



# Otsego Lake Water Quality Data

December 4, 2009



Data were collected using a HydroLab Scout II Multi-probe.

## TEMPERATURE & DISSOLVED OXYGEN PROFILES

DECEMBER 4, 2009

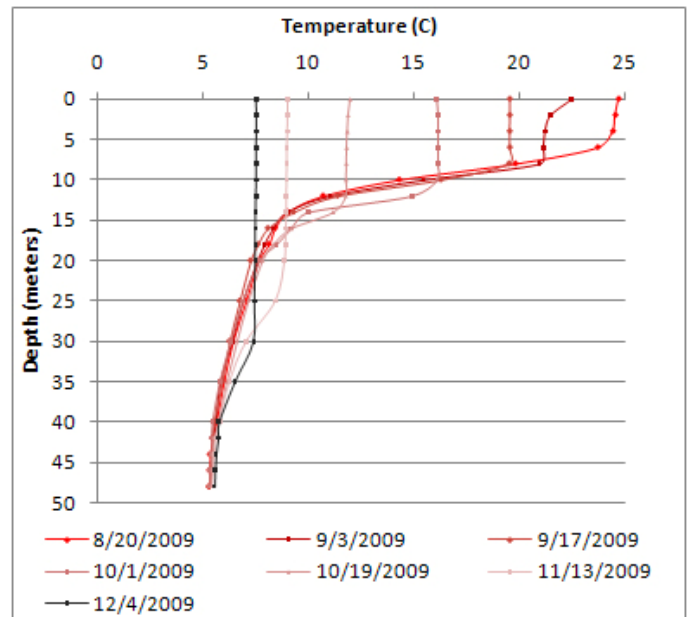
Depth		Temp		Dissolved Oxygen mg/L
m	ft	°C	°F	
0	0	7.56	45.6	9.94
2	6.5	7.57	45.6	9.80
4	13.1	7.57	45.6	9.66
6	19.7	7.56	45.6	9.65
8	26.2	7.56	45.6	9.61
10	32.8	7.56	45.6	9.56
12	39.4	7.55	45.6	9.56
14	45.9	7.53	45.6	9.55
16	52.5	7.52	45.5	9.54
18	59.0	7.52	45.5	9.51
20	65.6	7.52	45.5	9.53
25	82.0	7.48	45.5	9.53
30	98.4	7.43	45.4	9.22
35	114.8	6.53	43.8	6.12
40	131.2	5.77	42.4	2.14
42	137.8	5.73	42.3	1.81
44	144.4	5.63	42.1	0.98
46	150.9	5.58	42.0	0.58
48	157.5	5.56	42.0	0.45

**Epilimnion**  
- "upper" or "outer" layer  
- Warmer water  
- Oxygen is continually replenished via atmosphere & produced via photosynthesis in daylight hours

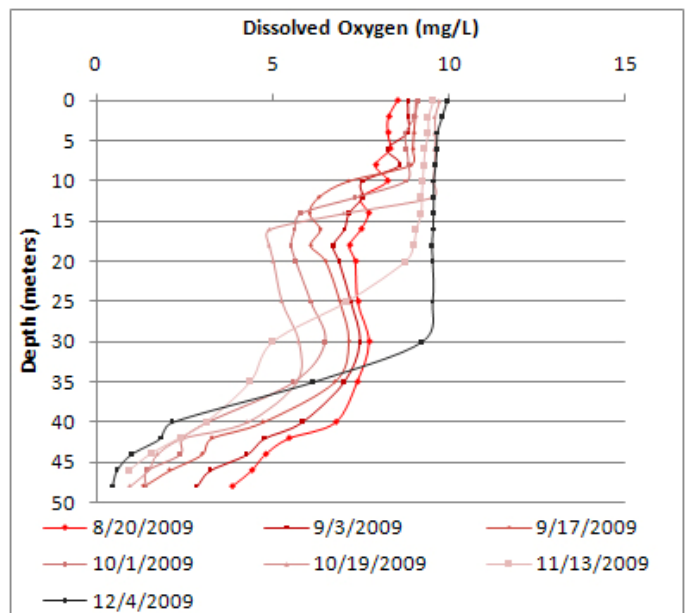
**Thermocline**  
This zone of rapid temperature change serves as the boundary between warm surface waters and the dense, cold water of the hypolimnion.

**Hypolimnion**  
- "below" lake layer  
- Cold water  
- Oxygen cannot be replenished while stratification is in place

Temperature profiles over the course of the year show transitions between seasonal thermal stratification regimes. Layers develop through the spring and summer as the surface waters are warmed and mixed by sun and wind, while the water below remains cold and therefore is more dense. These layers provide different habitat conditions in the open water (off-shore) areas of the lake. As over-night air temperatures drop and daylight periods decrease, the surface waters begin to cool, as seen from 9/3 through the 12/4 profile, and the thermocline occurs at greater depth.



Dissolved oxygen: the concentration of oxygen dissolved in water. Colder water can dissolve a greater amount of oxygen than warm water.



Dissolved oxygen concentrations also follow a predictable progression throughout the year. During spring and fall turnover, when temperatures are constant from the surface to bottom, oxygen is distributed throughout the water column. Once thermal stratification is in place, oxygen in the bottom waters cannot be replenished via atmospheric interactions. In late summer and through fall, as temperatures begin to drop in the epilimnion, oxygen concentrations in this layer increase because water can "hold" more oxygen at colder temperatures.

As the seasons progress, deep-water oxygen is consumed primarily by bacterial decomposition of dead algal cells and to a small degree by organisms living in the bottom waters. When algal production is excessive, usually due to high phosphorus levels, oxygen can fall to levels approaching those needed by sensitive, cold water fish such as lake trout and salmon.

The lake is currently approaching turn-over. Dissolved oxygen concentrations are high throughout the epilimnion (surface to 35m) as a result of a decrease in temperature and wind-driven mixing. Oxygen concentrations at depths below 35 m are at stressful levels for sensitive species. Turn-over can occur when the temperature (and density) are even throughout the water column.



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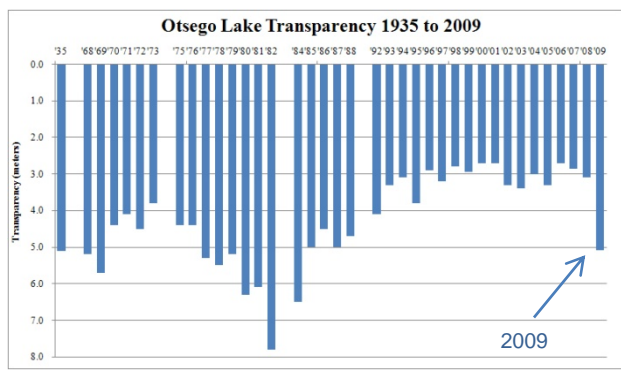
## ALGAE, TRANSPARENCY & THE FOOD WEB

## DETERMINING AVAILABLE FISH HABITAT

Algae are primary producers, serving as the base of the lake food web. The amount of algae in a system determines the amount of energy available to the ecosystem, and thus the amount living mass that it will produce. The algal population is routinely assessed with 2 common methods: *transparency*, which is an indirect assessment of algal density based on water clarity, and *chlorophyll a* concentration, which is a pigment common to all plants. Chlorophyll *a* concentration can be used to estimate the amount of algae in a volume of water.

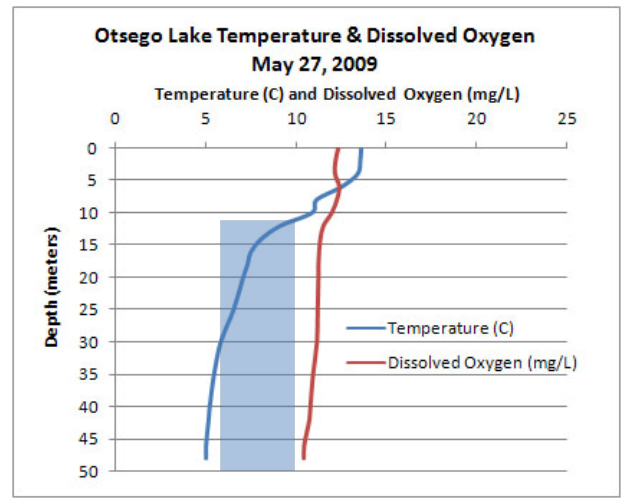
All cold-water organisms have both temperature and oxygen requirements; when considered together, they determine the available habitat, or volume of water, that is suitable for different species. For example, lake trout prefer temperatures up to 10°C (50° F) and may be stressed when dissolved oxygen is less than 6 mg/L. Current profiles for Otsego Lake show that oxygen levels in the cold bottom waters remain low as oxygen is consumed by decomposition of dead algal cells. Available habitat has increased compared to profiles collected late in the growing season as the surface waters have cooled. Deep-water oxygen levels will continue to decline until fall overturn, usually occurring in December. Blue shading indicates suitable habitat available to lake trout.

2009 transparency readings have shown a marked increase compared to the annual averages of the past; this increase likely results from the establishment of zebra mussels, which are efficient filter-feeders of algae. A final comparison cannot be made until all data is collected for 2009.



Though it may appear that lake management efforts target conditions specific to the lake trout population, ideal management programs consider the most sensitive organisms for end results and management goals.

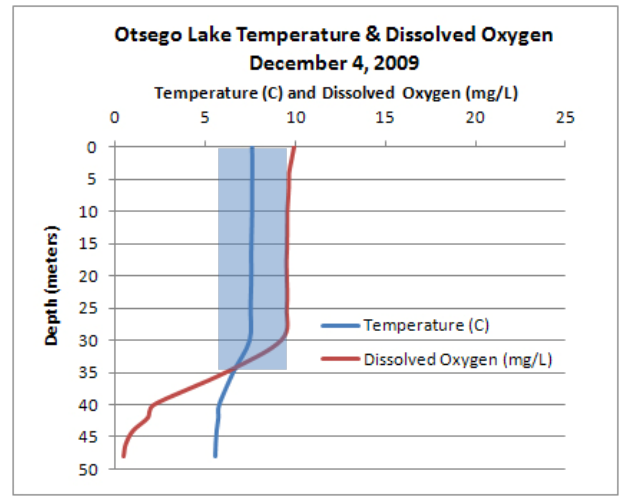
A more detailed assessment of the algal community is also under way. Samples were collected on a number of dates during June and July, the algal cells were identified, and the relative abundance of each taxonomic group was determined. This information is useful for interpreting nutrient impacts on population dynamics, energy and nutrient cycling dynamics, and the impacts of zebra mussel filtration on the algal community. Zebra mussels generally reject blue-green algae while feeding and as a result can cause large blue-green blooms, which can be highly toxic. A full report of this research will be available in the 2009 BFS Annual Report.



## ZEBRA MUSSEL SETTLING UPDATE



Observations of zebra mussel settling patterns and densities have been made in an attempt to provide timely information to lake-side residents and lake users that wish to protect themselves and their personal property from negative impacts of zebra mussels.



Mussels have not been observed on fiberglass boat hulls, though they have been documented on those made of aluminum, where the greatest densities were seen along seams and rivets. Mussel density along the keel seam averaged 80 per 10 cm<sup>2</sup> and had an average length of 2.5 mm, though two distinct size classes were apparent. The density of mussels that have settled on artificial Plexiglas® substrates since June will be determined in the coming weeks and reported here. Settling rates are still relatively high and precautions should be taken to protect property.