Potamogeton crispus*).

Three to six ecoregional variants are suspected to differ in dominant and characteristic fishes, mollusks, and insects. More data on aquatic macrophytes and macroinvertebrates, as well as regional variants, are needed.

Distribution: throughout New York State, usually at low elevations, especially common in the Great Lakes Plains ecozone.

Rank: G4 S3S4 *Revised:* 2001

Examples: Canandarago Lake, Otsego County; Honeoye Lake, Ontario County; Onondaga Lake, Onondaga County; Saratoga Lake, Saratoga County; Streeter Lake, St. Lawrence County; Chodikee Lake, Ulster County.

Sources: Bloomfield 1978a, 1980; Cole 1975; Maitland 1978; NYNHP field surveys.

8. Summer-stratified monomictic lake: the aquatic community of a lake that is so deep (or large) that it has only one period of mixing or turnover each year (monomictic), and one period of stratification. These lakes generally do not freeze over in winter (except in unusually cold years) or form only a thin or sporadic ice cover during the coldest parts of midwinter, so the water circulates and is isothermal during the winter. These lakes are typically thermally stratified only in the summer; they are oligotrophic to mesotrophic and alkaline.

Profundal and pelagic assemblages are usually well developed. The dominant fishes include salmonids such as cisco (*Coregonus artedii*), and lake trout (*Salvelinus namaycush*) as well as yellow perch (*Perca flavescens*), rainbow smelt (*Osmerus mordax*), rock bass (*Ambloplites rupestris*), walleye (*Stizostedion vitreum*), brown bullhead (*Ameiurus nebulosus*), white sucker (*Catostomus commersoni*), and northern pike (*Esox lucius*). Other characteristic fishes may include gar (*Lepisosteus* sp.), bowfin (*Amia calva*), lampreys (Petromyzontidae), lake sturgeon *(Acipenser fulvescens*), burbot (*Lota lota*), sauger (*Stizostedion canadense*), and round whitefish (*Prosopium cylindraceum*).

Characteristic invertebrates may include the mollusks eastern elliptio (*Elliptio complanata*), eastern lampmussel (*Lampsilis radiata*), pocketbook (*L. ovata*), pink heelsplitter (*Potamilus alatus*), floaters (*Pyganodon cataracta, P. grandis*), and mud amnicola (*Amnicola limosa*).

A characteristic crustacean of the hypolimnion of Finger Lake examples is *Senecella calanoides*, which was named after Seneca Lake. Dominant invertebrates of the profundal zone of Lake Champlain are Spheriidae and the oligochaetes *Stylodrilus heringianus* and *Peloscolex variegatus.* Winter epilimnion plankton species assemblages are usually well developed.

Characteristic plankton may include the phytoplankton *Fragilaria* spp. and *Anabaena* spp. in summer, and *Melosira* spp. and *Cryptomonas ovata* in winter, and the zooplankton *Daphnia* spp., and *Diaptomus* spp. in summer, and *Limnocalanus macrurus*, and *Cyclops becuspidatus* in winter.

Characteristic aquatic macrophytes include pondweeds (*Potamogeton gramineus, P. richardsonii, P. pectinatus*), horned pondweed (*Zannichellia palustris*), naiad (*Najas flexilis*), waterweed (*Elodea canadensis*), tapegrass (*Vallisneria americana*), and coontail (*Ceratophyllum demersum*).

The best-known examples in New York are Cayuga Lake, Seneca Lake, and Lake Champlain. These lakes are very deep relative to their size, with mean depths of 54.5 m (179 ft), 88 m (290 ft), and over 18m (60 ft) respectively. The area of these three lakes are 172 k^2 (66.4 sq. mi.), 175 k^2 (67.7 sq. mi.), and 1,331 k^2 (514 sq. mi.) respectively. The Great Lakes (e.g., Lakes Ontario, and Lake Erie) are also summer-stratified monomictic lakes, but they are not included in this community because of their larger size, and access to estuarine biota through the St. Lawrence River, and

the Welland Canal.

Up to two ecoregional variants are possible (Saint Lawrence-Lake Champlain, and Finger Lakes types) with one to few examples of each, potentially differing in dominant, and characteristic vascular plants, fishes, mollusks, and insects.

Distribution: uncommon in upstate New York, north of the Coastal Lowlands ecozone; probably restricted to the Finger Lakes in the Great Lakes Plain ecozone, and Lake Champlain in the Adirondacks ecozone.

Rank: G3G4 S1S2 *Revised:* 2001

Examples: Cayuga Lake, Cayuga, Seneca, and Tompkins Counties; Seneca Lake, Seneca, Schuyler, and Yates Counties; Lake Champlain, Clinton, Essex, and Washington Counties.

Sources: Berg 1963; Bloomfield 1978a; Greeley 1930; Lake Champlain Basin Study 1979; Muenscher 1928.

9. Winter-stratified monomictic lake: the aquatic community of a large, shallow lake that has only one period of mixing each year because it is very shallow in relation to its size (e.g., Oneida Lake, with a mean depth less than 6 m (20 ft), and surface area of approx. 200 k^2 (80 square miles), and is completely exposed to winds. These lakes continue to circulate throughout the summer; stratification becomes disrupted at some point during an average summer. These lakes typically never become thermally stratified in the summer, and are only stratified in the winter when they freeze over, and become inversely stratified (coldest water at the surface). They are eutrophic to mesotrophic.

Littoral, and epilimnion species assemblages predominate. Pelagic species assemblages are well developed. Characteristic fishes are walleye (*Stizostedion vitreum*), largemouth bass (*Micropterus salmoides*), yellow perch (*Perca flavescens*), bullhead (*Ictalurus* sp.), white sucker (Catostomus commersoni), muskellunge (*Esox masquinongy*), and trout perch (*Percopsis omiscomaycus*).

Characteristic macroinvertebrates may include isopods (Isopoda), amphipods (Amphipoda), and ramshorn snails (Planorbidae). Characteristic phytoplankton may include *Dinobryon* sp., and *Ceratium* sp. Vascular plants are typically diverse. Characteristic aquatic macrophytes include water stargrass (*Heteranthera dubia*), coontail (*Ceratophyllum demersum*), waterweed (*Elodea* spp.), naiad (*Najas flexilis*), tapegrass (*Vallisneria americana*), and pondweeds (*Potamogeton perfoliatus, P. pectinatus, P. pusillus, P. richardsonii, P. nodosus, P. zosteriformis*). The macroalgae Chara may be abundant.

Only two to three ecoregional variants are suspected (Great Lakes , Northern Appalachian, and possibly Lower New England types), potentially differing in dominant, and characteristic vascular plants, fishes, mollusks, and insects.

Distribution: uncommon in upstate New York, north of the Coastal Lowlands ecozone, and probably restricted to the Great Lakes Plains ecozone, and the St. Lawrence River valley of the Adirondacks ecozone.

Rank: G3G4 S2 *Revised:* 2001

Examples: Oneida Lake, Oneida, and Oswego Counties; Horseshoe Lake, St. Lawrence County; Black Lake, St. Lawrence County; Perch Lake, Jefferson County.

Sources: Berg 1963; Bloomfield 1978b; NYNHP field surveys.

10. Meromictic lake: the aquatic community of a relatively deep lake with small surface area that is so protected from wind-stirring that it has no annual periods of complete mixing, and remains chemically stratified throughout the year. These lakes may be protected from mixing by a sheltered surrounding landscape (e.g., a deep basin) or by adjacent tree cover. Meromictic lakes in New York freeze over in winter, so they are thermally stratified in winter; they pass through spring, and fall periods of isothermy without circulating. Meromictic lakes frequently have dichothermic stratification, meaning that the minimum temperature occurs in the middle stratum. The stagnant waters in the lower part of a meromictic lake become heavily loaded with dissolved salts, and lack oxygen. Chemical stratification is most often measured by salinity gradients or total cation, and anion concentrations. Gradients may be present for chemicals such as hydrogen sulfide, ammonia, phosphorus or iron. Flushing rates are typically low. Some examples of this lake type may be dystrophic, and thus resemble bog lakes.

Species diversity is low because very few organisms can tolerate the extreme chemical conditions of the lower strata of a meromictic lake. Fishes are absent or sparse, and confined to the epilimnion. Characteristic fishes are warmwater species, and may include brown bullhead (*Ameiurus nebulosus*), perch, and white sucker (*Catostomus commersoni*).

Characteristic macroinvertebrates may include gastropods (six species of snails in Green Lake Fayetteville), crustaceans (Crustacea), dragonflies (Anisoptera), beetles (Coleoptera), true bugs

(Hemiptera), Megaloptera, and caddisflies (Trichoptera).

Freshwater sponge forms a dense cover in the littoral zone of one example, Potters Pond. Plankton is typically diverse, and dense. A purple sulfur bacterium (*Lamprocystis roseopersicina*) is characteristic of the hypolimnion of Green Lake Fayetteville. Other characteristic plankton may include cyanobacteria, the phytoplankton *Synura* sp., *Asterionella* sp., *Peridium* sp., and *Ceratium hirundinella*, and the zooplankton *Diaphanasoma brachyurium*, *Ceriodaphnia*, and cyclopoid copepods.

Characteristic vascular plants may include stoneworts (*Chara* spp.), waterweeds (*Elodea* spp.), and pondweeds (Potamogeton spp.).

The best-known example in New York is Green Lake Fayetteville. Two or more ecoregional variants (Great Lakes, Northern Appalachian types) are suspected, potentially differing in dominant, and characteristic vascular plants, insects, and plankton. More data on this community are needed.

Distribution: uncommon in upstate New York, north of the Coastal Lowlands ecozone.

Rank: G3G4 S1S2 *Revised:* 2001

Examples: Green Lake Fayetteville, Onondaga County; Lowery Pond, one of Junius Ponds, Seneca County; Potters Pond, Franklin County; Ballston Lake, Saratoga County.

Sources: Berg 1963; Bohannan et al. 1994; Eggleton 1956; Pendl, and Stewart 1986; NYNHP field surveys.

11. Marl pond: the aquatic community of a small, shallow spring-fed pond in which the water has a high concentration of calcium; as a result of chemical or photosynthetic removal of carbon dioxide from the water, the calcium precipitates out of the water as calcium carbonate ($CaCO_3$). This calcium carbonate is deposited on the substrate, and forms a marl sediment. Calcium carbonate levels are typically greater than 50 ppm.

Stoneworts (*Chara* spp.), some other algae, cyanobacteria, and at least one species of moss (*Didymodon tophaceus*) can be involved in photosynthetic precipitation of calcium carbonate; stoneworts are usually present, and abundant in marl ponds. Marl ponds have very low primary productivity, and sparse growth of aquatic macrophytes. Characteristic vascular plants may include the pondweeds *Potamogeton filiformis*, and *P. strictifolius.*

Certain diatoms may be abundant, but low levels of available plant nutrients restrict growth of other algae, and cyanobacteria. A characteristic plankton in nearby states include calciphilic desmids, the cladoceran *Holopedium*, and calciphilic species of the rotifer *Brachionus* sp. More data on this community are needed.

Distribution: known only from the Finger Lakes Highlands subzone of the Appalachian Plateau ecozone; may be other examples in the Great Lakes Plain ecozone.

Rank: G3G4 S1 *Revised:* 2001

Examples: Cortland Marl Ponds, Cortland County.

Sources: Cole 1979; NYNHP field surveys.

12. Inland salt pond: the aquatic community of a small, spring-fed pond in which the water is salty from flowing through salt beds in the aquifer. These salt springs occur in central New York, and were once common around Onondaga Lake in Syracuse, and near Montezuma. Most of the springs have been exploited for the production of salt, and are very disturbed or completely destroyed. The pond is permanently flooded, but the water levels fluctuate seasonally. The bottom, and shores of an inland salt pond are very mucky.

The one example of this community that has remained least disturbed is dominated by ditch grass (*Ruppia maritima*), and has at least one species of small fish (probably a killifish, *Fundulus* sp.). Another characteristic plant is the pondweed *Potamogeton pectinatus.* More data on this community are needed.

Distribution: known only from the Great Lakes Plain ecozone.

Rank: G2 S1 *Revised:* 1990

Example: Carncross Salt Pond, Wayne County.

Sources: Catling, and McKay 1981; NYNHP field surveys.

13. Oxbow lake: the aquatic community of a small, shallow, usually stagnant lake or pond of fluvial origin that occurs in an old river meander or oxbow that has been cut off from an unconfined river or marsh headwater stream by deposition of a levee. The associated river typically overflows this levee periodically, replenishing hydrological, and biotic features of the river into this lake type. Many examples of this lake type may be relatively short-lived in

dynamic river complexes, transforming into a backwater slough through permanent breaching of the downstream levee, or into a riverine community through permanent breaching of the upstream levee. These are usually eutrophic lakes.

Characteristic biota are typically riverine species assemblages. Aquatic vegetation is abundant; characteristic aquatic macrophytes may include species typical of eutrophic ponds such as pondweeds (*Potamogeton* spp.), white water-lily (*Nymphaea odorata*), and water-shield (*Brasenia schreberi*).

Characteristic fauna may include odonates (Odonata). Four to seven ecoregional variants are suspected to differ in dominant, and characteristic vascular plants, fishes, mollusks, and insects. Up to three morphological variants are known: 1) classical oxbow lakes formed from old river channels, 2) small levee lakes formed as pools from levee overwash, and 3) floodplain lakes formed, and replenished during high annual water of the associated river. More data on this community are needed.

Distribution: throughout New York State north of the Coastal Lowlands ecozone, usually at low elevations.

Rank: G4 S3 *Revised:* 2001

Examples: Raquette River, Franklin County; North Branch Moose River, Herkimer County; Schroon River, Essex County; Little River, St. Lawrence County; Hemp Pond, Livingston County.

Source: NYNHP field surveys.

14. Coastal plain pond: the aquatic community of the permanently flooded portion of a coastal plain pond with seasonally, and annually fluctuating water levels. These are shallow, groundwater-fed ponds that occur in kettle-holes or shallow depressions in the outwash plains south of the terminal moraines of Long Island, and New England. A series of coastal plain ponds are often hydrologically connected, either by groundwater, or sometimes by surface flow in a small coastal plain stream. Water is typically acidic, darkly stained, and has low transparency. The substrate is typically sand to muck.

Aquatic vegetation may be abundant; characteristic plants include water-shield (*Brasenia schreberi*), white water-lily (*Nymphaea odorata*), bayonet-rush (*Juncus militaris*), spikerush (*Eleocharis robbinsii*), bladderworts (*Utricularia purpurea, U. fibrosa*), water milfoil (*Myriophyllum humile*), naiad (*Najas flexilis*), waterweed (*Elodea* spp.), pondweed (*Potamogeton oakesianus*), pipewort (Eriocaulon aquaticum), brown-fruited rush (Juncus pelocarpus), golden-pert (Gratiola aurea), and a peat moss (*Sphagnum macrophyllum*).

Characteristic fishes include chain pickerel (*Esox niger*), banded sunfish (*Enneacanthus obesus*), and eastern mudminnow (*Umbra pygmaea*). Coastal plain ponds are breeding ponds for tiger salamander (*Ambystoma tigrinum*). Other characteristic fauna may include painted turtle (*Chrysemys picta*), wood duck (*Aix sponsa*), and muskrat (*Ondatra zibethicus*). More data on this community are needed.

Distribution: in the Coastal Lowlands ecozone on Long Island.

Rank: G3G4 S2 *Revised:* 2001

Examples: Crooked Pond, Suffolk County; Scoys Pond, Suffolk County; Kents Pond, Suffolk County; Weeks Pond, Suffolk County.

Sources: Muenscher 1939; Theall 1983; NYNHP field surveys.

15. Oligotrophic pond: the aquatic community of a small, shallow, nutrient-poor pond. The water is very clear, and the bottom is usually sandy or rocky. Oligotrophic ponds are too shallow to remain stratified throughout the summer; they are winter-stratified, monomictic ponds. Additional characteristic features of an oligotrophic pond include the following: blue or green water with high transparency (Secchi disk depths of 4 to 8 m); water low in plant nutrients (especially low in nitrogen, also low in calcium); low primary productivity (inorganic carbon fixed = 7 to 25 $g/m^2/yr$). Alkalinity is typically low (less than 12.5 mg/l calcium carbonate). A name change, and slight conceptual change to acidic pond is being evaluated.

Aquatic vegetation is typically sparse, and species diversity is low. Littoral, epilimnion, and acidic tolerant species assemblages usually predominate. Characteristic species are rosette-leaved aquatics such as pipewort (*Eriocaulon aquaticum*), water lobelia (*Lobelia dortmanna*), and quillwort (*Isoetes echinospora*). Additional characteristic aquatic macrophytes may include pondweed (*Potamogeton epihydrus*), milfoil (*Myriophyllum farwellii*), bladderwort (*Utricularia vulgaris*), and burreed (*Sparganium fluctuans*).

Fish diversity is typically low, and fish assemblages are generally poorly developed. Oligotrophic ponds may have either coldwater or warmwater fishes, depending upon summer temperatures. Very small ponds with no inlet or outlet may lack fish, and have an abundance of aquatic insects. A characteristic fish of the coldwater ponds is brook trout (*Salvelinus fontinalis*). Native populations

of brook trout have been extirpated from most examples in the state. Additional characteristic fishes may include creek chub (*Semotilus atromaculatus*). Characteristic macroinvertebrates may include the clam *Pisidium* sp., several odonates (*Aeshna* spp., *Ischnura* spp., *Cordulia* spp., and *Leucorrhina* spp.), diving beetles (Dytiscidae), water boatman (Corixidae), and backswimmers (Notonectidae). Characteristic plankton may include the phytoplankton *Tabellaria*, and *Asterionella*, and the zooplankton *Keratella*, and *Nauplii*.

Three to four ecoregional variants (Northern Appalachian, Lower New England, Alleghany Plateau, and possibly North Atlantic Coast types) are suspected to differ in dominant, and characteristic vascular plants, fishes, mollusks, and insects.

Tarn pond, and flow-through or fluvial pond might be distinct variants worthy of recognition as separate communities, but need further evaluation. Tarn ponds occur in alpine to subalpine zones, and are typically frozen annually for extended periods. Characteristic vegetation of tarn ponds may include bladderwort (*Utricularia geminiscapa*), pondweed (*Potamogeton confervoides*), and floating-heart (*Nymphoides cordata*). Characteristic animals of tarn ponds may include lake trout (*Salvelinus alpinus*). Flow-through ponds are closely associated with riverine complexes (e.g., large natural widenings of rivers or large impoundments of river channels dammed by beaver), and have a high flushing rate. Characteristic animals of flow-through ponds may include beaver *(Castor canadensis*). More data on regional variants are needed.

Distribution: throughout New York State, usually at high elevations; more common in the Adirondacks, also occurs in the Appalachian Plateau, Taconic Highlands, and Tug Hill ecozones.

Rank: G4 S4 *Revised:* 2001

Examples: South Pond, Hamilton County; Kildare Pond, St. Lawrence County; Rensselaer Plateau, Rensselaer County; Tug Hill Plateau, Lewis, Oswego, and Jefferson Counties.

Source: NYNHP field surveys.

16. Eutrophic pond: the aquatic community of a small, shallow, nutrient-rich pond. The water is usually green with algae, and the bottom is mucky. Eutrophic ponds are too shallow to remain stratified throughout the summer; they are winter-stratified, monomictic ponds. Additional characteristic features of a eutrophic pond include the following: water that is murky, with low transparency (Secchi disk depths typically less than 4 m); water rich in plant nutrients (especially high in phosphorus, nitrogen, and calcium), high primary productivity (inorganic carbon fixed = 75 to 250 $g/m^2/yr$);, and a weedy shoreline. Alkalinity is typically high (greater than 12.5 mg/l calcium carbonate). A name change, and slight conceptual change to alkaline pond is being evaluated.

Species diversity is typically high. Aquatic vegetation is abundant. Littoral, and epilimnion species assemblages usually predominate. Characteristic plants include coontail (*Ceratophyllum demersum*), duckweeds (*Lemna minor, L. trisulca*), waterweed (*Elodea canadensis*), pondweeds (*Potamogeton* spp.), water starwort (*Heteranthera dubia*), bladderworts (*Utricularia* spp.), naiad (*Najas flexilis*), tapegrass (*Vallisneria americana*), algae (*Cladophora* spp.), yellow pond-lily (*Nuphar luteum*), and white water-lily (*Nymphaea odorata*). Characteristic fishes are usually warmwater fishes. Characteristic macroinvertebrates may include several types of odonates (*Aeshna* spp., *Ischnura* spp., *Gomphus* spp., and *Basiaeschna* spp.), and leeches (Hirundinae). Characteristic, and dominant plankton may include the phytoplankton *Chrysosphaerella longispina*, and *Ceratium* spp., and the zooplankton *Nauplii*, rotifers such as *Keratella*, cyclopoids, and cladocerans.

Three to seven ecoregional variants (including Northern Appalachian, Great Lakes, Lower New England types) are suspected to differ in dominant, and characteristic vascular plants, fishes, mollusks, and insects. Flow-through or fluvial pond might be a distinct variant worthy of recognition as a separate community type, but needs further evaluation. Flow-through ponds are closely associated with riverine complexes (e.g., large natural widenings of rivers or large beaver impoundments of river channels), and have a high flushing rate. Characteristic animals of flow-through ponds may include beaver (*Castor canadensis*). More data on this community are needed.

Distribution: throughout New York State, and is more common at low elevations, especially in the Great Lakes Plain ecozone, and St. Lawrence River Valley.

Rank: G4 S4 *Revised:* 2001

Examples: Black Pond, Jefferson County; Deer Pond, Essex County; Lima Ponds, Livingston County; Rogers Pond, Essex County; Sullivan Pond, Warren County; White Lily Pond, Rensselaer County.

Sources: Gilman 1979; NYNHP field surveys.

B. LACUSTRINE CULTURAL

This subsystem includes communities that are either created, and maintained by human activities, or are modified by human influence to such a degree that the trophic state, morphometry, water chemistry, or biological composition of the resident community are substantially different from the character of the lake community as it existed prior to human influence.

1. Lacustrine submerged structure: the aquatic community associated with an artificially introduced structure submerged in lacustrine waters, such as a pond or lake, that provides habitat for fish and other organisms. This includes structures that have been intentionally sunk for the purpose of attracting fish, as well as sunken ships, disposed waste, submerged bridge abutments, or any other introduced material that provides suitable habitat.

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 2001

2. Acidified lake: the aquatic community of a formerly alkaline (oligotrophic or mesotrophic), dimictic lake that has received so much acid deposition (pH less than 4.7; sulfate, and nitrate are now the dominant anions in precipitation in the Northeast) that the pH of the lake has decreased significantly. The changes in diatom assemblages in sediment cores from a few of these lakes have been used to infer the pH history of these lakes. Acidified lakes show a large decrease in pH (with pH usually less than 5.25) during the last 30 years relative to pH changes during the previous centuries. Associated with the decrease in pH are significant changes in the biota of the lake, such as a decrease in the number of species of fishes, diatoms, and most aquatic macrophytes present, and a change in the composition of species assemblages. Typically there are blooms of benthic green algae, and cyanobacteria, and an increase in the growth of peat mosses (*Sphagnum* spp.) or bladderworts (*Utricularia* spp.). One bladderwort (*Utricularia geminiscapa*), and one pondweed (*Potamogeton confervoides*) are reported to be restricted to lakes with pH less than 5.1. These lakes may be best distinguished from naturally acidic lakes (e.g., bog lake) through historical comparisons.

Distribution: most common in the Adirondacks, but may also occur throughout eastern New York in the Appalachian Plateau, Taconic Highlands, and Hudson Valley ecozones.

Rank: G5 S5 *Revised:* 1990

Example: Silver Lake Webb, Herkimer County.

Sources: Charles 1984; Roberts et al. 1985; Schindler 1988; Singer et al. 1983; Whitehead et al. 1986.

3. Cultural eutrophic lake: the aquatic community of a formerly eutrophic to mesotrophic lake that has received an increase in nutrients (especially phosphorus, and nitrogen) from sewage effluent, agricultural runoff, and other pollutants. This nutrient enrichment has resulted in a significant increase in productivity of the lake (especially in the phytoplankton); annual productivity of these lakes exceeds 300 g carbon/m^2/yr. An extremely eutrophic lake is characterized by high amounts of photosynthetic pigment in the water and, consequently, low transparency; blooms of cyanobacteria are common from midsummer through fall.

Characteristic macrophytes are weedy exotics such as Eurasian water milfoil (*Myriophyllum spicatum*), water chestnut (*Trapa natans*), and pondweed (*Potamogeton crispus*). These macrophytes may grow to high densities, excluding other species, and thus severely reducing species diversity.

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 1990

Sources: Bloomfield 1978a, 1980.

4. Farm pond/artificial pond: the aquatic community of a small pond constructed on agricultural or residential property. These ponds are often eutrophic, and may be stocked with panfish such as bluegill (*Lepomis macrochirus*), and yellow perch (*Perca flavescens*). The biota are variable (within limits), reflecting the species that were naturally or artificially seeded, planted, or stocked in the pond.

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 1990

5. Reservoir/artificial impoundment: the aquatic community of an artificial lake created by the impoundment of a river with a dam. Reservoirs are constructed to collect water for municipal and/or agricultural water use, to provide hydroelectric power, and to improve opportunities for recreational activities (e.g. boating, swimming), and development.

Characteristic fishes include chain pickerel (*Esox niger*), and other pikes (*Esocidae*); brown bullhead

(*Ictalurus nebulosus*) or yellow bullhead (*I. natalis*) or both of these; bluegill (*Lepomis macrochirus*) or pumpkinseed (*L. gibbosus*) or both of these; golden shiner (*Notemigonus crysoleucas*), and fathead minnow (*Pimephales promelas*). Reservoirs are often stocked with rainbow trout (*Salmo gairdneri*).

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 1990

6. Quarry pond: the aquatic community of an excavated basin that is created as part of a rock quarrying operation. The sides of the basin are often very steep, thereby eliminating any shallow shoreline habitats. Water levels usually fluctuate, reflecting recent precipitation patterns.

Distribution: throughout New York State north of the Coastal Lowlands ecozone.

Rank: G5 S5 *Revised:* 1990

7. Artificial pool: the aquatic community of a small pool that is constructed for recreational activities (e.g. swimming) or as a decorative element in a landscape design. The water is typically chlorinated, and flushed on a regular basis to reduce or eliminate the growth of algae, and bacteria; there is minimal development of any aquatic biota.

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 1990

8. Industrial cooling pond: the aquatic community of an artificial pond constructed as a holding pond to allow for cooling of high temperature industrial effluents.

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 1990

9. Sewage treatment pond: the aquatic community of an artificial pond constructed for sewage treatment (chemical, and biological decomposition of sewage) prior to release to a stream or aquifer.

Distribution: throughout New York State.

Rank: G5 S5 *Revised:* 1990

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