Fish

Onondaga Creek Fact Sheet

INTRODUCTION

What is the relationship between an aquatic "ecosystem" and a fish "community"? An aquatic ecosystem is made up of the interactions between all of the animals and plants, and their physical and chemical surroundings (e.g., physical habitat, nutrients, oxygen, temperature), in a specific place. A fish community is one part of the ecosystem, including only fish and their interactions with each other. The physical and chemical surroundings usually determine the character of the fish community, and can vary between places and change over time (e.g., due to seasons or human influences). Fish communities are likely to reflect those environmental differences. Common ways to group fish are described in Text Box 1.

How are ecosystems and fish communities delineated? Ecosystem or fish community boundaries are arbitrary, but are usually defined by natural patterns in environmental features. For example, lakes or ponds are commonly identified as distinct ecosystems. Watershed divides are frequently used as boundaries between lotic ecosystems. Boundaries within natural rivers and creeks can be more difficult to define because the character of the system changes, sometimes gradually, along its length. However, obstructions to water or fish movement sometimes provide clear boundaries between fish communities. These include natural barriers such as waterfalls, and man-made barriers like dams or extensive reaches of degraded habitat.

What are fish communities like in undisturbed streams? Fish communities vary between headwaters and mouth of a creek. In undisturbed streams, fish communities near headwaters are typically comprised of a few cold water species, gradually transitioning to cool or warm water communities at the mouth, with the greatest diversity in between. This transition in species composition reflects changes in topographic, aquatic and riparian habitats, water quality, and food types along the length of a stream. Migratory and transient species may use parts of the creek seasonally for feeding, reproduction, or refuge, temporarily increasing diversity.

How are fish communities studied in streams? Fish surveys investigate species, number, size, sex, reproductive status, and health of fish using a number of field techniques. A common sampling technique for fish surveys in wadeable streams is electroshocking. Various types of nets can be used in deeper waters. Repeated sampling in an area enclosed with nets can be used to calculate the total number of fish at a location. Fish density (number / area) is the total abundance divided by the estimated stream area. The aquatic environment in

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Text Box 1

How do ecologists refer to groups of fish?

Ecologists frequently group fish into broad categories based on the behavior of the fish, their preferred environment, or human use. A single fish species may belong in several of the following groups:

By temperature preference:
- Cold water (e.g., trout, salmon, whitefish)
- Cool water (e.g., walleye, muskellunge)
- Warm water (e.g., carp, bluegill, largemouth bass)

By movement pattern:
- resident (e.g., brook trout, minnows)
- migratory (e.g., salmon, eel)
- transient (e.g., large predatory fish)

By location within the ecosystem or type of ecosystem:
- Lotic – flowing water
- Lentic – still water
- Benthic – bottom-dwelling
- Littoral – near shore
- Pelagic – open water

By the food they eat:
- Herbivore – aquatic vegetation
- Planktivore – free-floating plankton (usually zooplankton)
- Benthivore – benthic macroinvertebrates (e.g., insect larvae, mussels, or worms), periphyton (small attached algae and microbes)
- Piscivore – fish
- Omnivore – plant and animal

By response to pollution:
- Tolerant
- Intolerant

By human use:
- Sport fish
- Pan fish
- Commercial fish

Onondaga Creek changes along its length and seasonally. During a particular fish survey, species composition at that time is affected by a number of environmental and circumstantial factors. Multiple samples conducted at intervals along a creek and its tributaries, and at multiple times, can give an overall picture of local fish communities and their spatial relationships to natural and man-made conditions.

FINDINGS

What factors affect fish distribution in Onondaga Creek? Habitat and water quality, angling, and stocking regimes affect fish communities in Onondaga Creek. Habitat and water quality change dramatically from the headwaters and tributaries to its mouth at Onondaga Lake (see Aquatic Habitat and Water Quality Fact Sheets), so we would expect changes in the fish community along the creek length. However, the natural gradient has been altered by several impoundments and barriers to natural fish movement, channelization, reduction in riparian wetland and floodplain habitats, among other impacts, which affect local fish communities and impede upstream movement.

What kinds of fish are in Onondaga Creek? Thirty-four species have been identified in the Onondaga Creek fish surveys, divided into fairly distinct coldwater and warmwater fish communities (Figure 1).[1] The cold water of the Tully Valley and headwaters segment, and the West Branch segment, support a distinct and persistent assemblage of brown trout, sculpins (slimy and mottled), dace (longnose and blacknose), creek chub, and white sucker.[2] Wild brook trout were reported in very small headwaters tributaries, and locally in the upper main stem. All but the brown trout are native to New York State. In 2003 and 2005, stocked Atlantic salmon have also been reported in the upper main stem. Relatively few warm water fish have been reported in the upper main stem and West Branch, most likely washed down from impoundments upstream or transients occasionally introduced by anglers. No formal survey data were located for the Onondaga Nation territory. Hemlock and Kennedy Creeks above the Nation supported the same cold water assemblage in the early 1990's. As of 1989, both brook and brown trout were reported in Upper Furnace Brook, which empties into the urban segment of Onondaga Creek. The greatest number of species was reported in the urban main stem, due to encroachment of lake species up to the Dorwin Ave. drop structure barrier.

Since 1989, 28 fish species have been recorded in surveys of the urban main stem. Most of these species are transient warm-water species, but brown trout, longnose dace, Atlantic salmon, mottled sculpin, and white sucker from the cold water assemblage were also observed in the city. Creek chub, trout, and suckers were reported among dead fish found at the Seneca Turnpike (below the Dorwin drop structure) that were killed after a brine leak in 1984 from the Allied Chemical Company's pipeline which transported brine from solution mines in the Tully Valley to Syracuse (Linhorst, 1984). White suckers comprised 90% of the fish kill (Kelly, 1984). Blacknose dace and slimy sculpin were never reported in the urban main stem, suggesting that these species may be indicative of the Onondaga Creek cold

Text Box 2

Fish surveys in Onondaga Creek.

Between 1982 and 2005, at least 15 fish surveys of varying scope were conducted in the Onondaga Creek watershed by academic or government researchers. Most of the information in this report was obtained from those surveys and accompanying reports. Surveys included:

Dr. Neil Ringler and students, State University of New York, College of Environmental Science and Forestry (SUNY ESF)

- 1982 - Furnace Brook (student E. Bannon)
- 1991, '92, '93, '94 - main stem and tributaries in the Tully Valley and tributary headwaters above the Onondaga Nation (student R. Danehy)
- 2003 (July and September) - main stem from headwaters to urban (student S. Coghlan)

NYS Department of Environmental Conservation (NYSDEC)

- 1989 - Tully Valley and urban main stem, Furnace Brook
- 1992 - small tributary headwaters
- 1998 - headwaters and Tully Valley main stem
- 2001 - West Branch
- 2002 - tributary in Tully Valley
- 2003 - urban main stem

U.S. Geological Survey (USGS)

- 1998 - Tully Valley main stem

Dr. Karin Limburg and students, SUNY ESF

- 2005 - headwaters and Tully Valley main stem

1 Fish community spatial delineations are approximate, based on the nearest and most recent available fish survey data.

2 The white sucker is not typically considered a "coldwater" fish, but is included in the coldwater assemblage simply because it was consistently found with coldwater fish in available surveys.

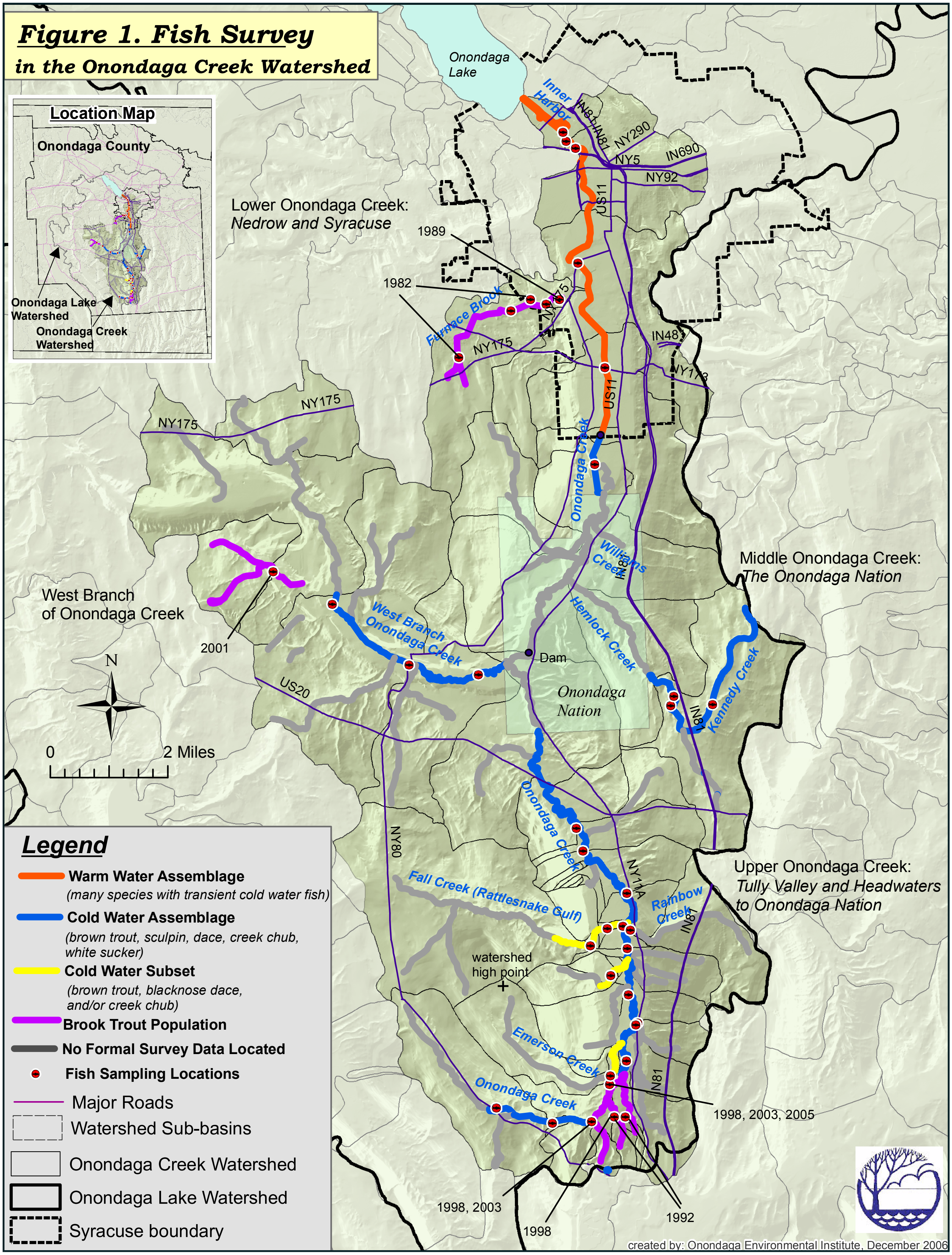


Figure 1. Fish Survey
in the Onondaga Creek Watershed
Location Map
Onondaga County
Onondaga Lake Watershed
Onondaga Creek Watershed
Onondaga Lake
Inner Harbor
Lower Onondaga Creek: Nedrow and Syracuse
Middle Onondaga Creek: The Onondaga Nation
Upper Onondaga Creek: Tully Valley and Headwaters to Onondaga Nation
West Branch of Onondaga Creek
Furnace Brook
West Branch Onondaga Creek
Onondaga Creek
Williams Creek
Hemlock Creek
Kennedy Creek
Fall Creek (Rattlesnake Gulf)
Rainbow Creek
Emerson Creek
Onondaga Nation
Dam
watershed high point
1989
1982
2001
1998, 2003, 2005
1998, 2003
1998
1992
NY175
NY173
NY290
NY5
NY92
IN690
IN81/I481
US11
IN48
US20
NY80
NY11A
IN81
N
0
2 Miles
Legend
Warm Water Assemblage
(many species with transient cold water fish)
Cold Water Assemblage
(brown trout, sculpin, dace, creek chub, white sucker)
Cold Water Subset
(brown trout, blacknose dace, and/or creek chub)
Brook Trout Population
No Formal Survey Data Located
Fish Sampling Locations
Major Roads
Watershed Sub-basins
Onondaga Creek Watershed
Onondaga Lake Watershed
Syracuse boundary
created by: Onondaga Environmental Institute, December 2006

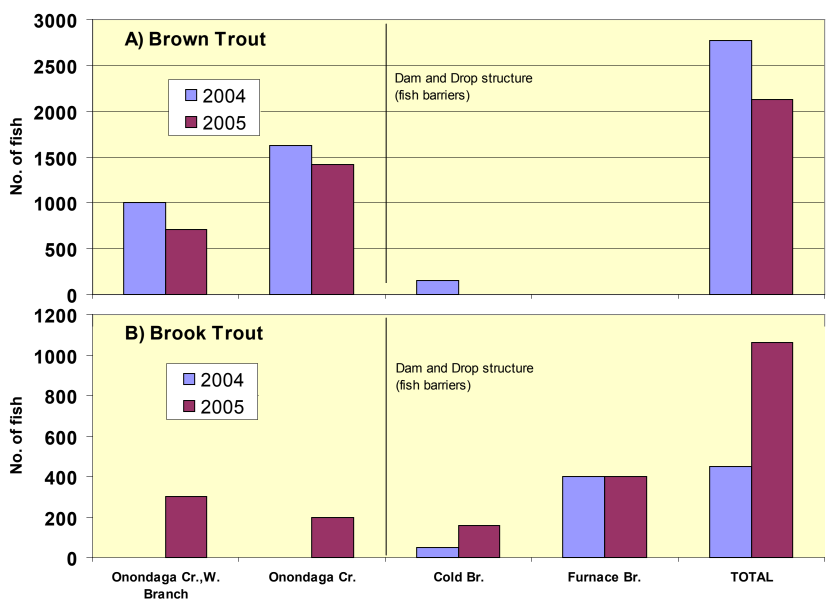
water fish community. A low barrier upstream of the Kirkpatrick Street bridge may be impassable to certain species from the lake.

Has the fish community changed? The cold and warm water fish communities have changed little between 1989 and 2005. A number of surveys (Text Box 2) show a remarkable persistence in the watershed's cold water fish assemblage. In the lower main stem, the most consistent observations include brown trout, white sucker, bluegill, and largemouth bass, all of which are also common in the lake. No detailed survey information was located for periods prior to 1982, but Dr. Neil Ringler (SUNY ESF) and collaborators reported in 1996 that little change in the lower creek fish community had been seen between an earlier 1928 survey and 1991 (Ringler et. al. 1996). Several species that had been eliminated from the system were not reported in formal surveys since 1928, and therefore are candidates for eventual restoration. Beauchamp (1908) documents an anecdote from a prominent Syracusan, Thurlow Weed. Mr. Weed remembered catching salmon in Onondaga Creek in the spring of 1810, with help from members of the Onondaga Nation. Earlier records and the oral history of the Onondaga Nation indicated that eel, also a migratory species that lives part of its life cycle in the Great Lakes or ocean, were once common in the creek (Smardon Affadavit, 1998). Restoration of local populations of large migratory species, such as salmon and eel, is a challenging and ecologically complex problem (see below).

Is the cold water fishery naturally sustainable at present? The current cold water fishery may not be sustainable under persistent angling pressure, without a supplemental stocking program. Onondaga Creek is not a large flowing system, and much of the system is severely degraded. Onondaga County currently stocks significant numbers of brown trout and brook trout each spring in the upper Onondaga Creek watershed to support angling (Figure 2); NYSDEC does not stock fish in the Onondaga Creek watershed (D. Lemon, pers. comm.). Brown trout have been stocked in the creek at least since 1928. Significant densities of wild brook trout are found only in small tributaries to the upper main stem in which the water is too cold for brown trout. The USGS reported high densities of brook trout (up to 9,800 to 37,000 fish/acre stream bed) at unreported locations in these tributaries based on NYSDEC data (McKenna et al. 1999), yet total numbers of fish may not be high due to narrow tributaries. Few brook trout are in the main stem, despite persistent stocking. The USGS suggested this is due to competition between the trout species, favoring brown trout. Brown trout biomass is at least seven times greater than brook trout biomass in the creek's main stem (McKenna et al. 1999). Atlantic salmon, a migratory species that spawns in headwaters and grows to adulthood in very large open waters, was stocked in Onondaga Creek in 1994 by the NYSDEC, and at six locations in 2002 and 2003 by SUNY ESF researchers (Coghlan, 2004). No adult salmon have been captured in any formal surveys, although juvenile fish were captured upstream in 2003 and 2005, and in the lower creek in 2003.

Figure 2. Trout stocking by Onondaga County in the Onondaga Creek watershed, 2004 and 2005.

Please note scale difference between graphs. A small, unreported number of fish were placed downstream of the drop structure at Dorwin Ave.



Are the fish contaminated? Significant levels of DDT, PCBs, and mercury were found in a 1989 analysis of Onondaga Creek fish (Table 1); many of the sampled fish were inedible according to US Environmental Protection Agency (EPA) Fish Consumption Limits. No additional fish contaminant data were located, and it is uncertain why further studies were not performed. The available data indicate that fillet samples were composited from several fish, representing a mean rather than the full range of concentrations. Mean contaminant concentrations in fillets exceeded EPA consumption limits in a number of samples (Table 1). Mercury, PCBs, and DDT and derivatives were detected in three composite white sucker samples collected along the main stem at Spencer Street. A few white perch samples collected at that site also contained detectable amounts of heavy metals. In white suckers sampled at Spencer St., mean mercury concentrations ranged between 0.13 and 0.64 ppm, mean PCBs from 0.15 to 0.41 ppm, and mean DDT levels were low, ranging between 0.01 and 0.03 ppm. White perch sampled at Spencer Street contained mean mercury concentrations up to 1.9 ppm, and PCBs up to 6.1 ppm. Fish collected from the main stem at Webster Rd. in the Tully Valley were also evaluated for contaminants. In white sucker fillets, mean mercury concentration ranged from 0.05 to 0.11 ppm; in brown trout from 0.04 to 3.9 ppm. Total PCBs ranged from 0.46 to 0.64 ppm in white sucker and 0.52 to 3.2 ppm in brown trout. Heavy metals including zinc, copper, nickel, chromium, and manganese were also detected at significant levels in white suckers at Webster Rd. Significantly higher mean mercury concentrations were seen in white suckers at Spencer St. than at Webster Rd., suggesting that the upper and lower creek white suckers belong to separate subpopulations. No further data on contaminants in Onondaga Creek fish were located.

Table 1. Fish contaminant data from 1989 Onondaga Creek sampling[1].
(Data reliability is under review)

Sample location	Sample date	Species	Number of fish in sample	Average length (in)	Mercury (ppm)	Total DDT (ppm)	Total PCB (ppm)
EPA Fish Consumption Limits[2] - 1 meal/month (ppm)					0.48 - 0.97	0.14 - 0.28	0.023 - 0.047
EPA Fish Consumption Limits - 4 meals/month (ppm)					0.12 - 0.24	0.035 - 0.069	0.0059 - 0.012
Spencer St., Syracuse	8-Jun-89	White perch	14	8.0	1.8		
	8-Jun-89	White perch	16	7.0	1.9		0.63
	15-Aug-89	White perch	14	8.0	1.8	0.34	6.1
	6-Sep-89	White perch	13	7.0	1.9		
	8-Jun-89	White sucker	11	13.6	0.43	0.02	0.18
	8-Jun-89	White sucker	3	10.0	0.13	0.03	0.15
	8-Jun-89	White sucker	9	16.3	0.64	0.03	0.41
Webster Rd., LaFayette	15-Aug-89	Brown trout	11	8.4	0.05	0.05	0.92
	15-Aug-89	Brown trout [3]	1	13.8	3.9	0.1	3.2
	15-Aug-89	Brown trout	9	9.5	0.04	0.05	0.52
	15-Aug-89	Brown trout	9	9.5	0.04		
	8-Jun-89	White sucker [3]	11	13.6	0.11		
	15-Aug-89	White sucker	17	7.8	0.11	0.06	0.64
	15-Aug-89	White sucker	4	9.7	0.05	0.02	0.46
	15-Aug-89	White sucker	4	9.3	0.05		

1. Highlighted data are exceedences of risk-based EPA Fish Consumption limits. Blank cells indicate that the substance was either below the detection limit or not analyzed (Source: NYSDEC 2005 (database)).

2. EPA Consumption limits based on cancer risk assessments (more protective than non-cancer values) with the exception of mercury for which only non-cancer values were developed. Meal size was assumed to be 8 oz. of fillet. Information Source: USEPA. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories. Volume 2. Risk Assessment and Fish Consumption Limts (3rd ed.). Office of Water, November 2000. EPA Document No. EPA 823-B-00-008.

3. Data were combined from separate database records of metals and organics concentrations, based on similarities in sample identification data (e.g., sample date, species, number of fish in sample, and/or average length); confirmation is pending examination of original hardcopy data reports.

IMPLICATIONS

How do we interpret absence versus presence in fish surveys? Fish presence/absence data from surveys should be interpreted carefully, and should consider other relevant information about fish biology. Fish are mobile in the creek. They follow changes in water conditions, food availability, and density of competitors and predators. Population densities are variable. Thus, the presence or absence of a particular fish species can be interpreted as significant only if consistent over long periods, which underscores the importance of long-term monitoring in Onondaga Creek. For instance, the creek chub has never been caught in urban creek surveys, suggesting that conditions may be unsuitable for chub in the city. However, it is not always true that fish absent in surveys are actually absent in the creek. The common carp has been reported in the creek surveys only once, in 2005, at Kirkpatrick Street (near the mouth) and never upstream of there. But anecdotal accounts relate large numbers at the Dorwin Ave. drop structure. Similarly, occasional presence does not necessarily indicate conditions are suitable for local persistence. Small fish could be washed downstream or only use a reach to traverse between more suitable locations. The frequency of capture, number and size of fish, and habitat requirements provide clues to whether a species is resident or transient in a particular creek segment.

Barriers to movement – good or bad? There is a balance between desired fish community outcomes when considering establishing or removing barriers to fish movement. For example, removal of the Dorwin St. drop structure or the low barrier near Spencer St. may enhance the likelihood of establishing a reproducing salmon population[3], but it would also likely result in the upstream spread of warm and cool water species from the lower creek and lake that are likely to be contaminated.

Brook Trout (Salvelinus fontinalis)

Fish images by E. Edmonson, courtesy of NYSDEC.

Contamination in creek fish – local sources, fish movement, or angler "assistance"? The source of contamination in creek fish is unknown. Mean concentrations of toxic chemicals in fish fillets exceeded EPA consumption limits in a number of cases (Table 1). Since the analyzed samples were mean values, higher concentrations must have been present in individual fish. A high level of contaminants in a single brown trout, and significant levels of contaminants in other species, begs the question of the source of contamination. Brown trout data were available only from the Webster Road site in the Tully Valley; no data on brown trout from the urban segment of the creek were located for comparison.

A brown trout with the highest levels of contamination weighed about 400 g (0.9 lb), while the less contaminated fish averaged between 96 and 138 g. One possible explanation is that there is an unrecognized source of contaminants in the upper creek. Larger fish typically accumulate contaminants such as PCBs and mercury to higher concentrations than smaller fish, so a local source is plausible. In 1989 at Webster Road, various metals, including mercury (0.28 ppm, dry wt), chromium (12 ppm), titanium (12 ppm), zinc (100 ppm), and aluminum (1020 ppm) were detected in caddis fly larvae, a significant component of the upper creek food web (NYSDOH, 1989). Caddis fly larvae do not travel upstream, so the source of the metals in the larvae must have been near, or upstream of, the Webster Road site. It is conceivable that the individual brown trout with elevated mercury at Webster Road accumulated a significant amount of its mercury through the local food web. However, this seems unlikely because several composite brown trout samples and all of the white sucker composite samples from that site did not show elevated mercury levels. Another possibility is that the fish was "stocked" by an angler after having caught it from the lake or the lower creek. It is also conceivable that the brown trout swam upstream from the lake, although the drop structure at Dorwin Ave. is regarded by some as an effective barrier to almost all upstream fish movement, with the possible exception of eels (e.g., D. Lemon pers. comm.). No formal studies concerning the extent of fish movement within the creek or between the creek and lake were located for the Onondaga Creek watershed, so this remains an open question. Finally, the original lab reports for the fish data were not located; it is also possible that the high tissue mercury in the individual fish at Webster Road was represented incorrectly in the electronic database (NYSDEC 2005).

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3 Barrier removal is only one important factor among many in the complex issue of re-establishing local populations of naturally reproducing salmon populations.

Although PCBs were found to be elevated in all fish samples collected at Webster Road (in contrast to mercury), PCBs, pesticides, and other toxic organic chemicals were not detected in crayfish at Webster Road using laboratory analytical methods available at the time. Thus, the source of PCB contamination in fish captured at Webster Road crossing in 1989 was likely not at, or just above, Webster Road.

Fish community restoration - what are the possibilities and implications? Restoration is conceivable for formerly abundant species but will likely require a long-term plan with a regional geographic scope in order to successfully reintroduce wide-ranging species. Depending on the species, successful restoration may depend on a combination of improving specific aspects of habitat (see Habitat Fact Sheet), angling management, and stocking programs. It is conceivable that the fish community in Onondaga Creek upstream of the city could be restored to dominance by native species. Brown trout is the dominant fish species in the cold water assemblage. It is the only species in the Onondaga Creek cold water assemblage that is not native to New York State, and is more heavily stocked in the upper creek than native brook trout (Figure 2). If brown trout stocking were to cease, and brook trout stocking increase, then their relative dominance in the system could shift from brown trout to brook trout over time. Brook trout caught in small tributaries in the Tully Valley were characterized as "wild" by the NYSDEC in 1992, suggesting that a sustainable brook trout population is possible given appropriate adjustments to angling and stocking. Insufficient information was located to assess whether free movement of brown trout from the lake to the headwaters might interfere with this type of restoration. Brook trout have re-colonized other streams in the region after being absent (D. Lemon, pers. comm.), likely due to improvements in water quality (N. Ringler, pers. comm.).

It is possible that alternative goals for native cold water assemblages or species might compete with each other. For instance, successful reintroduction of historically abundant eel and salmon, both top predators, in the system may significantly affect the cold water fish assemblage. Atlantic salmon, which were historically abundant in the system but is no longer a naturally sustained population, were experimentally stocked in 2002 and 2003 at six locations in the creek (Coghlan, 2004). Sixteen salmon were recaptured in the upper creek in 2005.

There are active international interest, research, and field implementations toward restoring Atlantic salmon, American eel, and other extirpated species in the Great Lakes system. The NYSDEC's Comprehensive Wildlife Conservation Strategy for New York state (NYSDEC, 2006) addresses restoration of these species. The NYSDEC's (Region 7) current position is that, without a successful regional reintroduction, Atlantic salmon stocking is likely not to be successful ultimately because of a lack of the habitat necessary to complete their migratory life cycle within the Onondaga watershed (D. Lemon, pers. comm.). Similarly, American eel restoration is of interest to the NYSDEC and Onondaga Creek would provide habitat for eels, but successful reintroduction in the Onondaga Creek/Onondaga Lake system is likely to be tied to the Lake Ontario basin-wide population status, which has been in dramatic decline (D. Lemon, pers. comm.). In addition to a stocking program, salmon and eel restoration might require significant improvements in the corridor from the creek to Lake Ontario, including Onondaga Lake. NYSDEC (Region 7) has identified lake sturgeon as a candidate for future reintroduction to the Onondaga Lake system because the lake has potential to support sturgeon (D. Lemon, pers. comm.); presumably, successful re-establishment in the lake would increase usage of Onondaga Creek.

Life History Sketches of Candidate Species for Restoration

The fish illustrated below were historically documented in Onondaga Lake watershed, but now naturally reproducing populations are absent. All three species are of interest for Onondaga Creek restoration. These fish spend part of their lives in streams like Onondaga Creek. Excerpts about their life history are quoted from The Inland Fishes of New York State by C. Lavett Smith, published in 1985 by the New York State Department of Environmental Conservation. More information about species restoration is above. See also the Habitat Fact Sheet.

American Eel - Habitat, Diet and Distribution

American Eel (Anguilla rostrata)

"Because of their migratory habits, eels are found from the ocean to small headwater creeks far inland. They are adept at working their way upstream over or around low falls and dams and sometimes travel overland, presumably on rainy nights….Eels spend much of their time buried in gravel or mud bottoms or under rocks.

Ogden (1970) studied the food habits of eels in eight New Jersey streams. The size of the food items increased with the size of the eels; the smallest had fed on insects and the larger eels had eaten fish and crustaceans.

In New York, the eel is extremely abundant in the Lower Hudson and it also occurs inland in the St. Lawrence, the Great Lakes and their tributary streams, including the Finger Lakes."[1]

Atlantic Salmon - Habitat, Diet and Distribution

"The salmon is an anadromous fish that moves into streams to spawn. Some populations are landlocked and able to complete their life cycle in fresh water.

Landlocked salmon move into the streams in early fall...After spawning, the female moves upstream and fans more gravel which is carried downstream by the current and covers the eggs...The eggs hatch in April and the young salmon spend 2 or 3 years in streams before moving into big waters until they mature.

In the streams, the young salmon feed mostly on aquatic insects, with terrestrial insects contributing to the diet, especially in late summer and fall.

They were native to Lakes Ontario and Champlain but apparently did not survive the environmental changes and overfishing. In 1810, when DeWitt Clinton visited the western part of the state there were populations in Lakes Seneca, Cayuga, Onondaga and Oneida.

Salmon of Lake Ontario began to decline in the early 1800s...Mill dams and other manmade obstructions prevented them from reaching their spawning grounds and deforestation, leading to increased temperatures and silting, overfishing and pollution were contributing causes."[2]

Atlantic Salmon (Salmo salar)

Lake Sturgeon - Habitat, Diet and Distribution

"Lake sturgeons are confined to larger lakes and rivers where they show a marked preference for clean sand, gravel, or rock bottom where food is abundant and they tend to avoid muddy areas. They move into smaller streams during spawning runs… The lake sturgeon spawns in the spring not long after the ice disappears and sometimes even under the ice. Spawning takes place along windswept shores of rock islands or the fish move into streams to spawn in the rapids.

The lake sturgeon feeds on insects, especially mayflies and midge larvae, and other benthic invertebrates including snails, clams, amphipods, and crayfish. It also feeds on fish...

The lake sturgeon occurs throughout most of the Northeast...It ranges through the Great Lakes and down the St. Lawrence...In New York, it has been recorded from Lakes Ontario and Champlain and it was once an important commercial fish in Lake Erie.

1 from (Smith, 1985) *The Inland Fishes of New York State*, p 61
2 *ibid.*, pp 229, 230

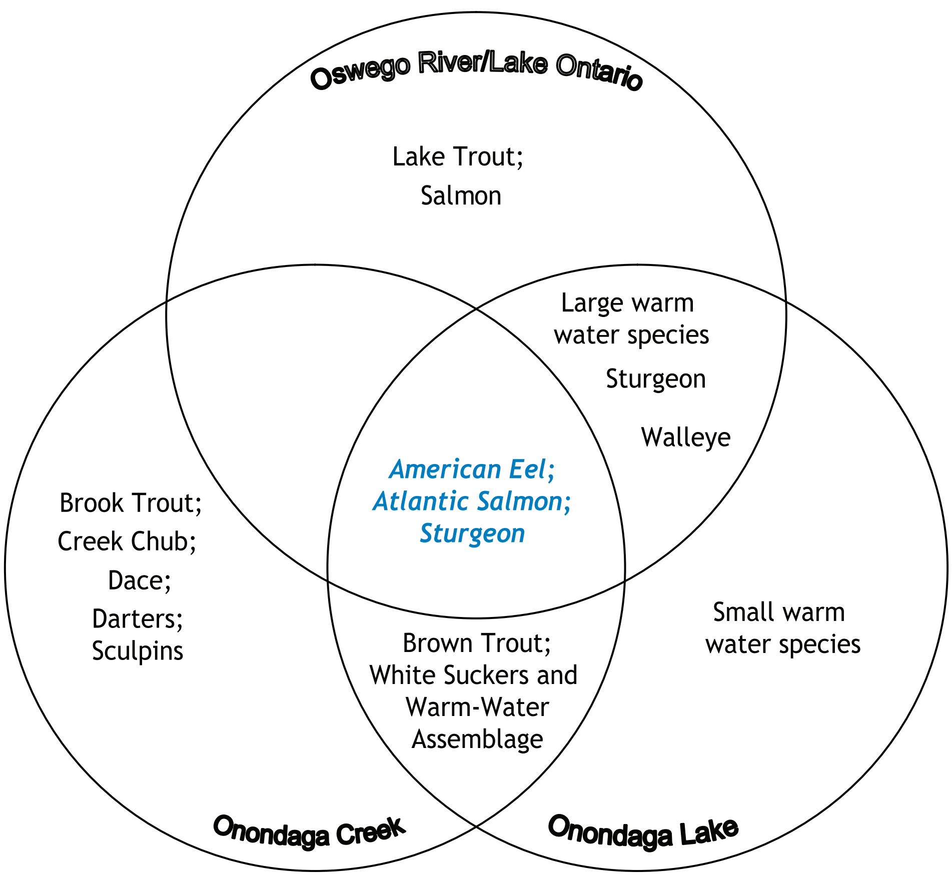
Lake Sturgeon (Acipenser fulvescens)

Sturgeon were formerly so abundant that they were considered trash fish. Their long generation time and slow growth, however, has led to their decline throughout most of their range."[1]

Fish Movement - Conceptual Model

Certain fish species move between habitats in different waterbodies during their life cycles. In the diagram below, local waterbodies are represented as interconnected circles; Onondaga Creek flows into Onondaga Lake, the outlet of Onondaga Lake flows into the Oswego River/Lake Ontario system via the Seneca River. Current fish movement between waterbodies for selected species is illustrated in the diagram in black print; likely former migrations are represented in blue (bold, italics). For example, since Brown Trout can move back and forth from Onondaga Lake to lower Onondaga Creek, they are listed at the intersection of Onondaga Creek and Onondaga Lake. If unobstructed, some species may migrate a greater distance. Atlantic Salmon formerly migrated from Lake Ontario to Onondaga Creek to spawn. American Eel live part of their lives in streams (Onondaga Creek was one such stream), but migrate to the Atlantic Ocean to reproduce, via Lake Ontario and the St. Lawrence River. Other species spend their lives in one waterbody. For example, the smaller cold-water assemblage fish found in Onondaga Creek, like Creek Chub, will remain in Onondaga Creek.

1 *ibid.*, p 46



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FOR MORE INFORMATION:

Onondaga Environmental Institute

102 West Division Street, 3rd Floor
Syracuse, NY 13210

Phone: (315) 472-2150
Fax: (315) 474-0537
Email: outreach@oei2.org

The Onondaga Lake Partnership (OLP) sponsors the Onondaga Creek Revitalization Plan project with funds from the U.S. Environmental Protection Agency. Visit www.onlakepartners.org for more information about the OLP.

This fact sheet and additional information about the Onondaga Creek Revitalization Plan project can be found on the World Wide Web at www.esf.edu/onondagacreek/.