Assessment of temporal patterns in dissolved organic carbon in Tempe Town Lake

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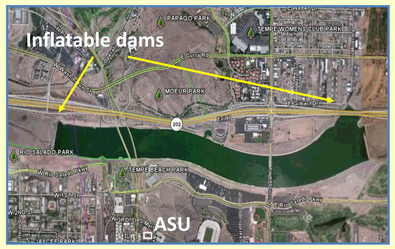
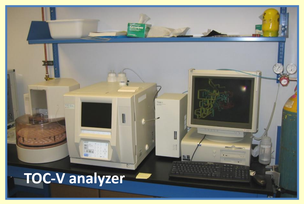
Introduction

- Tempe Town Lake was constructed in 1999, and provides recreation and flood control for the city of Phoenix
- Sources of water to the lake are CAP (Colorado River) water, reclaimed water, and storm water from Indian Bend Wash and the Salt River
- Seepage losses are captured and pumped back into the lake
- Water clarity and algal growth are important considerations for the recreational services provided to Phoenix by Tempe Town Lake; both are highly related to DOC dynamics.
- Identifying biogeochemical and hydrological drivers of DOC and water clarity will be critical for management of these variables in the lake.

Study Site and Methods



- **Temperature, pH, O_2, & conductivity** measured in situ with meters
- Water samples filtered (0.2μm) for: D/H, $\delta^{18}O_{H2O}$, nutrients, major ions, trace elements
- **DOC**/TN: High-temperature combustion



Monsoon characteristics

Daily sampling: Jan–Oct 05, Jan–Mar 08, Jul–Sep 08
Weekly sampling: Oct 07–Jan 08, Mar–Jul 08, Sep 08–Apr 10, Oct 11—present
Monthly sampling: Oct 05 – Oct 07

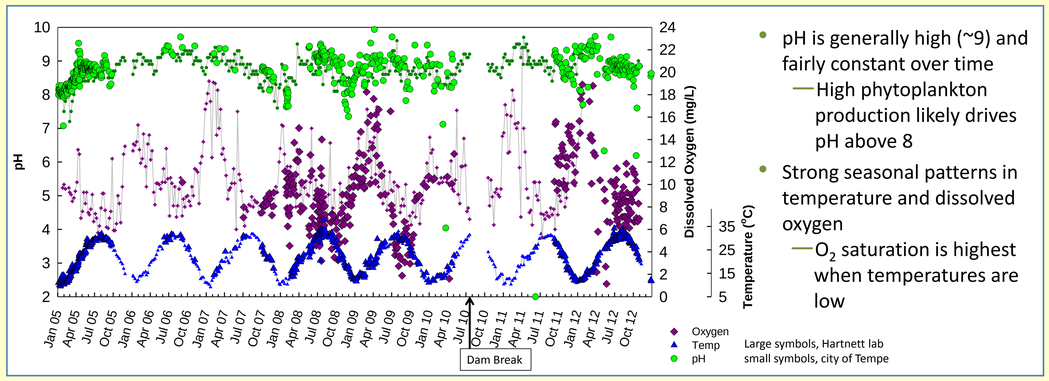
Central Arizona has experienced long-term drought throughout the period of this study.

*Southwest Monsoon Characteristics**

year	start date	end date	# rainfall events	total rainfall (in)
2005	18 July	11 Sept	8	1.53
2006	02 July	14 Sept	11	3.33
2007	19 July	11 Sept	6	0.74
2008	03 July	07 Sept	10	6.77
2009	13 July	11 Sept	4	1.88
2010	09 July	10 Sept	6	0.48
2011	05 July	17 Sept	5	1.77
2012	06 July	14 Sept	13	3.51

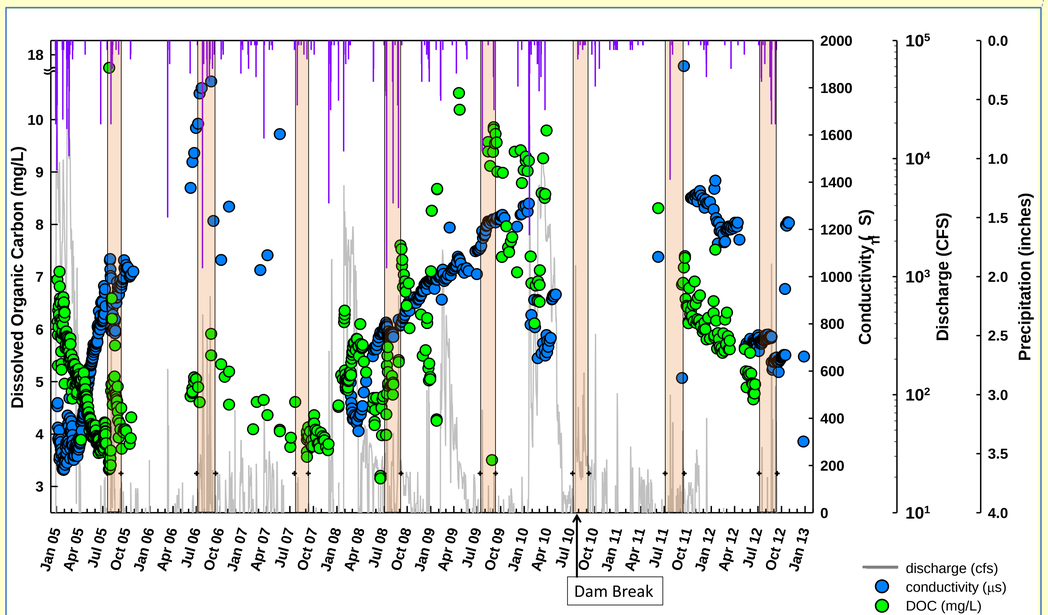
*determined using NWS dew point criteria; data from NWS and the Maricopa County Flood Control District

Basic Water Chemistry



- pH is generally high (~9) and fairly constant over time
  - High phytoplankton production likely drives pH above 8
- Strong seasonal patterns in temperature and dissolved oxygen
  - O_2 saturation is highest when temperatures are low

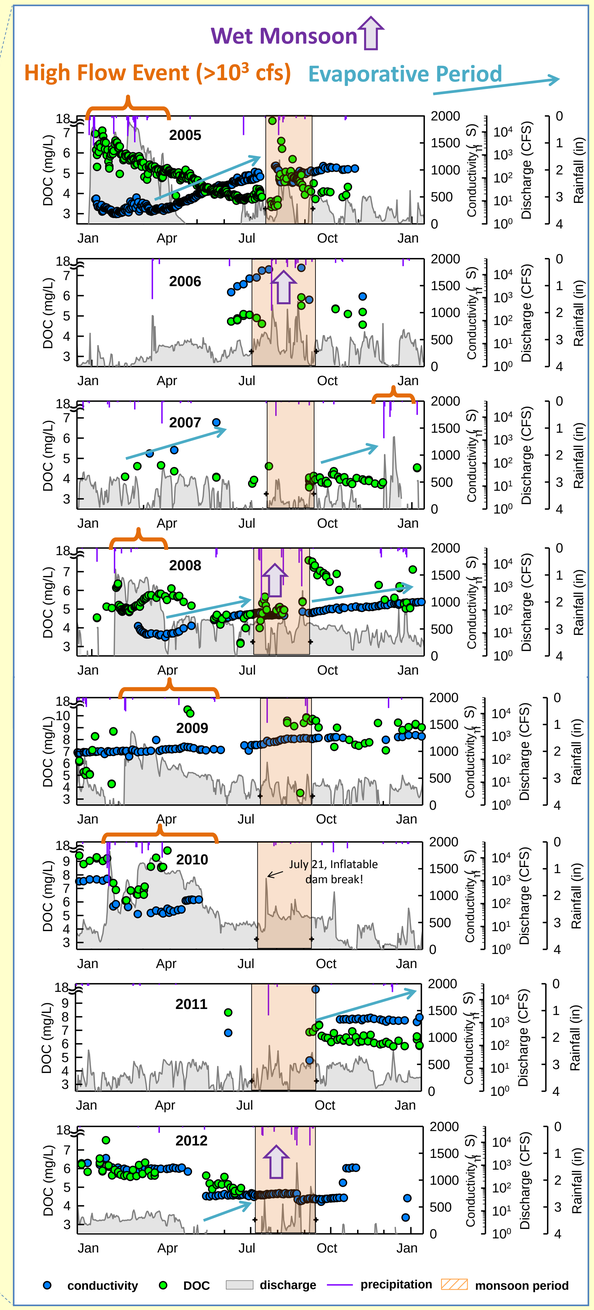
Time Series Data



Three general patterns in DOC concentration

1. Increases in DOC corresponding to upstream dam releases on the Verde and Salt Rivers
2. Increases in DOC after major (amount and/or duration) rain events, suggesting stormwater is a significant source DOC to the lake
3. Decreases in DOC during hot, dry (evaporative) periods.

Time Series Data By Year



Work in progress, future work

- Linking climate, hydrology, and water quality metrics during storms in Indian Bend Wash to pulses of DOC in Tempe Town Lake
- Converting City of Tempe water clarity data into a usable format in order to make quantitative comparisons
- Explore potential for monitoring some component of phytoplankton/community respiration or NPP that can be related to DOC dynamics

Summary

- Tempe Town Lake exhibits large seasonal and interannual changes in dissolved organic carbon content (and composition).
- Increases in DOC correspond with (1) input of river water (due to upstream dam releases), (2) intense monsoon storms that carry urban run-off, and (3) with dry, evaporative periods

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