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Oak Orchard Creek Orleans County, New York

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Oak Orchard Creek is a major tributary of Lake Ontario, with a watershed straddling Orleans and Genesee counties. Surrounding land use is a mix of residential, small commercial businesses, and agriculture. The Elba and Oakfield sewage treatment plants are located along Oak Orchard Creek, as are three hydroelectric dams located in Oak Orchard, Glenwood, and Waterport (Zollweg et al. 2005). The New York State Department of Environmental



Oak Orchard Creek: Carlton, NY

Conservation lists fishing in Oak Orchard as threatened. There have been high measures of DDT, DDE, DDD, PAHs, and arsenic identified near Lyndonville, NY, at one of these sites (Makarewicz 2000). Nuisance algae, bacterial abundance, and algal mat development along the southern shoreline of Lake Ontario are major causes of beach closings, fouling the nearshore waters and limiting water recreation. This short report provides a synopsis of data collected

monthly from May through September (2003 to 2009) on the water quality of Oak Orchard Creek and the lakeside (swimmable depth) of Lake Ontario near the mouth of the creek.

Phosphorus is of concern as it stimulates the growth of plants, causing blooms of algae such as *Cladophora*. Average total phosphorus (TP) levels in the lakeside waters ($175.4 \pm 64.5 \mu\text{g P/L}$) (Fig. 1a) were higher than in creek water ($93.9 \pm 10.7 \mu\text{g P/L}$); however, soluble reactive phosphorus (SRP) levels were generally higher in the creek ($52.3 \pm 7.5 \mu\text{g P/L}$) than in lakeside waters ($23.3 \pm 8.8 \mu\text{g P/L}$) (Fig. 1b). Both TP and SRP concentrations exceeded the NYSDEC ambient guideline of $20 \mu\text{g P/L}$. Oak Orchard Creek had no clear annual summer trends in terms of increasing or decreasing phosphorus levels since 2003 (Fig. 1). In 2009, reports identified Oak Orchard Creek as losing 79.1kg P/day (174.4 lbs/day) which is deposited into Lake Ontario at the mouth of the creek (Makarewicz and Lewis 2009). Compared to TP concentrations in other Lake Ontario streams ($83.8 \pm 7.0 \mu\text{g P/L}$) and lakeside sites ($62.0 \pm 7.4 \mu\text{g P/L}$) monitored, average TP concentrations in Oak Orchard Creek ($93.9 \pm 10.7 \mu\text{g P/L}$) and the nearby lakeside waters ($175.4 \pm 64.5 \mu\text{g/L}$) were higher. These values were also considerably higher than those found in open ($9.5 \pm 0.7 \mu\text{g P/L}$) offshore waters of Lake Ontario. Algae levels (indicated by *chlorophyll a*, Fig. 1c) along the Lake Ontario shoreline (lakeside) have decreased since 2003; however, they increased dramatically in 2009. Since 2003, soil and sediment in the water (total suspended solids, Fig. 1e), phycocyanin (Fig. 1d), an indicator of the nuisance species of blue-green algae, nitrate (Fig. 1f), and total Kjeldahl nitrogen (TKN) (Fig. 1g) had no trends through the study period. Seasonally, lakeside chlorophyll, phycocyanin and sediment concentrations

(Figs. 2c, d, e) mimicked TP and SRP levels (Figs. 2a, b) with values increasing from May through September (Figs. 2 a, b, c, d, e). Nitrate levels were higher in May and September (Fig. 2f) and TKN values higher in August and September (Fig. 2g). Seasonally in the creek, chlorophyll, nitrate, and TKN (Figs. 3c, f, g) concentrations were the lowest in August while TP and SRP increased as the summer progressed (Figs. 3a, b).

References

Image Oak Orchard Creek, Carlton, NY:

[http://upload.wikimedia.org/wikipedia/commons/3/38/Oak_Orchard_River - Lake Alice.jpg](http://upload.wikimedia.org/wikipedia/commons/3/38/Oak_Orchard_River_-_Lake_Alice.jpg)

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Table 1. Average (\pm SE) discharge and loading values for Oak Orchard Creek from February 2006 thru December 2007 (from Makarewicz and Lewis 1999).

2008 Discharge m³/day	TP (kg/day)	Nitrate (kg/day)
827,608 \pm 26,410 (28224 - 3329804)	79.1 \pm 3.2 (3.1 - 366.8)	1145.2 \pm 54.4 (90.6 - 6583.2)
Nonevent	28	515
Event	52	630

Table 2. Average concentrations (2003 to 2009, May through September) and standard errors (S.E.) of total phosphorus (TP), soluble reactive phosphorus (SRP), nitrate, chlorophyll a, phycocyanin, total suspended solids (TSS), total Kjeldahl nitrogen (TKN), sodium, and silica.

	TP ($\mu\text{g P/L}$)		SRP ($\mu\text{g P/L}$)		Nitrate (mg/L)		Chlorophyll ($\mu\text{g/L}$)		Phycocyanin ($\mu\text{g/L}$)		TSS (mg/L)		TKN ($\mu\text{g/L}$)		Sodium (mg/L)		Silica (mg/L)	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Lakeside	62.0	7.4	7.0	0.9	0.27	0.01	19.1	4.1	17.8	2.2	33.5	4.8	795	96	13.78	0.19	0.56	0.06
Rivers	83.8	7.0	44.8	5.4	0.57	0.03	6.5	0.8	13.2	3.0	10.5	1.9	559	25	26.65	1.28	1.42	0.15
Embayments	129.7	59.6	15.5	2.0	0.14	0.01	20.0	2.4	237.5	207.6	17.0	5.70	923	70	27.47	1.49	1.29	0.11
Lake Ontario 30m	9.9	0.7	3.1	0.5	0.31	0.02	2.0	0.17	5.5	1.2	0.7	0.14	253.3	21.0	11.46	0.23	0.35	0.05
Lake Ontario 100m	9.5	0.7	5.2	2.1	0.31	0.01	2.6	0.26	6.1	1.3	0.8	0.12	343.4	50.9	11.45	0.24	0.40	0.07

Map of the “North Coast” of New York showing sampling locations for the Lake Ontario Coastal Initiative. Oak Orchard watershed is shown in the insert.

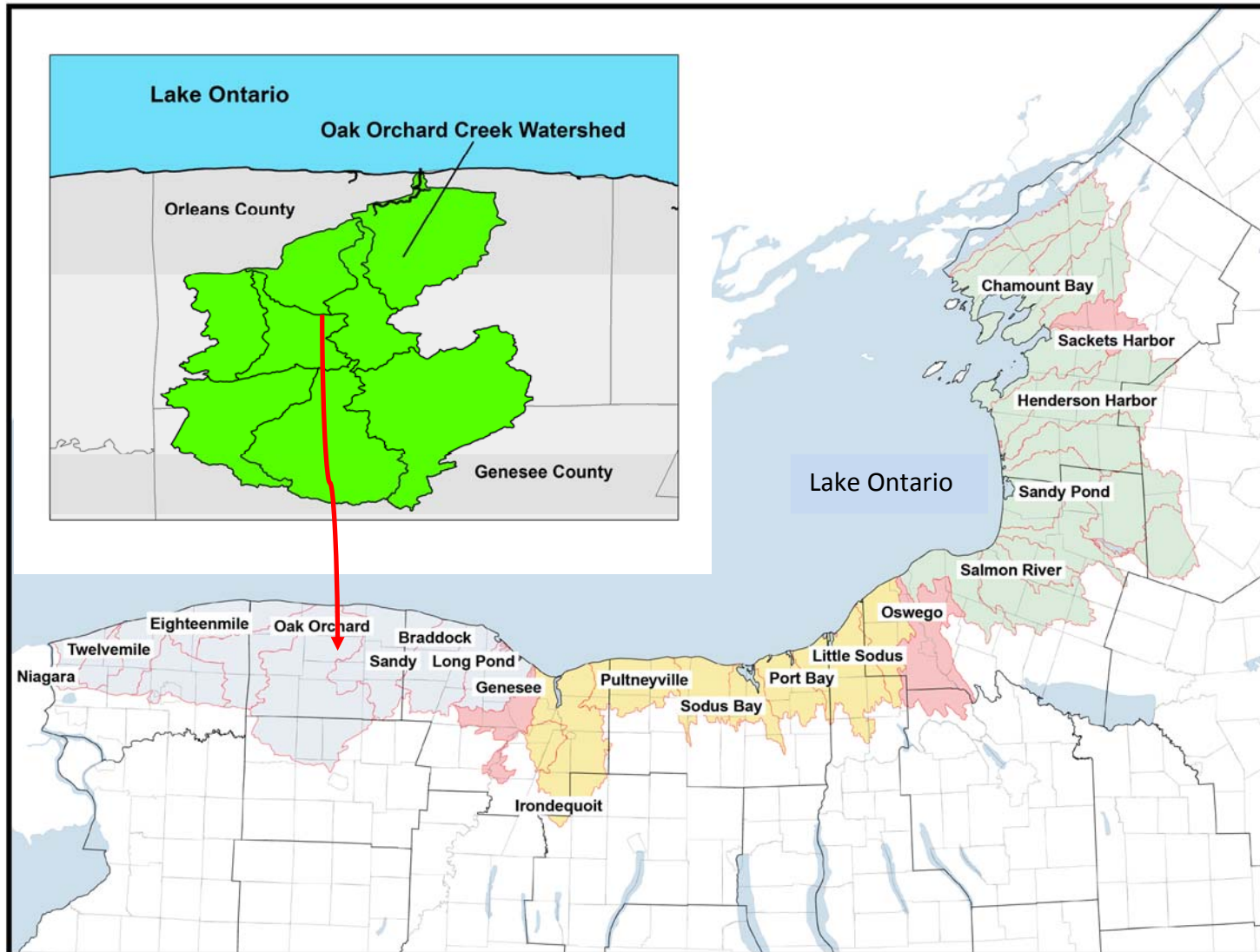


Figure 1. Average (\pm S.E) summer total phosphorus, soluble reactive phosphorus, chlorophyll a, phycocyanin, total suspended solids, nitrate, and total Kjeldahl nitrogen concentrations at the lakeside of Lake Ontario near Oak Orchard Creek and Oak Orchard Creek. Surface water samples were taken monthly (May-September) at a 1-meter depth.

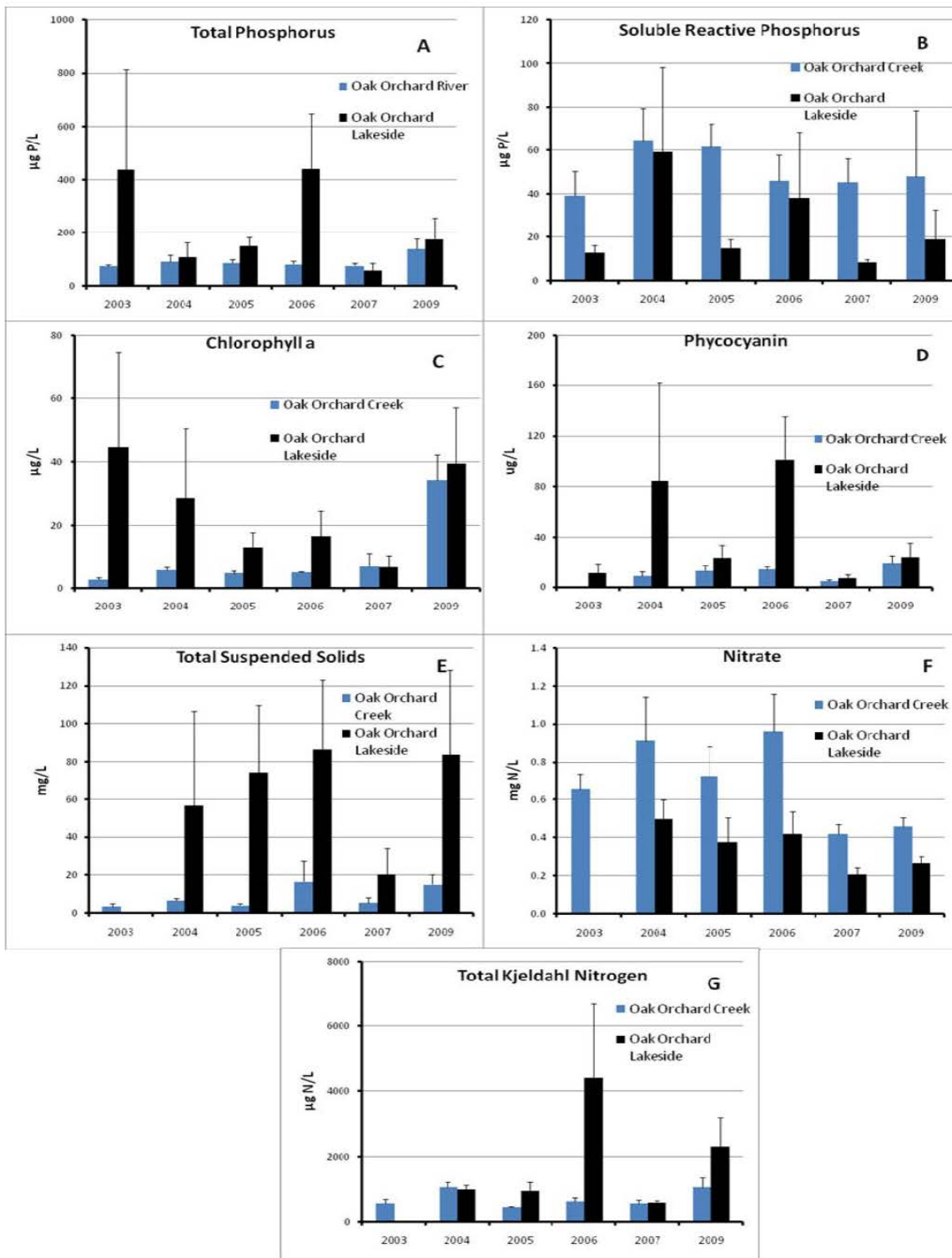


Figure 2. Average (\pm S.E) seasonal concentrations of total phosphorus, soluble reactive phosphorus, chlorophyll a, phycocyanin, total suspended solids, nitrate, and total Kjeldahl nitrogen at the lakeside of Lake Ontario near Oak Orchard Creek.

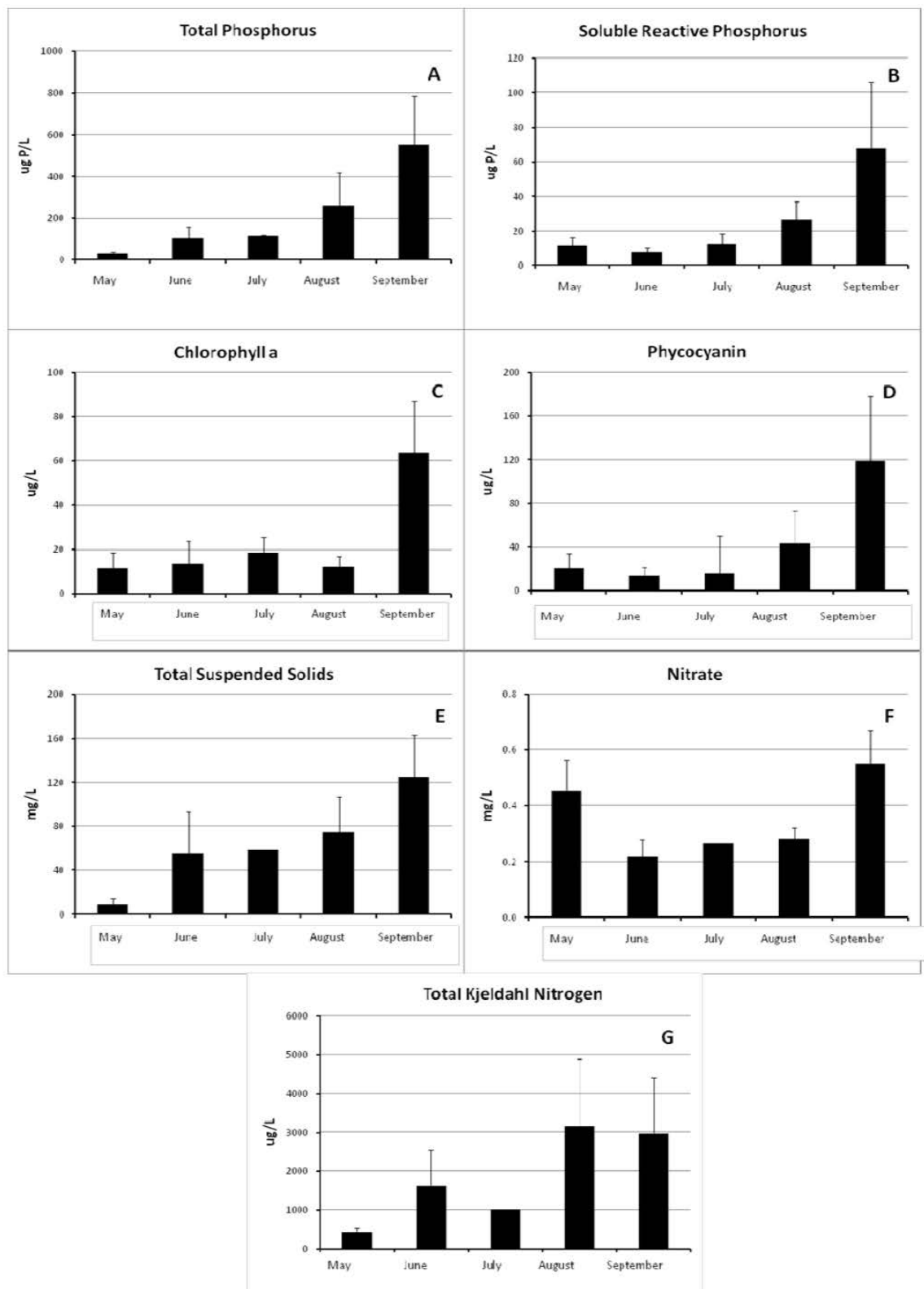


Figure 3. Average (\pm S.E) seasonal concentrations of total phosphorus, soluble reactive phosphorus, chlorophyll a, phycocyanin, total suspended solids, nitrate, and total Kjeldahl nitrogen in Oak Orchard Creek.

