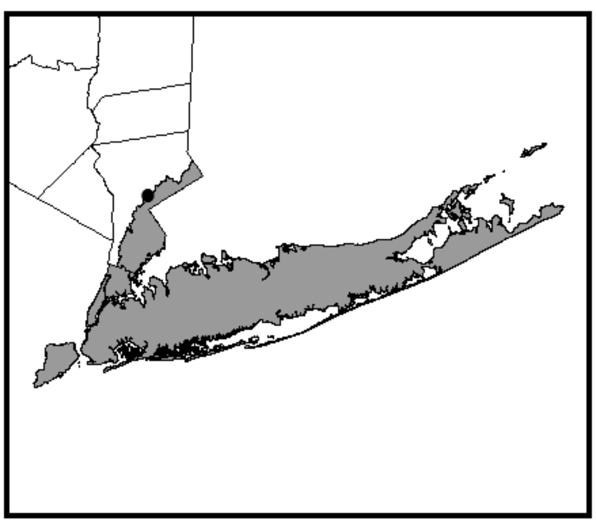
LCI Lake Water Quality Summary

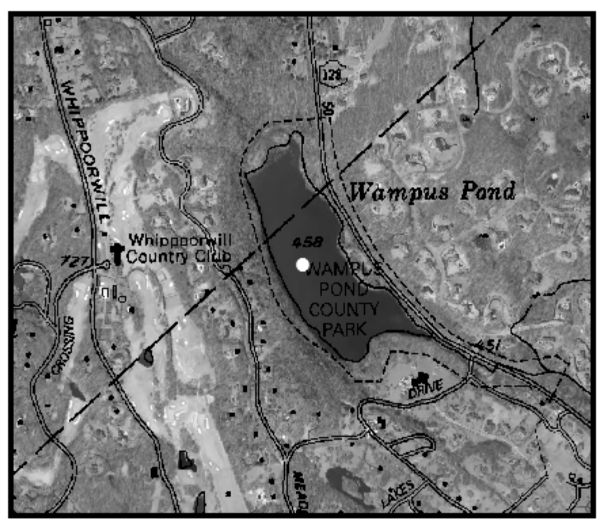
General Information

Lake Name:	**Wampus Lake Reservoir (Wampus Pond)**
Location:	Wampus Pond Park, Towns New Castle and North Castle, Westchester County, New York
Basin:	Atlantic Ocean/Long Island Sound Basin
Size:	15.5 hectares (38 acres)
Lake Origins:	natural
Major Tributaries:	none
Lake Tributary to?:	Wampus River
Water Quality Classification:	B (best intended use: primary contact recreation)
Sounding Depth:	7.6 meters (25 feet)
Sampling Coordinates:	Latitude: 41.14747, Longitude: -73.73028
Sampling Access Point:	Wampus Pond County Park
Monitoring Program:	Lake Classification and Inventory (LCI) Survey
Sampling Dates:	6/25/2009, 7/22/09, 8/21/2009, 9/21/2009
Samplers:	Scott Kishbaugh, NYSDEC Division of Water David Newman, NYSDEC Division of Water, Albany Steven Finnemore, NYSDEC Division of Water, Albany
Contact Information:	Scott Kishbaugh, NYSDEC Division of Water sakishba@gw.dec.state.ny.us; 518-402-8282

Lake Map

(sampling location marked with a circle)





Background and Lake Assessment

Wampus Lake Reservoir (official name) is part of Wampus Pond County Park operated ~~by Westchester~~ County. Visitors to the park use the pond for fishing and the county provides row boat rentals to allow people to see more of the pond. The park is also extensively used by lunchtime picnickers or those sunning themselves on the boat dock. The immediate area around the pond is forested, with the only development being a boathouse and small parking area at the county park. The watershed of the pond is partially forested with some residential developments and a golf course.

Wampus Lake Reservoir was listed in The 2000 Atlantic Ocean/ Long Island Sound Basin Waterbody Inventory and Priority Waterbodies List (WIPWL) as "*Needs Verification*". The WIPWL list states, "Recreational uses and aquatic life support may be impacted by silting and excessive aquatic vegetation in the shallow south end of the lake. Large developments in the immediate watershed are thought to be contributing to the silt and sediment load to the lake." Due to the listing in the WIPWL and a lack of water quality data in the New York State DEC Division of Water's database the lake was included in the 2009 intensive Lake Classification and Inventory (LCI) survey of the Atlantic Ocean/Long Island Sound Drainage Basin.

Wampus Pond can generally be characterized as *mesoeutrophic*, or moderately to highly productive. The average water clarity reading (TSI = 47, typical of *mesoeutrophic* lakes) was slightly higher than expected given the average phosphorus reading (TSI = 52, typical of *mesoeutrophic* lakes), but was expected given the average chlorophyll *a* reading (TSI = 50, typical of *mesoeutrophic* lakes). These data suggest that baseline nutrient levels do not support persistent algae blooms, but there may tend to be slightly elevated algae levels in the pond during the summer.

The pond tended to have a slight yellowish tint to it with an obvious algal greenness during the July sampling event. This is consistent with the slightly elevated chlorophyll *a* readings in June, August and September and the high chlorophyll *a* reading in July. There was no indication of excessive silt in the water column, which would be inconsistent with the WIPWL. Rooted aquatic vegetation was observed in the shallow areas near the eastern shore as well as the shallower areas along the northern and southern ends of the lake. The vegetation that was observed included the invasive species *Myriophyllum spicatum* (Eurasian watermilfoil) and *Potamogeton crispus* (curlyleaf pondweed) (see fact sheets below) and the native plants *Nuphar sp.* (yellow waterlily), *Nymphaea sp.* (white water lily), *Elodea canadensis* (common water weed), *Polygonum amphibium* (water smartweed) and *Ceratophyllum demersum* (coontail). There was a dense population of the Eurasian watermilfoil at the north end of the lake with curlyleaf pondweed being found near the boat dock at the county park.

Wampus Pond exhibits thermal stratification, in which depth zones (warm water on top, cold water on the bottom during the summer) are established, as in most NYS lakes greater than 6 meters in depth. The thermocline in the lake was in the 3-5 meters range for the entire summer. Anoxic conditions (devoid of oxygen) were observed in the bottom few meters of the lake during all sampling events. This is typically seen in lakes that have elevated chlorophyll *a* levels. pH readings indicate alkaline water, with the readings dropping off as depth increases, typical of lakes with slightly elevated chlorophyll *a* levels. Conductivity readings indicate hard water (high ionic strength), which is typical for nearby lakes in developed watersheds. The oxygen reduction potential (ORP) readings were well below zero in the hypolimnion, indicating persistent oxygen deficits.

The lake appears to be typical of hardwater, weakly colored, alkaline lakes. Other lakes with similar water quality characteristics often support warmwater fisheries, although fisheries habitat cannot be fully evaluated through this monitoring program. Coldwater fisheries are unlikely to be supported, given the lack of cold water and high oxygen refugia necessary to protect any salmonids or aquatic life susceptible to high summer temperatures. It is not known if these coldwater fish have historically been supported in the lake.

The July, August and September total phosphorous levels were above the state's guidance value and suggest high nutrient inputs to the lake. There were high levels of soluble phosphorus in the bottom waters, as is typical in lakes experiencing oxygen deficits in the bottom waters. Ammonia, iron and manganese levels were elevated in the bottom waters, also common among water bodies with deepwater oxygen deficits. Chloride levels were high, indicating significant impacts from road salting or other runoff through developed areas. Sodium levels were only slightly below the state's drinking water standards and also indicate impacts from runoff through developed areas. It is not know if any of these results in ecological impacts to the lake.

Evaluation of Lake Condition Impacts to Lake Uses

Potable Water (Drinking Water)

Wampus Pond is not classified for use as a potable water supply. Although the LCI data are not sufficient to evaluate potable water use, these data suggest that the lake water would require substantial treatment to serve as a potable water supply. Surface water withdrawals may be impacted by elevated algae levels while deepwater intake quality would be compromised by elevated ammonia, iron, manganese and sodium levels.

Contact Recreation (Swimming)

Wampus Pond is classified for contact recreation- swimming and bathing. It is not known if people visiting the park swim in the lake. Bacteria data are needed to evaluate the safety to Wampus Pond for swimming-these are not collected though the LCI. The data collected through the LCI show that the water clarity was consistently above the New York State Department of Health's standard of 1.2 meters to protect the safety of swimmers. The density of floating leaf and submergent vegetation may make swimming difficult in certain areas of the pond.

Non-Contact Recreation (Boating and Fishing)

Wampus Pond should continue to be suitable for boating and fishing. The density of floating leaf and submergent vegetation may make these activities difficult in certain areas of the pond.

Aquatic Life

The anoxic condition and elevated ammonia, iron and manages levels observed may stress some aquatic life. The dense stands of Eurasian watermilfoil may be outcompeting native vegetation. Additional biological studies would be needed to fully evaluate aquatic life.

Aesthetics

These data indicate that occasional high algae levels and the densities of native and invasive vegetation may detract from the aesthetics of the lake, however for most users of the park, water quality should not detract from their enjoyment of the lake and the park.

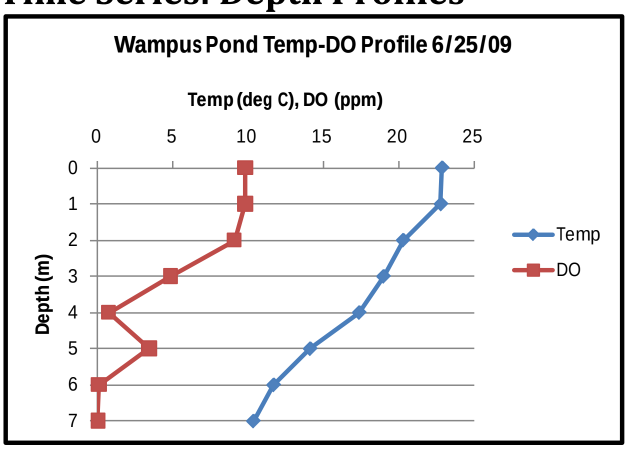
Additional Comments

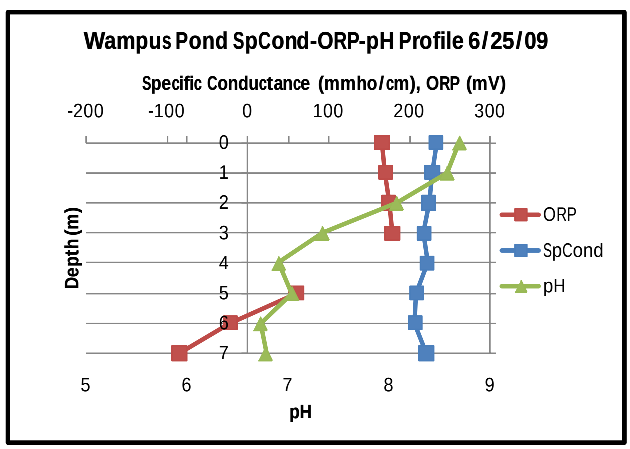
1. The WIPWL indicates that the lake may have been included in the Westchester County Department of Health "Lakes Surveillance Program" and data from the lake may have been collected from 1986-1989. Comparing the 2009 data with this historical data may help determine if water quality has remained consistent through the years or if there has been an improvement or decline in water quality at the lake.
2. Periodic surveillance for invasive exotic plant species may help to prevent the establishment and spread of any new invaders, given the escalating problems with exotic aquatic weeds.
3. The county should determine if the extent of the invasive weed growth is sufficient to warrant active management. The DEC-NYS Federation of Lake Associations publication <u>Diet for a Small Lake</u> identifies potential plant management actions that could be pursued by the county if warranted.

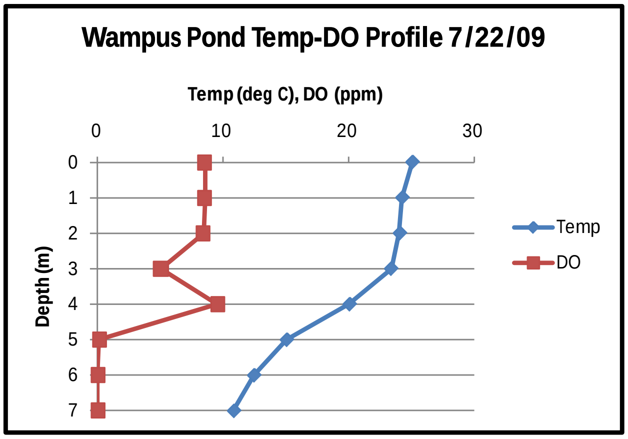
Aquatic Plant IDs

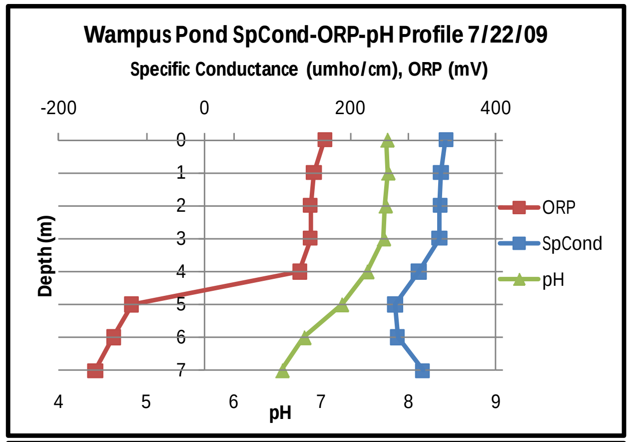
Exotic Plants:	*Myriophyllum spicatum* (Eurasian watermilfoil)
	Potamogeton crispus (curlyleaf pondweed)
Native Plants:	*Ceratophyllum demersum* (coontail)
	Elodea canadensis (common water weed)
	Nymphaea sp. (white water lily)
	Nuphar sp. (yellow water lily)
	Polygonum amphibium (water smartweed)

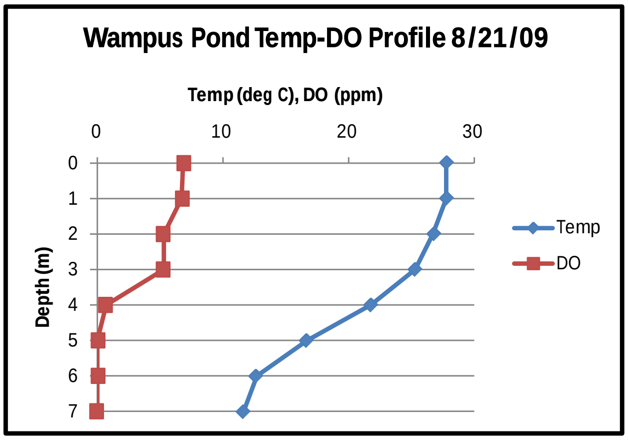
Time Series: Depth Profiles

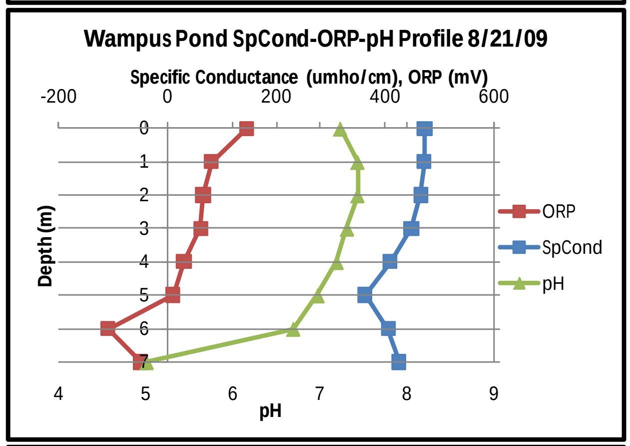





Wampus Pond Temp-DO Profile 7/22/09
Temp (deg C), DO (ppm)
Depth (m)
Temp
DO


Wampus Pond SpCond-ORP-pH Profile 7/22/09
Specific Conductance (umho/cm), ORP (mV)
Depth (m)
pH
ORP
SpCond
pH


Wampus Pond Temp-DO Profile 8/21/09
Temp (deg C), DO (ppm)
Depth (m)
Temp
DO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Specific Conductance (umho/cm), ORP (mV)
Depth (m)
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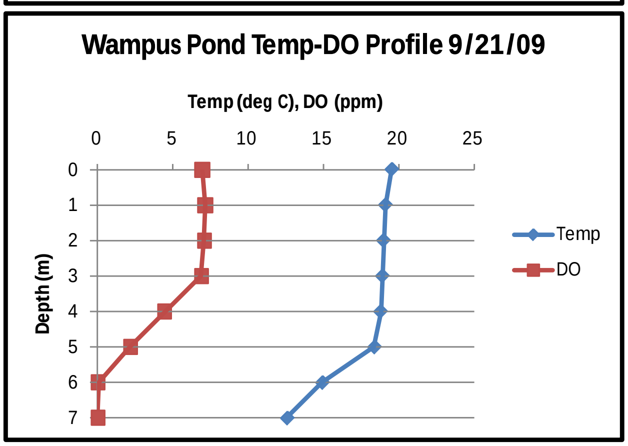
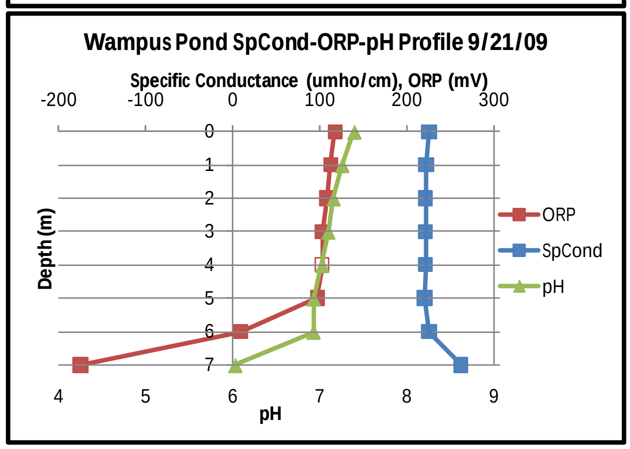

Wampus Pond Temp-DO Profile 9/21/09
Temp (deg C), DO (ppm)
Depth (m)
Temp
DO


Wampus Pond SpCond-ORP-pH Profile 9/21/09
Specific Conductance (umho/cm), ORP (mV)
Depth (m)
pH
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SpCond
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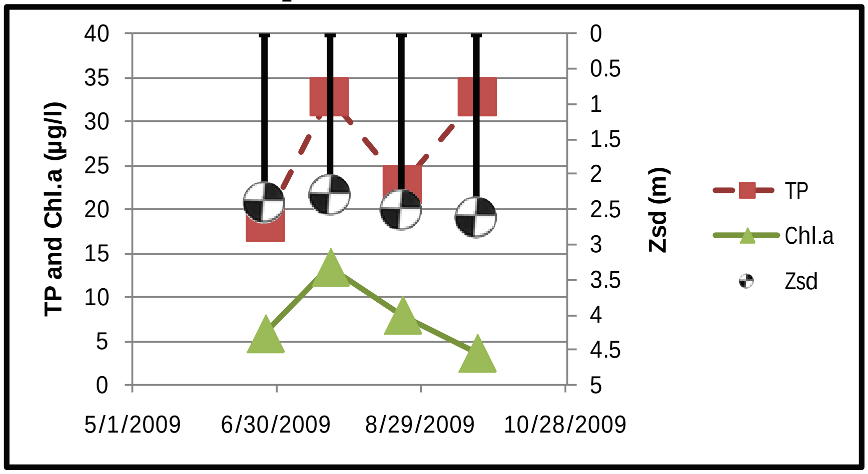
Time Series: Trophic Indicators



WQ Sampling Results

Surface Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
SECCHI	meters	4	2.3	2.45	2.6	Mesotrophic	No readings violate DOH guidance value
TSI-Secchi			48.0	47.1	46.2	Mesotrophic	No pertinent water quality standards
TP	mg/l	4	0.0185	0.0268	0.0329	Eutrophic	75% of readings violate DOH guidelines
TSI-TP			46.2	51.5	54.5	Eutrophic	No pertinent water quality standards
TSP	mg/l	4	0.0042	0.0075	0.0116	High % soluble Phosphorus	No pertinent water quality standards
NOx	mg/l	4	0.002	0.2143	0.847	Elevated nitrate	No readings violate DOH guidance value
NH4	mg/l	4	ND	0.012*	0.019	Low ammonia	No readings violate DOH guidance value
TKN	mg/l	4	0.52	0.6	0.67	Intermediate organic nitrogen	No pertinent water quality standards
TN/TP	mg/l	4	42.93	76.46	167.32	Phosphorus Limited	No pertinent water quality standards
CHLA	ug/l	4	3.7	7.75	13.4	Mesotrophic	No pertinent water quality standards
TSI-CHLA			43.4	50.7	56.1	Eutrophic	No pertinent water quality standards
Alkalinity	mg/l	4	64	77.4	84	Moderately Buffered	No pertinent water quality standards
TCOLOR	ptu	4	ND	9.4**	20	Uncolored	No pertinent water quality standards
TOC	mg/l	4	3.8	4.9	6.5		No pertinent water quality standards
Ca	mg/l	4	21.2	26.6	28.6	Minimally Supports Zebra Mussels	No pertinent water quality standards
Fe	mg/l	4	ND	0.056	0.129		No readings violate DOH guidance value
Mn	mg/l	4	0.0223	0.0435	0.0621		No readings violate DOH guidance value
Mg	mg/l	4	8.44	9.17	9.54		No readings violate DOH guidance value
K	mg/l	4	2.39	2.73	2.95		No pertinent water quality standards
Na	mg/l	4	17.6	18.55	19.7		No readings violate DOH guidance value
Cl	mg/l	4	42.6	44.75	46.7	Significant road salt runoff	No readings violate DOH guidance value
SO4	mg/l	4	7.8	9.48	10.5		No readings violate DOH guidance value

***** The ammonia average was calculate with non-detects being treated as equal to half the detection limit or 0.005 mg/l
****** The true color average was calculated with non-detects being treated as equal to half the detection limit or 2.5ptu.

Bottom Samples

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
TP-bottom	mg/l	4	0.0804	0.2026	0.358	Elevated deepwater phosphorus	No pertinent water quality standards
TSP-bottom	mg/l	4	0.0163	0.0813	0.242	High % soluble phosphorus	No pertinent water quality standards
NOx-bottom	mg/l	4	0.0022	0.0068	0.0112	No evidence of DO depletion	No readings violate DOH guidance value
NH4-bottom	mg/l	4	0.046	0.216	0.472	Evidence of DO depletion	No readings violate DOH guidance value
TKN-bottom	mg/l	4	0.84	1.25	1.66		No pertinent water quality standards
Alk-bottom	mg/l	4	89.6	103.4	120	Moderately Buffered	No pertinent water quality standards
TCOLOR-bottom	ptu	4	5	27.5	70	Weakly Colored	No pertinent water quality standards
TOC-bottom	mg/l	4	4.7	5.3	6.2		No pertinent water quality standards
Ca-bottom	mg/l	4	26.5	29.2	30.1		Strongly Supports Zebra Mussels
Fe-bottom	mg/l	4	0.157	1.0533	2.92	Taste or odor likely	100% of readings violate DOH guidelines
Mn-bottom	mg/l	4	2.4	5.2825	8.4	Taste or odor likely	100% of readings violate DOH guidelines
Mg-bottom	mg/l	4	9190	9.9	10.3		No readings violate DOH guidance value
K-bottom	mg/l	4	2.62	3.04	3.37		No pertinent water quality standards
Na-bottom	mg/l	4	16.8	17.8	19		No readings violate DOH guidance value
Cl-bottom	mg/l	4	38.8	41.18	42.4		No readings violate DOH guidance value
SO4-bottom	mg/l	4	3.8	6.73	9	May have rotten egg odor	No readings violate DOH guidance value
As-bottom	mg/l	1	ND	ND	ND	No evidence of potable water threats	No readings violate guidance values

Lake Perception

	UNITS	N	MIN	AVG	MAX	Scientific Classification	Regulatory Comments
WQ Assessment	1-5, 1 best	4	2	2.5	3	Definite Algal Greenness	No pertinent water quality standards
Weed Assessment	1-5, 1 best	4	3	3.5	4	Dense Plant Growth at Lake Surface	No pertinent water quality standards
Recreational Assessment	1-5, 1 best	4	2	2.5	3	Slightly Impaired	No pertinent water quality standards

Legend Information

General Legend Information

Surface Samples	= integrated sample collected in the first 2 meters of surface water
Bottom Samples	= grab sample collected from a depth of approximately 1 meter from the lake bottom
N	= number of samples
SECCHI	= Secchi disk water transparency or clarity - measured in meters (m)
TSI-SECCHI	= Trophic State Index calculated from Secchi, = 60 – 14.41*ln(Secchi)

Laboratory Parameters

ND	= Non-Detect, the level of the analyte in question is at or below the laboratory's detection limit
TP	= total phosphorus- milligrams per liter (mg/l) Detection limit = 0.003 mg/l; NYS Guidance Value = 0.020 mg/l
TSI-TP	= Trophic State Index calculated from TP, = 14.42*ln(TP*1000) + 4.15
TSP	= total soluble phosphorus, mg/l Detection limit = 0.003 mg/l; no NYS standard or guidance value
NOx	= nitrate + nitrite nitrogen, mg/l Detection limit = 0.01 mg/l; NYS WQ standard = 10 mg/l
NH4	= total ammonia, mg/l Detection limit = 0.01 mg/l; NYS WQ standard = 2 mg/l
TKN	= total Kjeldahl nitrogen (= organic nitrogen + ammonia), mg/l Detection limit = 0.01 mg/l; no NYS standard or guidance value
TN/TP	= Nitrogen to Phosphorus ratio (molar ratio), = (TKN + NOx)*2.2/TP > 30 suggests phosphorus limitation, < 10 suggests nitrogen limitation
CHLA	= chlorophyll *a*, micrograms per liter (µg/l) or parts per billion (ppb) Detection limit = 2 µg/l; no NYS standard or guidance value
TSI-CHLA	= Trophic State Index calculated from CHLA, = 9.81*ln(CHLA) + 30.6
ALKALINITY	= total alkalinity in mg/l as calcium carbonate Detection limit = 10 mg/l; no NYS standard or guidance value
TCOLOR	= true (filtered or centrifuged) color, platinum color units (ptu) Detection limit = 5 ptu; no NYS standard or guidance value
TOC	= total organic carbon, mg/l Detection limit = 1 mg/l; no NYS standard or guidance value
Ca	= calcium, mg/l Detection limit = 1 mg/l; no NYS standard or guidance value
Fe	= iron, mg/l Detection limit = 0.1 mg/l; NYS standard = 0.3 mg/l
Mn	= manganese, mg/l Detection limit = 0.01 mg/l; NYS standard = 0.3 mg/l
Mg	= magnesium, mg/l Detection limit = 2 mg/l; NYS standard = 35 mg/l
K	= potassium, mg/l Detection limit = 2 mg/l; no NYS standard or guidance value
Na	= sodium, mg/l Detection limit = 2 mg/l; NYS standard = 20 mg/l
Cl	= chloride, mg/l Detection limit = 2 mg/l; NYS standard = 250 mg/l
SO4	= sulfate, mg/l Detection limit = 2 mg/l; NYS standard = 250 mg/l

Field Parameters

Depth	= water depth, meters
Temp	= water temperature, degrees Celsius
D.O.	= dissolved oxygen, in milligrams per liter (mg/l) or parts per million (ppm) NYS standard = 4 mg/l; 5 mg/l for salmonids
pH	= powers of hydrogen, standard pH units (S.U.) Detection limit = 1 S.U.; NYS standard = 6.5 and 8.5
SpCond	= specific conductance, corrected to 25ºC, micromho per centimeter (µmho/cm) Detection limit = 1 µmho/cm; no NYS standard or guidance value
ORP	= Oxygen Reduction Potential, millivolts (MV) Detection limit = -250 mV; no NYS standard or guidance value

Lake Assessment

WQ Assessment	**= water quality assessment**, 5 point scale, 1= crystal clear, 2 = not quite crystal clear, 3 = definite algae greenness, 4 = high algae levels, 5 = severely high algae levels
Weed Assessment	**= weed coverage/density assessment**, 5 point scale, 1 = no plants visible, 2 = plants below surface, 3 = plants at surface, 4 = plants dense at surface, 5 = plants cover surface
Recreational Assessment	**= swimming/aesthetic assessment**, 5 point scale; 1 = could not be nicer, 2 = excellent, 3= slightly impaired, 4 = substantially impaired, 5 = lake not usable

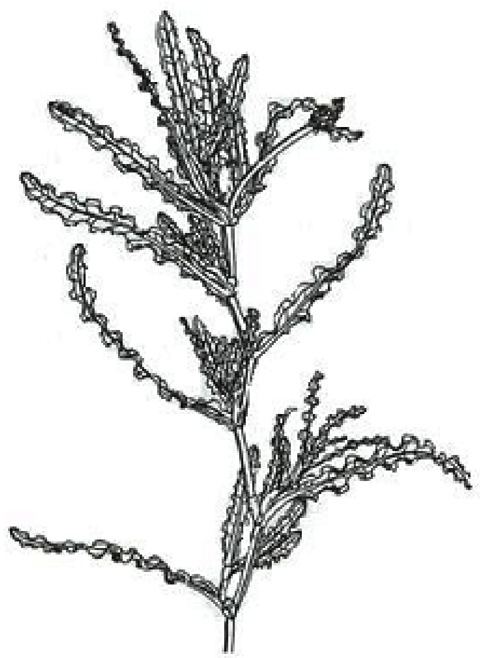
References

NYSDEC. 2002. The 2000 Atlantic Ocean/ Long Island Sound Basin Waterbody Inventory and Priority Waterbodies List. NYSDEC, Albany, NY. Available online at http://www.dec.ny.gov/docs/water_pdf/pwlatlv202.pdf.

SPECIES NAME: *Potamogeton crispus*

COMMON NAME: curlyleaf pondweed

ECOLOGICAL VALUE: While this is not a native plant to New York state, it has become well established in many lakes and does not disrupt the aquatic ecosystem as do other (recently-introduced) exotics, although it still can out-compete native species and dominate a macrophyte community, particularly in late spring and early summer (before the peak growing season for other native and non-native macrophytes).



DISTRIBUTION IN UNITED STATES: In hard or brackish, often polluted waters, naturalized from Europe and common in New England, western Massachusetts, with a range extending from Quebec west to Minnesota, south to Alabama and Texas, and scattered throughout the western states

DISTRIBUTION IN NEW YORK: widespread and often abundant along the Hudson River and Finger Lakes basins, with some occurrences in far western New York

DEGREE OF NUISANCE: *Potamogeton crispus* may establish easily and grow abundantly, reaching nuisance levels, although the extent of coverage and nuisance conditions is limited by the growing season (winter through early-mid summer)

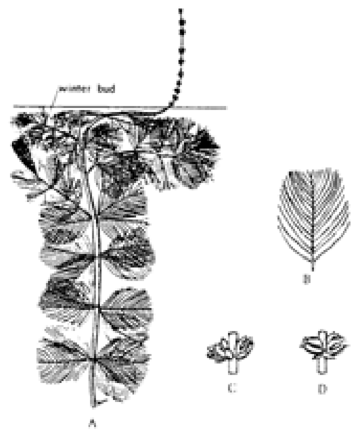
COMMENTS: *Potamogeton* is a highly variable genus within the pondweed family. Species within the genus often are characterized by two leaf types- firm floating leaves and thin emersed leaves. Many mature species have flowers borne in spikes (for wind pollination), conspicuous in early summer. Identification of the individual species can be extremely difficult, particularly among the narrow-leaved pondweeds. The *Potamogeton* are distinguished from the other genus within the pondweed family by having alternate leaves (unlike the *Zanichellia* and *Najas*), and by their presence in fresh or estuarine waters (unlike the *Zostera*). There are nearly 30 species found within New York State, some quite rare and others extremely common. *P. crispus* is one of the four major non-native exotic plant species in New York state, and has served as the impetus for several lake restoration and plant management programs. However, it naturally dies out in many lakes by early to mid summer, often to be replaced by other monocultures. It is characterized by finely-toothed leaf margins and a 'lasagna'-like leaf appearance.

Line drawing- Crowe, G.E. and C.B. Hellquist. Aquatic and wetlands plants of northeastern North America. 2000

SPECIES NAME: *Myriophyllum spicatum*

COMMON NAME: Eurasian water milfoil

ECOLOGICAL VALUE: like most submergents, *Myriophyllum* harbors aquatic insects, provides hiding, nurseries, and spawning areas for amphibians and fish, and provides some food for waterfowl. However, *Myriophyllum spicatum* may dominate a water system, restricting boat traffic, recreational activities and water movement. While infestations of milfoil create favorable shelter for small fishes and invertebrates, they also commonly crowds out more desirable waterfowl plants



Myriophyllum spicatum: A. habit of submersed form with emergent inflorescence, × ½. B. leaf, × 1. C. flowers, × 2. D. fruits, × 2.

DISTRIBUTION IN UNITED STATES: locally abundant and aggressive from Quebec and New England west to Ontario, Michigan, Wisconsin, and British Columbia, south to Florida, Oklahoma, Texas, Washington, California, and Mexico (the range of this plant continues to increase each year)

DISTRIBUTION IN NEW YORK: found in increasing amounts throughout the State, except in the interior Adirondacks and the Long Island area (although it has recently been discovered in both locations)

DEGREE OF NUISANCE: like most exotics, *M. spicatum* establishes easily, and once established, often becomes the dominant plant in the macrophyte community, growing abundantly to nuisance levels

COMMENTS: while some species of *Myriophyllum* have earned a reputation for aggressive and opportunistic growth, most of the species in this genus are not nearly so robust, and often peacefully coexist with other submergent plants. The individual species within the *Myriophyllum* genus are superficially similar, so complete plants, including flowers (often pink) and fruits, are often needed for positive identification. The leaf structures and patterns of the milfoil closely resemble those of the *Ceratophyllum* (coontail) and *Utricularia* (bladderwort), and as a result, these plants are often confused for each other, particularly when viewed from a slight distance. Peak growth for most species is in mid-summer. *M. spicatum* is distinguished from other milfoils by having smaller flower-leaf structures on the emergent spike, flat-topped ends on the upper most submerged leaves, and red tips during the peak growing season and white to slightly pinkish stems. *Myriophyllum* spreads and reproduces vegetatively. This is one of the most discussed and well-known plants in the state, due to its propensity to form dense canopies that overwhelm the underlying native plant populations. Improved surveillance has greatly expanded the known range of this species within the state, though the range may have concurrently extended due to spread from boat traffic, waterfowl, and water transport from infected to uncontaminated lakes. Appropriate control strategies avoid excessive fragmentation.

Line drawing- Crowe, G.E. and C.B. Hellquist. Aquatic and wetlands plants of northeastern North America. 2000