

III. RIVERINE SYSTEM

The riverine system consists of linear aquatic communities of flowing, non-tidal waters with a discrete channel, with persistent emergent vegetation sparse or lacking, but may include areas with abundant submerged or floating-leaved aquatic vegetation. The riverine communities in this classification are distinguished primarily by position of the stream in the watershed and water flow characteristics.

These communities are broadly defined, and may include two or more finer scale habitats (i.e., “microhabitats”), such as *riffles* (which include waterfalls), *runs*, and *pools*; these habitats usually have distinctive species assemblages (i.e., “associations”). A *riffle* is a part of the stream that is shallow and has a comparatively fast current; the water surface is disturbed by the current and may form standing waves (i.e., it is “turbulent”). A *run* is a part of the stream that has a moderate to fast current; the water is deep enough that the water surface is smooth and unbroken by the water current (although it may be disturbed by wind). A *pool* is a part of the stream that is deep and has a comparatively slow current; the water surface is calm unless disturbed by wind. The riverine communities are also distinguished by size of the stream. Large streams have an average width greater than about 30 m (100 ft), medium streams are from about 3 to 30 m (10 ft to 100 ft) wide, and small streams have an average width less than about 3 m (10 ft).

This classification of riverine communities is based on a combination of NYNHP field surveys, literature review and discussions with aquatic ecologists. To date about 46 plots have been sampled statewide by NYNHP in riverine communities. Bob Daniels of the New York State Museum provided much of the initial information on fish communities. Although the Heritage program has focused inventory work on streams since 1995; we do not currently have sufficient field data for confidently undertaking any major restructuring of the 1990 riverine classification. However, field work has suggested that this classification works well for representing the coarse scale distinctions between both abiotic and biotic features of river types. Although physically based, it is meant to serve as a coarse filter emphasizing resident stream biota. Two new coarse-scale physical-based types have been added to the classification, segregated out from other more broadly defined types of the 1990 classification: spring and deepwater river, the former a very small perennial stream, the latter a very large stream with profundal areas.

Further refinement of the riverine classification to distinguish regional variants will likely be based on additional field surveys and analysis of existing data collected by various aquatic scientists and agencies statewide. Regional variation in many of the designated

riverine communities is evident, but we do not currently have enough information or have undertaken analyses to confidently split common and widespread stream types into more specific regional variants. A finer scale classification of streams 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. The fish and mollusk assemblages in the riverine communities (especially in unconfined rivers and deepwater rivers) generally vary according to the watershed.

A. NATURAL STREAMS

This subsystem includes streams in which the stream flow, 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, stocked or accidentally introduced fishes), however the introduced species are not usually dominant in the stream community as a whole.

1. Rocky headwater stream: the aquatic community of a small- to moderate-sized perennial rocky stream typically with a moderate to steep gradient, and cold water that flows over eroded bedrock, boulders or cobbles in the area where a stream system originates. These streams are typically shallow, narrow, have a relatively small low flow discharge and usually represent a network of 1st to 2nd order stream segments. These streams typically include alternating riffle and pool sections. Most of the erosion is headward, and deposition is minimal. Waterfalls, chutes, flumes and cascades are typically present; these are here treated as features of the more broadly defined community. The predominant source of energy to the stream is terrestrial leaf litter or organic matter (these are allochthonous streams); trees shading the stream reduce primary productivity. These streams have high water clarity and are well oxygenated. They are typically surrounded by upland forests and situated in a confined valley.

Species assemblages characteristic of riffles and rocky substrate predominate the community. Characteristic fishes are coldwater species including eastern blacknose dace (*Rhinichthys atratulus*), creek chub (*Semotilus atromaculatus*), slimy sculpin (*Cottus cognatus*) or mottled sculpin (*C. bairdi*), and brook trout (*Salvelinus fontinalis*). Additional characteristic fishes may include longnose dace (*Rhinichthys cataractae*), reddsides dace (*Clinostoma elongatus*), and,

in pools, white sucker (*Catostomus commersoni*). Common introductions are rainbow trout (*Salmo gairdneri*) and brown trout (*S. trutta*). Characteristic amphibians may include northern two-lined salamander (*Eurycea bislineata*) and green frog (*Rana clamitans*).

Characteristic macroinvertebrates are riffle and rocky bottom specialists as well as leaf and algae shredders such as stoneflies (Plecoptera including Chloroperlidae, Leuctridae, Acroneuria sp.), mayflies (Ephemeroptera including Heptageniidae, Isonychia sp.), caddisflies (Trichoptera, including Rhyacophila sp. and especially Hydropsychidae), midges (Chironomidae), crayfish (Cambaridae including *Cambarus robustus*, *C. bartonii*), water penny beetle (*Psephenus* sp.), crane flies (Tipulidae including *Hexatoma* sp.) and blackflies (Simuliidae). Freshwater sponges may be abundant and coating rocks in some examples.

Characteristic pool macroinvertebrates may include true bugs (Gerridae, Vellidae and Mesovellidae). Mollusks are typically lacking or very sparse and of low diversity. These streams typically have bryophytes and periphytic/epilithic algae present, but few larger rooted plants. Characteristic bryophytes include: *Brachythecium rivulare*, *B. plumosum*, *Eurhynchium riparioides*, *Hygroamblystegium tenax*, *Hygrohypnum ochraceum*, *Rhizomnium punctatum*, *Mnium hornum*, *Fontinalis* spp., and *Scapania* sp.

Four to six ecoregional variants (including Northern Appalachian, Lower New England, Alleghany Plateau and Great Lakes types) are suspected to differ in dominant and characteristic vascular plants, fishes, bryophytes, and insects as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. Major watershed may be a secondary factor in distinguishing streams lower in a drainage basin.

Additional species characteristic of streams in the Northern Appalachians may include fishes such as pearl dace (*Margariscus margarita*), and northern redbelly dace (*Phoxinus eos*); and macroinvertebrates such as caddisflies (*Parapsyche* sp., *Palegapetus* sp., *Symphitopsyche* sp.), stoneflies (Capniidae, *Taenionema* sp., *Peltoperla* sp.), mayfly (*Eurylophella* sp.), midges (*Eukiefferella* sp.), and fishfly (Corydalidae).

Additional species characteristic of streams in the Saint Lawrence River and Lake Champlain Valleys may include fishes such as common shiner (*Luxilus cornutus*), bluntnose minnow (*Pimephales notatus*), fathead minnow (*P. promelas*) and slimy sculpin (*Cottus cognatus*); and macroinvertebrates such as stonefly (*Neoperla* sp.), caddisfly (*Chimara* sp., *Dolophilodes* sp.), beetles (*Promeresia* sp., *Stenelmis* sp., *Dubiraphia* sp., *Oulimnius* sp.), odonate (*Ophiogomphus compressa*), and midge (*Polypedilum*

sp.).

Additional species characteristic of streams in the Alleghany Plateau may include fishes such as tonguetied minnow (*Exoglossum laurae*), variegated darter (*Etheostoma variegatum*), greenside darter (*E. blenniodes*), rainbow darter (*E. caeruleum*), mimic shiner (*Notropis volucellus*), bigmouth shiner (*N. dorsalis*), striped shiner (*Luxilus chrysocephalus*) golden redbreast (*Moxostoma erythrurum*) and log perch (*Percina caprodes*); the amphibian longtail salamander (*Eurycea longicauda*); and the macroinvertebrates mayflies (*Sweltsa* sp., *Leuctra* sp., *Stenacron* spp., *Paraleptophlebia* spp.), caddisflies (*Lepidostoma* sp., *Polycentropus* sp., *Diplectrona modesta*, *Goera sylata*), stoneflies (*Yugus* sp.), alderfly (*Sialis* sp.), water penny beetle (*Ectopria* sp.), odonates (*Lanthus parvulus*, *Calopteryx amata*, *C. angustipennis*), and caddisflies (*Neophylax* sp., *Hydropsyche* spp., *Pycnopsyche psilotreta*, *Glossoma nigrrior*).

More data on regional variants are needed.

Distribution: throughout upstate New York north of the Coastal Lowlands ecozone, especially at high elevations.

Rank: G4 S4

Revised: 2001

Examples: Opalescent River Headwaters, Essex County; Johns Brook, Essex County; East Branch Fish Creek, Lewis County; Poestenkill Headwaters, Rensselaer County; Beaverkill River, Ulster County; Quaker Run, Cattaraugus County; Chaumont River, Jefferson County.

Sources: Slack and Glime 1985; C. L. Smith 1985; NYNHP field surveys.

2. Marsh headwater stream: the aquatic community of a small, marshy perennial brook with a very low gradient, slow flow rate, and cool to warm water that flows through a marsh, fen, or swamp where a stream system originates. These streams usually have clearly distinguished meanders (i.e., high sinuosity) and are in unconfined landscapes. Marsh headwater streams are typically deep. These streams are typically dominated by runs with interspersed pool sections; they are typically shallow, narrow, have a relatively small low flow discharge and usually represent a network of 1st to 2nd order stream segments. Most of the erosion is headward, and deposition is minimal. The substrate is typically gravel or sand, but some examples or segments may be dominated by silt, muck, peat, marl deposits or woody or leafy debris. These streams may have high turbidity and be somewhat poorly

oxygenated and can vary in alkalinity and color.

Species assemblages characteristic of pools and soft bottoms dominate the community. Characteristic fishes are warmwater minnows including fathead minnow (*Pimephales promelas*), northern redbelly dace (*Phoxinus eos*), golden shiner (*Notemigonus crysoleucas*), and central mudminnow (*Umbra limi*). Additional characteristic fishes may include brook trout (*Salvelinus fontinalis*), white sucker (*Catostomus commersoni*), longnose sucker (*C. catostomus*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*), and bluntnose minnow (*Pimephales notatus*). A characteristic mammal is beaver (*Castor canadensis*). Pool and soft bottom invertebrate specialists are typically common. Characteristic macroinvertebrates include true bugs (Gerridae, Vellidae, Mesovellidae). Macroinvertebrates found in this stream near lake outlets include blackflies (Simuliidae), caddisflies (*Hydropsyche* sp., *Cheumatopsyche* sp., *Symphytopsyche* sp.) midges (Chironomidae such as *Tanytarsini* sp.), and fingernail clams (*Sphaerium* spp.).

Submergent vascular plants may be abundant; characteristic aquatic macrophytes include water milfoil (*Myriophyllum heterophyllum*), coontail (*Ceratophyllum demersum*), pondweeds (*Potamogeton epihydrus*, *P. natans*), duckweeds (*Lemna minor*, *L. trisulca*), water stargrass (*Heteranthera dubia*), tapegrass (*Vallisneria americana*), bladderworts (*Utricularia* spp.), bur-reeds (*Sparganium americanum*, *S. angustifolium*, *S. fluctuans*), waterweed (*Elodea nuttallii*), naiad (*Najas* spp.), white water-lily (*Nymphaea odorata*) and yellow pond-lily (*Nuphar lutea*). Algae are primarily epiphytic and suspended.

Four to seven ecoregional variants are suspected to differ in dominant and characteristic vascular plants, fishes, bryophytes, invertebrates, and algae as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. Major watershed may be a secondary factor in distinguishing streams lower in a drainage basin.

Fishes characteristic of streams in the Saint Lawrence River and Lake Champlain Valleys may include muskellunge (*Esox masquinongy*), mooneye (*Hiodon tergisus*), northern pike (*Esox lucius*), black crappie (*Pomoxis nigromaculatus*), walleye (*Stizostedion vitreum*), rock bass (*Ambloplites rupestris*), yellow perch (*Perca flavescens*), northern hog sucker (*Hypentelium nigricans*), cutlips minnow (*Exoglossum maxillingua*), fallfish (*Semotilus corporalis*), pugnose shiner (*Notropis anogenus*), blackchin shiner (*N. heterodon*), spottail shiner (*N. hudsonius*), common shiner (*Luxilus cornutus*), Iowa darter (*Etheostoma exile*), brook lamprey (*Ichthyomyzon fossor*), shorthead redhorse (*Moxostoma macrolepidotum*), and banded killifish (*Fundulus*

diaphanus).

Characteristic macroinvertebrates of these streams may include true flies (*Tipula* sp., *Atherix* sp., *Simulium* sp.), midges (*Apsectrotyphus* sp., *Rheocricotopus* sp.), crustaceans (*Hyallela* sp.), clams (*Pisidium* sp.) and mayfly (*Stenonema* sp.). Characteristic plants of these streams may include water star-wort (*Callitriche hermaphroditica*), pondweeds (*Potamogeton hillii*, *P. filiformis*), milfoil (*Myriophyllum* spp.), and water marigold (*Megalodonta beckii*).

Species characteristic of examples in the Northern Appalachians may include the fishes blacknose dace (*Rhinichthys atratulus*), longnose dace (*R. cataractae*) and creek chub (*Semotilus atromaculatus*), the macroinvertebrates fingernail clam (*Sphaerium striatum*), caddisfly (*Polycentropus* sp.), mayfly (*Litobranca* sp.) and odonate (*Cordulegaster* sp.), water scorpions (Nepidae), and water penny beetle (*Psephenus* sp.), and the vascular plants milfoil (*Myriophyllum farwellii*) and water-shield (*Brasenia schreberi*). More data on regional variants are needed.

Distribution: throughout New York State.

Rank: G4 S4

Revised: 2001

Examples: Campbell Marsh, Jefferson County; South Branch Mad River, Lewis County; North Branch Fish Creek, Lewis County; Swarte Kill, Ulster County; Poestenkill Headwaters, Rensselaer County; Main Branch Oswegatchie River, Herkimer, St. Lawrence and Hamilton Counties; Brandy Brook, St. Lawrence County.

Sources: Gilman 1979; Haslam 1978; Peverly 1979; C. L. Smith 1985; NYNHP field surveys.

3. Confined river: the aquatic community of relatively large, fast flowing sections of streams with a moderate to gentle gradient. The name of this community has been changed from “midreach stream” to better reflect the concept. These streams have well-defined pattern of alternating pools, riffles, and runs. Confined rivers usually have poorly defined meanders (i.e., low sinuosity), occur in confined valleys and are most typical of the midreaches of stream systems. These streams are typically of moderate depth, width and low flow discharge and usually represent a network of 3rd to 4th order stream segments. Most of the erosion is lateral, creating braids, channel islands, and bars, and deposition is moderate with a mix of coarse rocky to sandy substrate. Waterfalls are typically present; these are here treated as features of the more broadly defined community. The predominant source of energy is generated in the stream (these are autochthonous

streams). These streams have high water clarity and are well oxygenated. They are typically surrounded by open upland riverside communities including riverside sand/gravel bar, cobble shore or one of the shoreline outcrop communities.

Species assemblages characteristic of riffles and rocky bottoms dominate the community. Fish diversity is typically high to moderate. Characteristic fishes include creek chub (*Semotilus atromaculatus*), pumpkinseed (*Lepomis gibbosus*), common shiner (*Luxilus cornutus*), and trout-perch (*Percopsis omiscomaycus*) in pools; rosyface shiner (*Notropis rubellus*) at the head of pools; tessellated darter (*Etheostoma olmstedi*), longnose dace (*Rhinichthys cataractae*), slimy sculpin (*Cottus cognatus*) or mottled sculpin (*C. bairdi*), and stonecat (*Noturus flavus*) in riffles; and bluntnose minnow (*Pimephales notatus*) and northern hogsucker (*Hypentelium nigricans*) in runs. Other characteristic fishes may include blacknose dace (*Rhinichthys atratulus*) and fantail darter (*Etheostoma flabellare*). Common introductions are rainbow trout (*Salmo gairdneri*), brown trout (*S. trutta*), and (in streams where it is not native) smallmouth bass (*Micropterus dolomieu*). Characteristic mollusks include eastern elliptio (*Elliptio complanta*), eastern floater (*Pyganodon cataracta*), fingernail clams (*Sphaerium* spp.). Other macroinvertebrates are diverse; characteristic macroinvertebrates include riffle and rocky bottom specialists as well as algae shredders such as crayfish (Cambaridae), mayflies (Ephemeroptera including Ephemeridae, Heptageniidae, *Isonychia* sp.), stoneflies (Plecoptera including Chloroperlidae, *Acroneuria* sp., *Neoperla* sp.), caddisflies (Trichoptera including Hydropsychidae, *Helicopsyche* sp., *Dolophilodes* sp., *Rhyacophila* sp.), crane fly (*Hexatoma* sp.), beetles (*Oulimnius* sp., *Psephenus* sp.), dobsonflies (Corydalidae), midge (*Polypedilum* sp.), crane flies (Tipulidae), and blackflies (Simuliidae). Odonate (Odonata including Calopterygidae) larvae may be characteristic of runs. True bugs (Gerridae, Vellidae, Mesovellidae) are characteristic of pools.

Epilithic algae are the predominate plant. Aquatic macrophytes are usually sparse; typical aquatic macrophytes include waterweed (*Elodea canadensis*) and linear-leaved pondweeds such as sago pondweed (*Potamogeton pectinatus*). An additional characteristic vascular plant may be *Podostemum ceratophyllum*. Bryophytes are often confined to shallows and the intermittently exposed channel perimeter.

Four to six variants associated with a combination of ecoregions (including Northern Appalachian, Great Lakes, Lower New England and Alleghany Plateau ecoregions) or major watersheds (including Great Lakes, Hudson River, Alleghany River, Susquehanna/Delaware Rivers) are suspected to differ

substantially in dominant and characteristic vascular plants, fishes, mollusks, insects, and algae as well as water chemistry (especially alkalinity and color), water temperature, underlying substrate type, and surrounding forest type. In addition, biota is suspected to differ among streams of moderate size (roughly 3rd to 4th order streams) and large size (roughly 5th to 6th order streams). Aquatic connectivity factors are thought to strongly influence the fish and mollusk composition. Species characteristic of Northern Appalachian streams may include the fishes brook trout (*Salvelinus fontinalis*), cutlips minnow (*Exoglossum maxillingua*), longnose sucker (*Catostomus catostomus*), and white sucker (*C. commersoni*); and the macroinvertebrates eastern pearlshell (*Margaritifera margaritifera*), and odonates (*Gomphus* spp., *Progomphus obscurus*).

Species characteristic of streams in the Saint Lawrence River and Lake Champlain Valley may include a diverse assemblage of mollusks such as heelsplitters (*Potamilus* sp. and *Lasmigona* sp.), lampmussels (*Lampsilus* spp. including *L. cariosa*), *Leptodea* sp., triangle floater (*Alasmidonta undulata*), creekmussel (*Strophitus* sp.), pondmussel (*Ligumia* sp.), *Anodontoides* sp., and pea clams (*Pisidium* spp.). Other macroinvertebrates characteristic of streams in this region may include beetles (*Promeresia* sp., *Stenelmis* sp., *Dubiraphia* sp.), caddisflies (*Chimara* sp., *Phylocentropus* sp.), mayfly (*Hexagenia* sp.), amphipod (*Gammarus* sp.), and true flies (*Sphaeromias* sp., *Culicoides* sp.).

Species characteristic of Alleghany Plateau and Great Lakes streams may include the fishes greenside darter (*E. blennioides*) and rainbow darter (*Etheostoma caeruleum*), central stoneroller (*Campostoma anomalum*), silverjaw minnow (*Ericymba buccata*), spotted darter (*Etheostoma maculatum*), golden redhorse (*Moxostoma erythrurum*) and shorthead redhorse (*M. macrolepidotum*); the mollusks mucket (*Actinonaias ligmentina*), Ohio pigtoe (*Pleurobema cordatum*), kidneyshell (*Ptychobranhus fasciolaris*), fluted-shell (*Lasmigona costata*), lampmussels (*Lampsilis fasciola*, *L. ventricosa*), and spike (*Elliptio dilitata*); and the other macroinvertebrates mayfly (*Stenonema* spp.), and caddisfly (*Cheumatopsyche* sp.).

More data on regional variants are needed.

Distribution: throughout New York State.

Rank: G4 S4

Revised: 2001

Examples: French Creek, Chautauqua County; Moose River, Herkimer, Lewis and Oneida Counties; Middle Branch Oswegatchie River, St. Lawrence, Herkimer and Lewis Counties; Hudson River, Essex, Warren and Saratoga Counties; East Branch Fish Creek, Lewis County; Rondout Creek; Ulster County; Shawangunk

Kill, Ulster County; Hoosic River; Rensselaer County.

Sources: C. L. Smith 1985; NYNHP field surveys.

4. Unconfined river: the aquatic community of large, quiet, base level sections of streams with a very low gradient. The name of this community has been changed from “main channel stream” to better reflect the concept. These streams are typically dominated by runs with interspersed pool sections and a few short or no distinct riffles. Unconfined rivers usually have clearly distinguished meanders (i.e., high sinuosity) and well developed levees, are in unconfined valleys and are most typical of the lowest reaches of stream systems. These streams are typically deep, wide, have a high low flow discharge, and usually represent a network of 5th to 6th order stream segments. They are characterized by considerable deposition, predominated by fine substrates such as silt, with a relatively minor amount of erosion. Waterfalls may be present; these are here treated as features of the more broadly defined community. The predominant source of energy is generated in the stream (these are autochthonous streams). These streams are usually warm water, may have high turbidity and be somewhat poorly oxygenated. They are typically surrounded by floodplain forest or eroded sand or clay banks or fine sediment bars.

Species assemblages characteristic of pools and soft bottoms dominate the community. Characteristic fishes are deep-bodied fishes such as suckers (Catostomids) - especially redhorses (*Moxostoma* spp.), sturgeon (*Acipenser* spp.), and shad (*Alosa* spp.). Many of the fishes are anadromous. Other characteristic fishes include warmwater fishes such as pickerel (*Esox americanus*), northern pike (*E. lucius*), largemouth bass (*Micropterus salmoides*), smallmouth bass (*M. dolomieu*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ameiurus nebulosus*) and white sucker (*Catostomus commersoni*). Other characteristic vertebrates may include species of ducks. Characteristic macroinvertebrates may include numerous species of mollusks such as *Pisidium* sp., suspected to differ substantially among regional variants, as well as stoneflies (Plecoptera), beetle (*Dubiraphia* sp.), midge (*Polypedium* sp.), mayfly (Leptophlebiidae), clam, odonates (Aeshnidae, Calopterygidae, Coenargonidae, Gomphidae) and caddisfly (*Hydaphylax* sp.).

Although the middle of an unconfined river is usually too deep for aquatic macrophytes to occur, the shallow shores and backwaters typically have rooted macrophytes. Characteristic submergent vascular plants may include naiad (*Najas flexilis*), pondweeds (*Potamogeton epihydrus*, *P. perfoliatus*, *P. spirillus*),

burreed (*Sparganium fluctuans*), tategrass (*Vallisneria americana*), and spikerush (*Eleocharis robbinsii*). Floating aquatic macrophytes such as white water-lily (*Nymphaea* sp.) may be common in pools along shallow shores and in backwaters. Two exotic weeds, Eurasian milfoil (*Myriophyllum spicatum*) and water chestnut (*Trapa natans*) may also occur along shores and backwaters. Mosses in the genus *Fontinalis* may be characteristic of shallow areas. Plankton assemblages may be abundant.

Four to six variants associated with a combination of ecoregions (including Northern Appalachian, Great Lakes, Lower New England and Allegheny Plateau types) or major watersheds distinguished by C. L. Smith (1985) (the St. Lawrence River basin, Hudson River, Delaware River, Susquehanna River, and Allegheny River) are suspected to differ substantially in dominant and characteristic vascular plants, fishes, mollusks, and insects as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. For example, the species of fish genera present in any one stream varies between major watersheds. In addition, biota is suspected to differ among streams of moderate size (roughly 3rd to 4th order streams) and large size (roughly 5th to 6th order streams). Aquatic connectivity factors are thought to strongly influence the fish and mollusk composition. Fishes characteristic of the Saint Lawrence River and Lake Champlain Valley may include the fishes muskellunge (*Esox masquinongy*), yellow perch (*Perca flavescens*), white perch (*Morone americana*), walleye (*Stizostedion vitreum*), mooneye (*Hiodon tergisus*), longnose sucker (*Catostomus catostomus*), Iowa darter (*Etheostoma exile*), johnny darter (*Etheostoma nigrum*), banded killifish (*Fundulus diaphanus*), pugnose shiner (*Notropis anogenus*), spottail shiner (*N. hudsonius*) and blackchin shiner (*N. heterodon*). Characteristic fishes of the Northern Appalachians may include the fishes brook trout (*Salvelinus fontinalis*), slimy sculpin (*Cottus cognatus*), creek chub (*Semotilus atromaculatus*), longnose dace (*Rhinichthys cataractae*), tessellated darter (*Etheostoma olmsteadii*), fathead minnow (*Pimephales promelas*) and bluntnose minnow (*Pimephales notatus*).

More data on flora (macrophytes and algae) and invertebrate fauna, as well as regional variants, are needed.

Distribution: throughout the state north of the Coastal Lowlands ecozone, usually at low elevations.

Rank: G4 S4

Revised: 2001

Examples: Mohawk River from Utica to the Hudson River; Hudson River from Glens Falls to the Troy Dam; Rondout Creek, Ulster County; Raquette River,

Franklin County; Oswegatchie River, St. Lawrence County; Poultney River, Washington County; Black River, Lewis, Jefferson and Oneida Counties; Genessee River, Livingston and Monroe Counties.

Sources: C. L. Smith 1985; NYNHP field surveys.

5. Backwater slough: the aquatic community of quiet to stagnant waters in sloughs that form in embayments and old meanders that are cut off from an unconfined river or marsh headwater stream only at the upstream end by deposition of a levee. Many examples of this river type may be relatively short-lived in dynamic river complexes, transforming into an oxbow lake through permanent formation of a downstream levee, or into an associated river type through permanent breaching of the upstream levee. The water is typically warm. Although classified as a river type, many hydrological characteristics may resemble those of lacustrine communities.

Characteristic biota are pool specialists and may resemble those of lacustrine species assemblages or marsh headwater streams. Aquatic vegetation is usually abundant; characteristic aquatic plants include waterweed (*Elodea canadensis*), milfoil (*Myriophyllum* spp.), duckweed (*Lemna minor*), and pondweeds (*Potamogeton* spp.). Emergent aquatic plants may be abundant along the shores. Characteristic fishes are golden shiner (*Notemigonus crysoleucas*), pumpkinseed (*Lepomis gibbosus*), brown bullhead (*Ictalurus nebulosus*), and chain pickerel (*Esox niger*). Characteristic macroinvertebrates may include odonates (Odonata), stoneflies (Plecoptera), diving beetles (Dytiscidae), mosquitoes (Cuculidae), true flies (*Tipula* sp., *Atherix* sp., *Simulium* sp.), midges (Chironomidae), crustaceans (*Hyaella* sp.), clams (*Pisidium* sp.) and mayflies (Stenonema). Wading birds and ducks such as pied-billed grebe (*Podilymbus podiceps*) and great blue heron (*Ardeas herodias*) may be characteristic. A characteristic mammal may be muskrat (*Ondatra zibethicus*).

Four to seven ecoregional variants are suspected to differ in dominant and characteristic vascular plants, fishes, mollusks, insects, and birds as well as water chemistry, water temperature, underlying substrate type, surrounding forest type and associated stream type. Major watershed may be a secondary factor in distinguishing streams lower in a drainage basin. More data on this community are needed.

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

Rank: G4 S2S3

Revised: 2001

Examples: Raquette River, Franklin County; North Branch Moose River; Log Flats, Livingston County; Ausable Delta, Clinton County; Little River, St. Lawrence County.

Sources: C. L. Smith 1985; NYNHP field surveys.

6. Intermittent stream: the community of a small, intermittent or ephemeral streambed in the uppermost segments of stream systems where water flows only during the spring or after a heavy rain and often remains longer, ponded in isolated pools. These streams typically have a moderate to steep gradient and hydric soils.

The streambed may be covered with diverse emergent and submergent bryophytes; characteristic bryophytes may include *Bryhnia novae-angliae*, *Bryum pseudotriquetrum*, *Chiloscyphus polyanthus*, *Hygrohypnum ochraceum*, *H. eugyrium*, *Hygroamblystegium tenax*, *Fontinalis* spp., *Brachythecium rivulare*, *B. plumosum*, *Eurhynchium ripariodes*, *Mnium affine*, *Scapania nemorosa* and *S. undulata*. Characteristic vascular plants are hydrophytic and may include water-carpet (*Chrysosplenium americanum*) and pennywort (*Hydrocotyle americana*). Fauna is diverse and limited to species that do not require a permanent supply of running water, that inhabit the streambed only during the rainy season, or that are pool specialists. Characteristic fauna include amphibians such as green frog (*Rana clamitans*) and northern two-lined salamander (*Eurycea bislineata*), and macroinvertebrates such as water striders (*Gerris* sp.), water boatman (Corixidae), caddisflies (Trichoptera), mayflies (Ephemeroptera), stoneflies (Plecoptera), midges (Chironomidae), blackflies (Simuliidae) and crayfish (*Cambarus bartoni*).

Four to seven ecoregional variants are suspected to differ in dominant and characteristic bryophytes and insects as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. In addition, there may be a unique alpine/subalpine variant and different variants associated with acidic versus calcareous substrates. Examples surveyed on the Alleghany Plateau are dominated by stoneflies in the family Perlodidae, and several mayflies (Heptageniidae, *Sweltsa* sp., *Clioperla* sp. and *Ameletus* sp.). Biota characteristic of this region may include northern pygmy clubtail (*Lanthes parvulus*), craneflies (*Hexatoma* sp.), caddisflies (*Pycnopsyche* sp., and *Neophylax* sp.) and stoneflies (*Peltoperla* sp.). More data on regional variants are needed.

Distribution: throughout New York State.

Rank: G4 S4

Revised: 2001

Examples: Carrollton Run, Cattaraugus County; Chicken Coop Brook, Essex County; Porter Mountain, Essex County; Waterman Brook Headwaters, Cattaraugus County; Chautauqua Gorge, Chautauqua County; Quackenkill Headwaters, Rensselaer County.

Sources: comments by Nancy Slack (of Russell Sage College); NYNHP field surveys.

7. Coastal plain stream: the aquatic community of slow-moving, often darkly-stained streams of the coastal plain of Long Island. Often there is abundant submerged vegetation: characteristic aquatic plants include pondweeds (*Potamogeton pusillus*, *P. epihydrus*), naiads (*Najas flexilis*, *N. guadalupensis*), waterweeds (*Elodea nuttallii*, *E. canadensis*, *E. densa*), stonewort (*Nitella* sp.), bladderwort (*Utricularia vulgaris*), duckweed (*Lemna minor*), Tuckerman's quillwort (*Isoetes tuckermanni*) and white water-crowfoot (*Ranunculus trichophyllus*). Watercress (*Nasturtium officinale*), an introduced species, is also common.

Characteristic fishes include American eel (*Anguilla rostrata*), redbfin pickerel (*Esox americanus americanus*), eastern banded killifish (*Fundulus diaphanus*), pumpkinseed (*Lepomis gibbosus*), banded sunfish (*Enneacanthus obesus*), and swamp darter (*Etheostoma fusiforme*). The exotic bivalve Asian clam (*Corbicula fluminea*) may have recently become a widespread invasive species throughout this stream type in the state.

Distribution: restricted to the Coastal Lowlands ecozone.

Rank: G3G4 S1 *Revised:* 2001

Examples: Carmans River, Suffolk County; Peconic River, Suffolk County.

Sources: Beitel 1976; Greeley 1939; Muenscher 1939; NYNHP field surveys.

8. Deepwater river: the aquatic community of very large, very deep, quiet, base level sections of streams with a very low gradient and where there are profundal areas. These streams are typically dominated by runs with interspersed pools and a few short or no distinct riffles. Deepwater rivers are restricted to the largest of stream systems, often corresponding to segments of 8th order or higher.

Species diversity is high, and assemblages characteristic of runs, pools and the pelagic zone dominate the community. Many of the fishes are

anadromous. Characteristic fishes include redhorses (*Moxostoma* spp.) and lake sturgeon (*Acipenser fulvescens*), northern pike (*E. lucius*), smallmouth bass (*M. dolomieu*), channel darter (*Percina copelandi*), Iowa darter (*Etheostoma exile*), eastern sand darter (*Ammocrypta pellucida*), walleye (*Stizostedion vitreum*), mooneye (*Hiodon tergisus*), and blackchin shiner (*Notropis heterodon*). Characteristic macroinvertebrates may include oligochaetes (Oligochaeta) and mollusks; oligochaetes may be abundant in the profundal zone. Many mollusks that were historically present in the Saint Lawrence River have presumably become extirpated. Although the middle of a deepwater river is too deep for aquatic macrophytes to occur, the shallow shores and backwaters may have rooted macrophytes. Plankton assemblages may be abundant. More data on this community are needed.

Distribution: restricted to Great Lakes drainage in the Great Lakes Plain ecozone.

Rank: G2G3? S1S2? *Revised:* 2001

Examples: Saint Lawrence River, St. Lawrence, Jefferson and Franklin Counties; Niagara River, Erie and Niagara Counties.

9. Spring: the aquatic community of very small, cold stream sources where the flow is perennial. Springs are characterized by water with constant cold temperature and rich in dissolved oxygen. These streams are typically very shallow and have a short length and relatively constant and very low discharge. Stream gradient, substrate and the proportion of flow microhabitats can vary greatly between examples. These streams may adjoin to any other aquatic community, but are typically found in association with headwater streams.

Species diversity may be high, and assemblages characteristic of riffles may dominate the community. They are known in the literature as "medicolous habitat" or "spring creeks." Fishes are absent. Characteristic amphibians may include dusky salamander (*Desmognathus fuscus fuscus*). Characteristic and dominant macroinvertebrates may include Tricladida, several caddisflies (Limnephilidae, *Lepidostoma* sp., *Rhyacophila* sp., *Dolophilodes distinctus*, *Pycnopsyche gentilis*), several stoneflies (Perlodidae, Chloroperlidae, *Peltoperla* sp., *Sweltsa* sp.), craneflies (Tipulidae), springtails (*Orchesella* sp.), mayflies (Ephemeroptera), clubtails (*Lanthus parvulus*, *L. vernalis*), and beetles (Coleoptera). Some low diversity examples studied by Sutton (1998) with cold alkaline water on the Great Lakes Plain are dominated

by the amphipod *Gammarus pseudolimnaeus*, the mayfly *Ephemera* spp., and midges (Chironomidae). Characteristic vascular plants may include water-carpenter (*Chrysosplenium americanum*), wood nettle (*Laportea canadensis*), clearweed (*Pilea pumila*), sedge (*Carex scabrata*), and Pennsylvania bittercress (*Cardamine pennsylvanica*). Characteristic bryophytes may include *Brachythecium* spp. and *Fissidens* sp.

Four to seven ecoregional variants (including Northern Appalachian, Lower New England, Great Lakes and Alleghany Plateau types) are suspected to differ in dominant and characteristic vascular plants, fishes, mollusks, and insects as well as water chemistry, water temperature, underlying substrate type, and surrounding forest type. More data on this community are needed.

Distribution: throughout New York State.

Rank: G4G5? S3S4?

Revised: 2001

Examples: Murray Brook, Cattaraugus County; Caledonia Spring Creek, Livingston County; Cedar Springs, Monroe County; Mossy Brook Bank Spring, Ulster County; Zoar Valley, Cattaraugus County.

Sources: Sutton, 1998; NYNHP field surveys.

B. RIVERINE 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 stream flow, morphometry, water chemistry, or the biological composition of the resident community are substantially different from the character of the stream community as it existed prior to human influence. No biotic riverine cultural types have been noted. NYNHP is currently unaware of examples of streams without physical or chemical alterations that have become dominated by exotic biota such as water chestnut (*Trapa natans*) and Eurasian water milfoil (*Myriophyllum spicatum*).

1. Riverine submerged structure: the aquatic community associated with an artificially introduced structure submerged in riverine waters, such as a stream or river, 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 stream: the aquatic community of a stream that has received so much acid deposition that the pH of the stream has decreased significantly. The dominant anions in precipitation in the Northeast are sulfate and nitrate; the pH of this precipitation is less than 4.7. The biota of streams may be more sensitive to acidification than the biota of lakes. In the Adirondack Highlands of Ontario, several species of mayflies and stoneflies have disappeared from acidified reaches of streams. Fish kills have been observed in streams following acid pulses (for example, after snowmelt). More data on this community are needed.

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

Rank: G5 S5

Revised: 1990

Source: Schindler 1988.

3. Canal: the aquatic community of an artificial waterway or modified stream channel constructed for inland navigation or irrigation. Most canals have a low gradient between locks; however, some feeder canals (built to supply water to another canal) have a steep gradient and are not navigable.

Characteristic fishes include brook stickleback (*Culaea inconstans*), central mudminnow (*Umbra limi*), brook silverside (*Labidesthes sicculus*), and pikes (*Esocidae*).

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

4. Ditch/artificial intermittent stream: the aquatic community of an artificial waterway constructed for drainage or irrigation of adjacent lands. Water levels either fluctuate in response to variations in precipitation and groundwater levels, or water levels are artificially controlled. The sides of ditches are often vegetated, with grasses and sedges usually dominant. Exotic or weedy species are common. Purple loosestrife (*Lythrum salicaria*), reedgrass (*Phragmites australis*), and reed canary grass (*Phalaris arundinacea*) often become established and may form dense, monospecific stands. Reed canary grass is often planted along ditches for erosion control. Other plants that are characteristic include sedges (*Carex* spp.) and cattails (*Typha* spp.).

RIVERINE REFERENCES

Algae indicative of eutrophic conditions may be abundant.

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

5. Industrial effluent stream: the aquatic community of a stream or a small section of a stream in which the temperature, chemistry, or transparency of the water is significantly modified by discharge of effluent from an industrial, commercial, or sewage treatment plant. The water or sediments may contain elevated concentrations of heavy metals, PCBs, ammonia, and other pollutants. Relative to unpolluted streams of similar morphology, species richness of fishes is low, and pollution-intolerant species (e.g. lampreys, darters, sculpins) may be absent. Algae indicative of eutrophic conditions and iron fixing bacteria may be abundant.

Distribution: throughout New York State.

Rank: G5 S5

Revised: 1990

Source: Reash and Berra 1987.

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