2013 TMDL Phytoplankton and Zooplankton monitoring

Determine the temporal and spatial distribution of all taxa.
as individual counts and as biomass

Assess as major taxonomic and functional groups.

2013 TMDL Phytoplankton and Zooplankton monitoring

- Samples collected by UFI
- Planning and oversight by Nelson Hairston
- Phytoplankton samples identified, counted and measured by Rachel Abbott and Bill Schaffner
- Zooplankton samples identified, counted and measured by Lindsay Schaffner and Nelson Hairston
- Plankton samples archived in Hairston Lab

Phytoplankton

Primary producers of the pelagic zone

Major users of dissolved nutrients (including phosphorus)

Base of the pelagic food chain

Important ecological differences among taxa:

- Nutrient and light requirements
- Edibility to consumers
- Effects on water quality

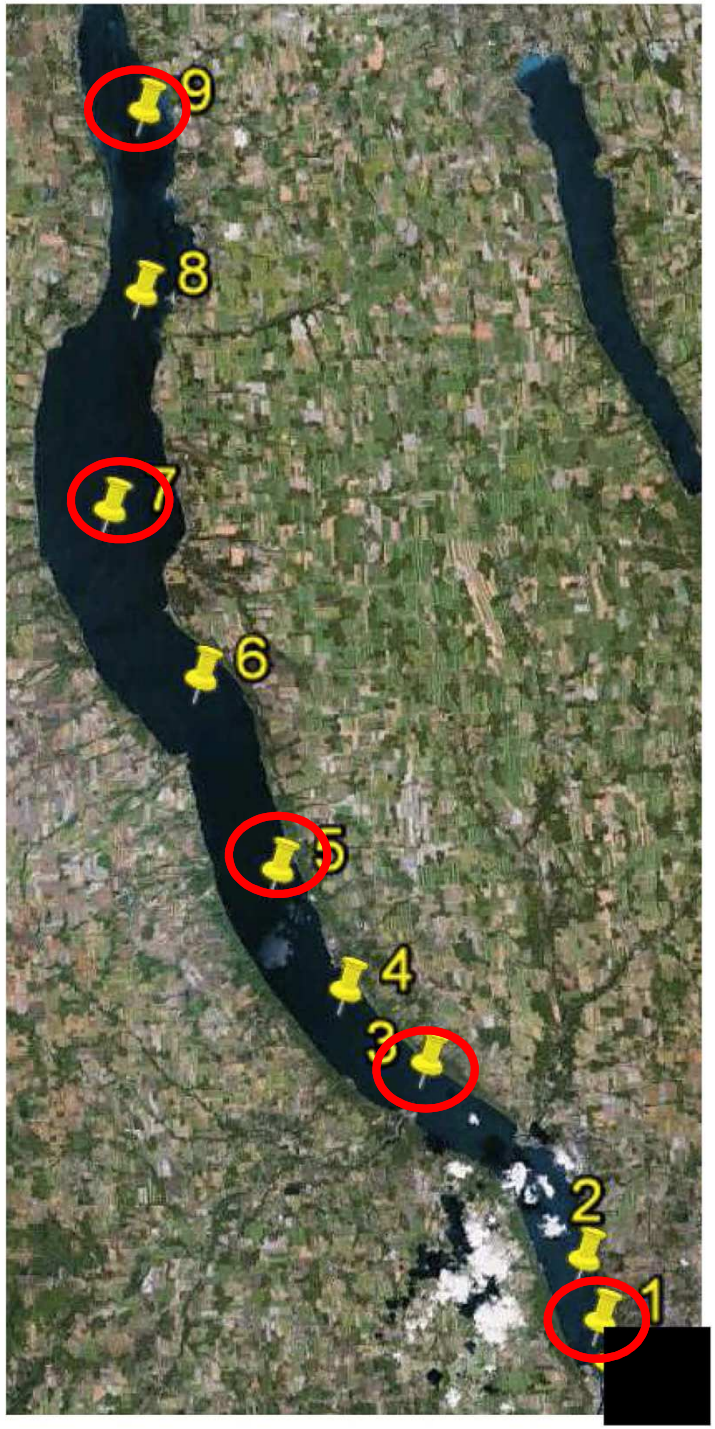
Phytoplankton Sampling Plan

Sampling Sites:

	epilimnion	hypolimnion
Site 1:	0-2.5m	
Site 3:	0-10 m	60 m
Site 5:	0-10 m*	60 m
Site 7:	0-10 m	60 m
Site 9:	0-2.5m	

Phytoplankton samples collected and analyzed at LSC sites 3 and 6 in 2010, 2011 & 2012

* Duplicate samples each date for estimating replicability



Phytoplankton Samples Counted

Samples counted to document spring bloom, clear-water phase (if present), late summer composition, fall bloom, and any dates of interest

22 Apr	21 May 4 June 18 June	9 July 6 Aug	3 Sept [1, 15, 29 Oct]
Spring Bloom	Clear-water Phase	Mid-summer	Fall and Fall turnover

72 samples counted in total

Phytoplankton preservation and counting

- Collected by UFI
- Preserved in Lugol's solution
- Settled 25% – 50% of each 100 mL sample, counted subsamples on inverted microscope: Utermöhl method

- Identified cells to Genus or Species when possible
  - Grouped when taxonomic i.d. was not possible

- Calculated biovolume (μm^3/ml) based on measured cell sizes and shapes on each date and site

- Assigned ~edibility classification
  - cell size; colony size; known toxicity or nutritional quality

Phylum (+)	Class	Most-common genera / grouping found
Heterokontophyta	Fragilariophyceae	*Asterionella* *Fragilaria* *Tabellaria*
	Chrysophyceae	*Chrysococcus* *Dinobryon*
	Synurophyceae	*Mallomonas*
	Other	Centric and pennate diatoms Flagellate Chrysophytes
Dinophyta	Dinophyceae	*Gymnodinium* *Peridinium*
Cryptophyta	Cryptophyceae	*Chroomonas* *Cryptomonas*
Euglenophyta	Euglenophyceae	*Trachelomonas*
Haptophyta	Coccolithophyceae	*Chrysochromulina*
Chlorophyta	Chlorophyceae	*Ankistrodesmus* *Chlamydomonas* *Golenkinia* *Kirchneriella* *Scenedesmus*
	Trebouxiophyceae	*Oöcystis*
	Other	Biflagellate Chlorophytes Coccoid Chlorophytes
Cyanobacteria	Cyanophyceae	*Oscillatoria*

Zooplankton: Why collect zooplankton data for a TMDL study?

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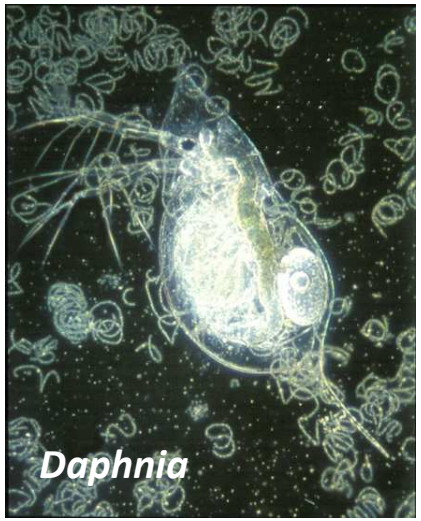
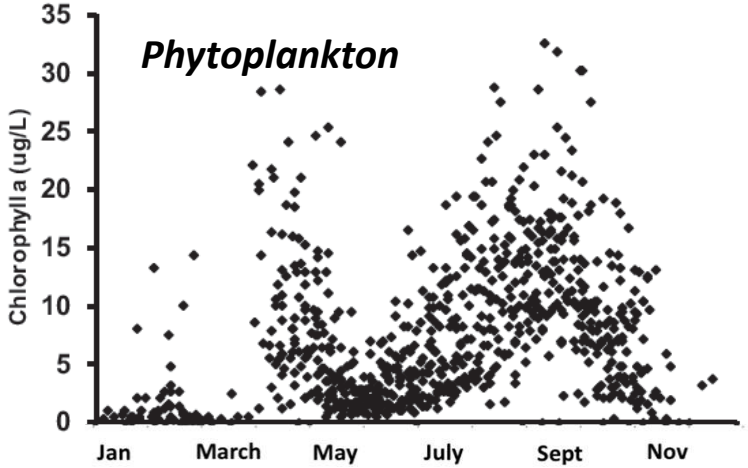
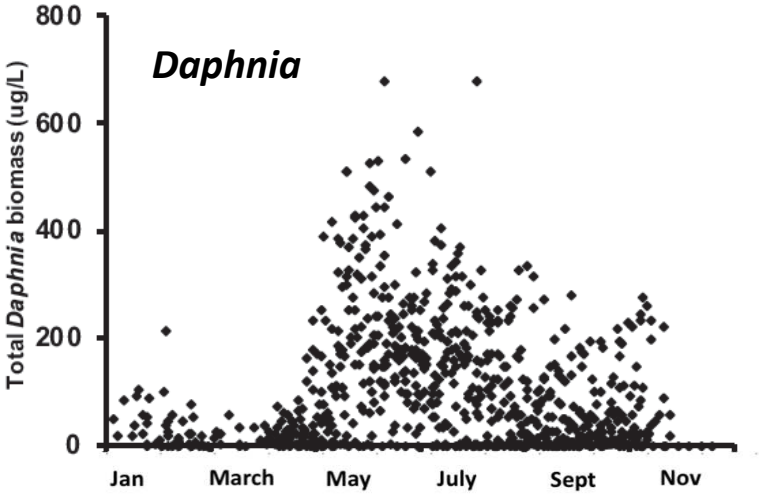


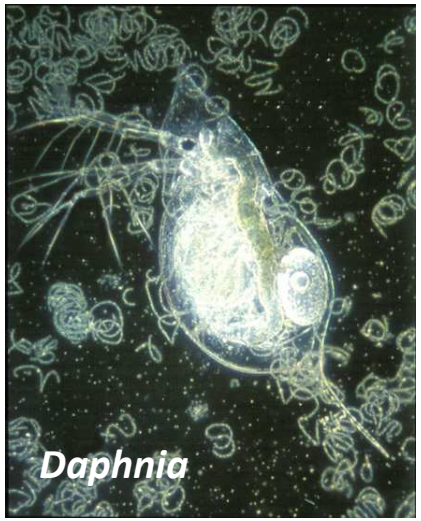
Zooplankton eat phytoplankton
… sometimes *a lot* of phytoplankton

Oneida Lake





Zooplankton: Why collect zooplankton data for a TMDL study?



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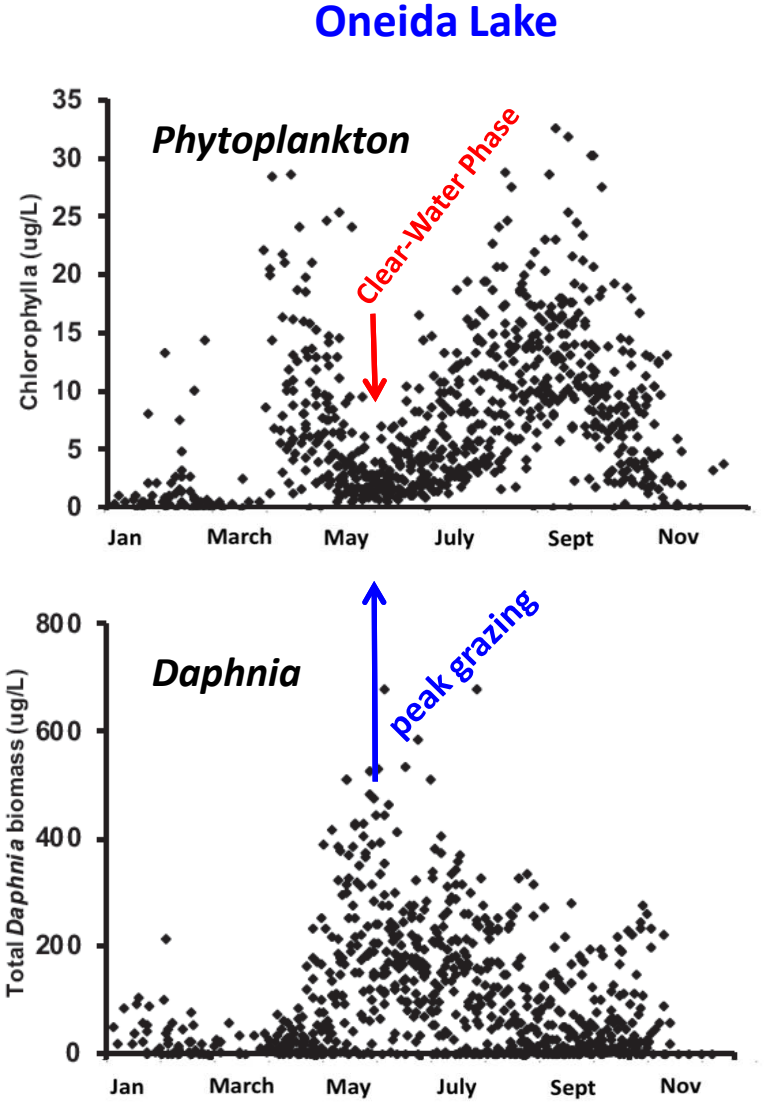
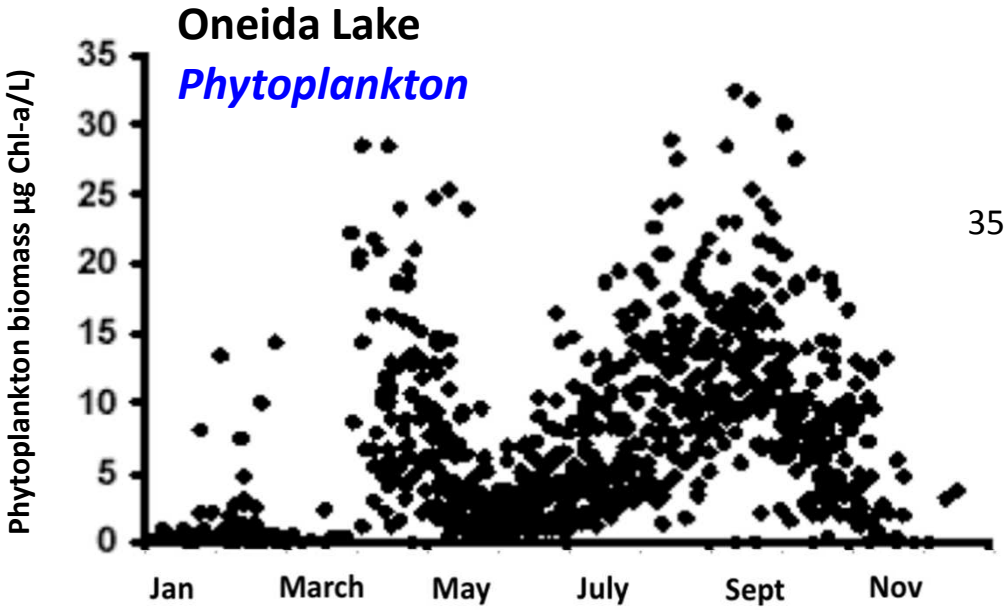
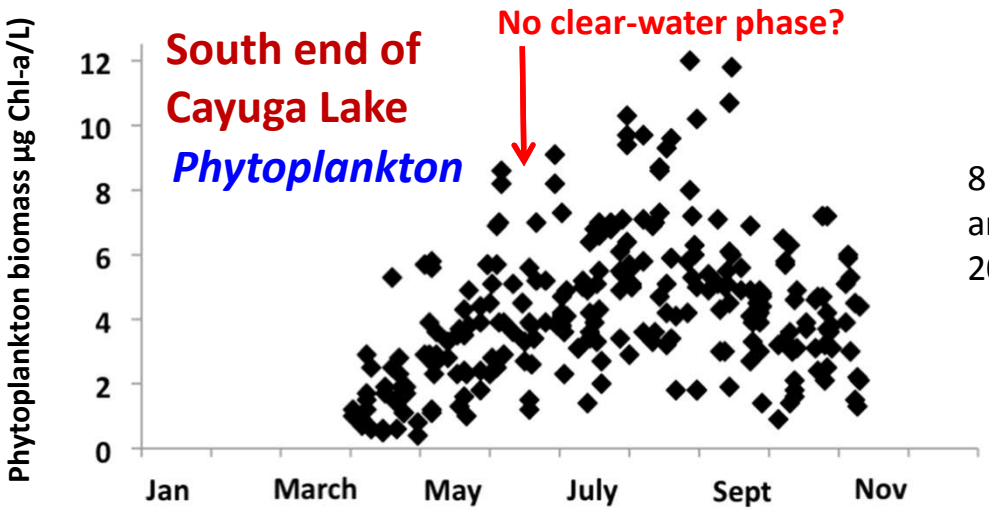


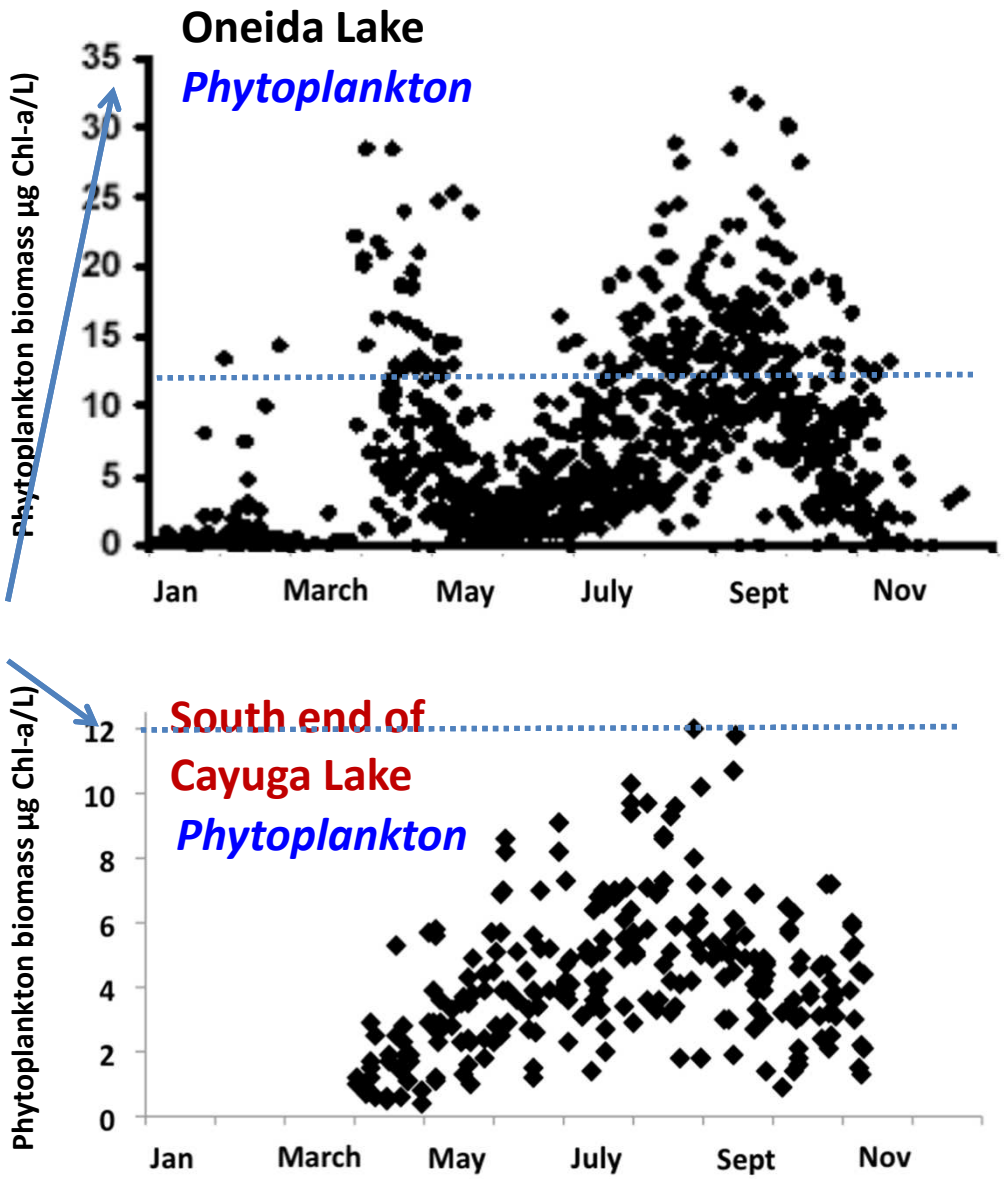


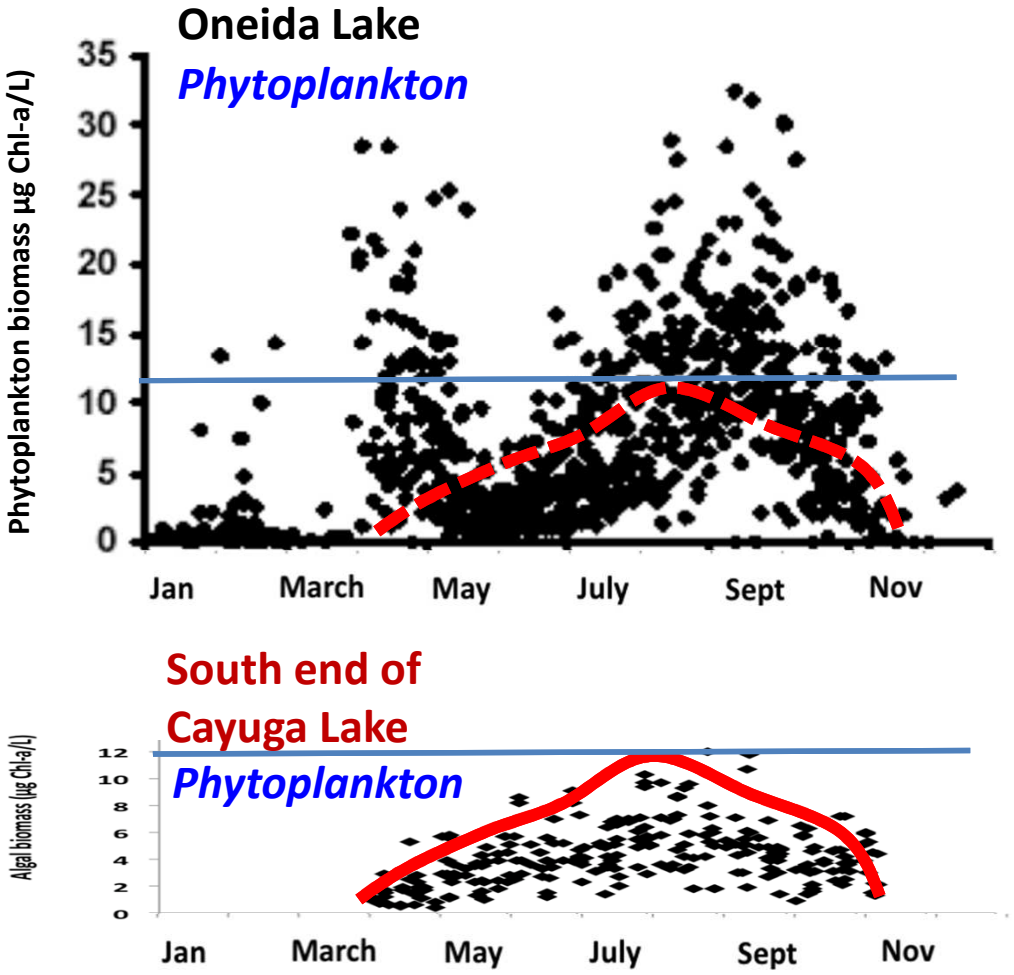
35 years of data from CBFS



8 years of data from the literature
and Hairston-lab data
2013 NOT included here

But …
Scale is different





What are grazer densities in Cayuga?

Zooplankton Sampling Plan

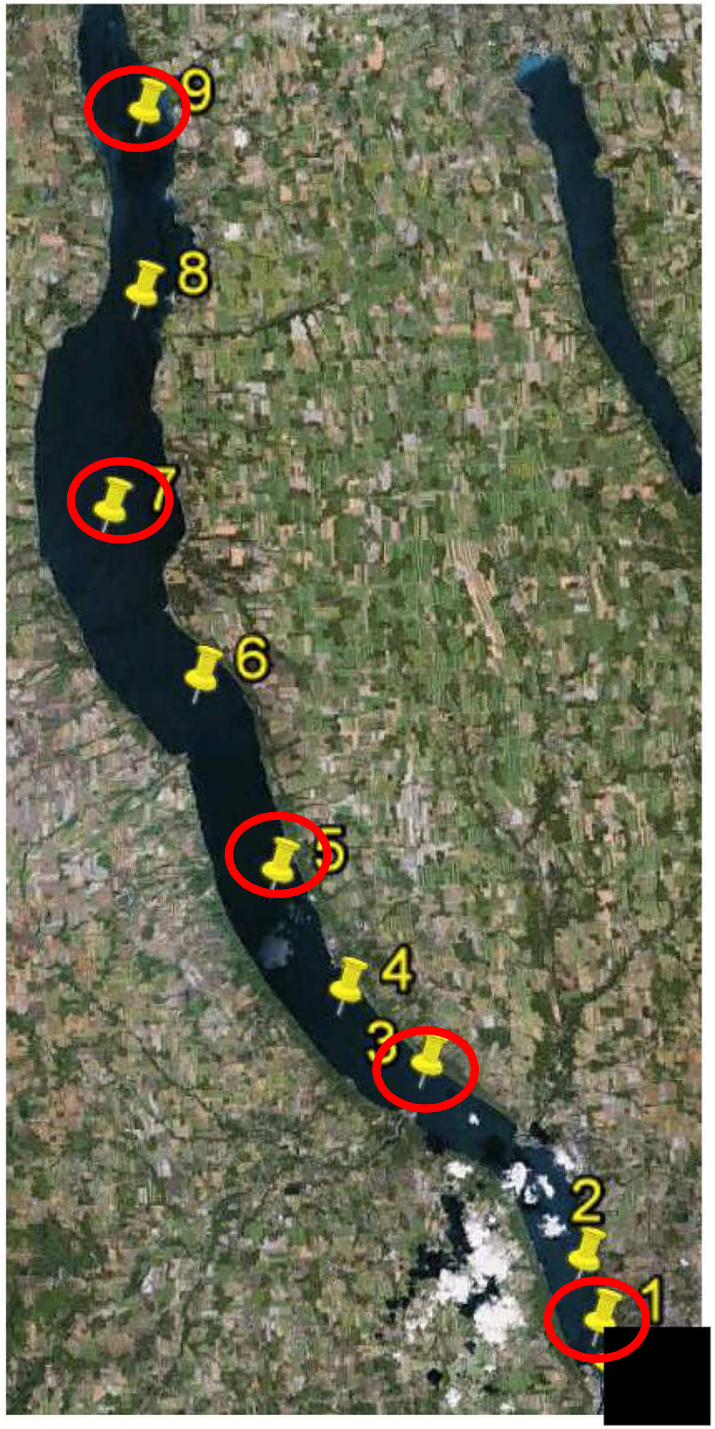
Sampling Sites:

	epilimnion	hypolimnion
Site 1:	0-2.5m	
Site 3:	0-10 m	40-60 m
Site 5:	0-10 m*	40-60 m
Site 7:	0-10 m	40-60 m
Site 9:	0-2.5m	

Samples taken on 11 dates:
every 2 weeks from 8 April to 29 October

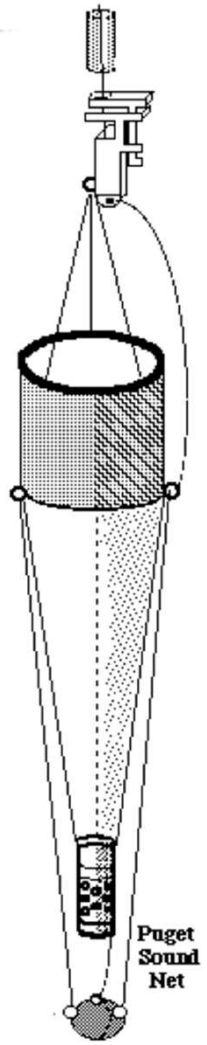
Daphnia densities available for reference from 2010, 2011 and 2012

* duplicate samples each date for estimating replicability



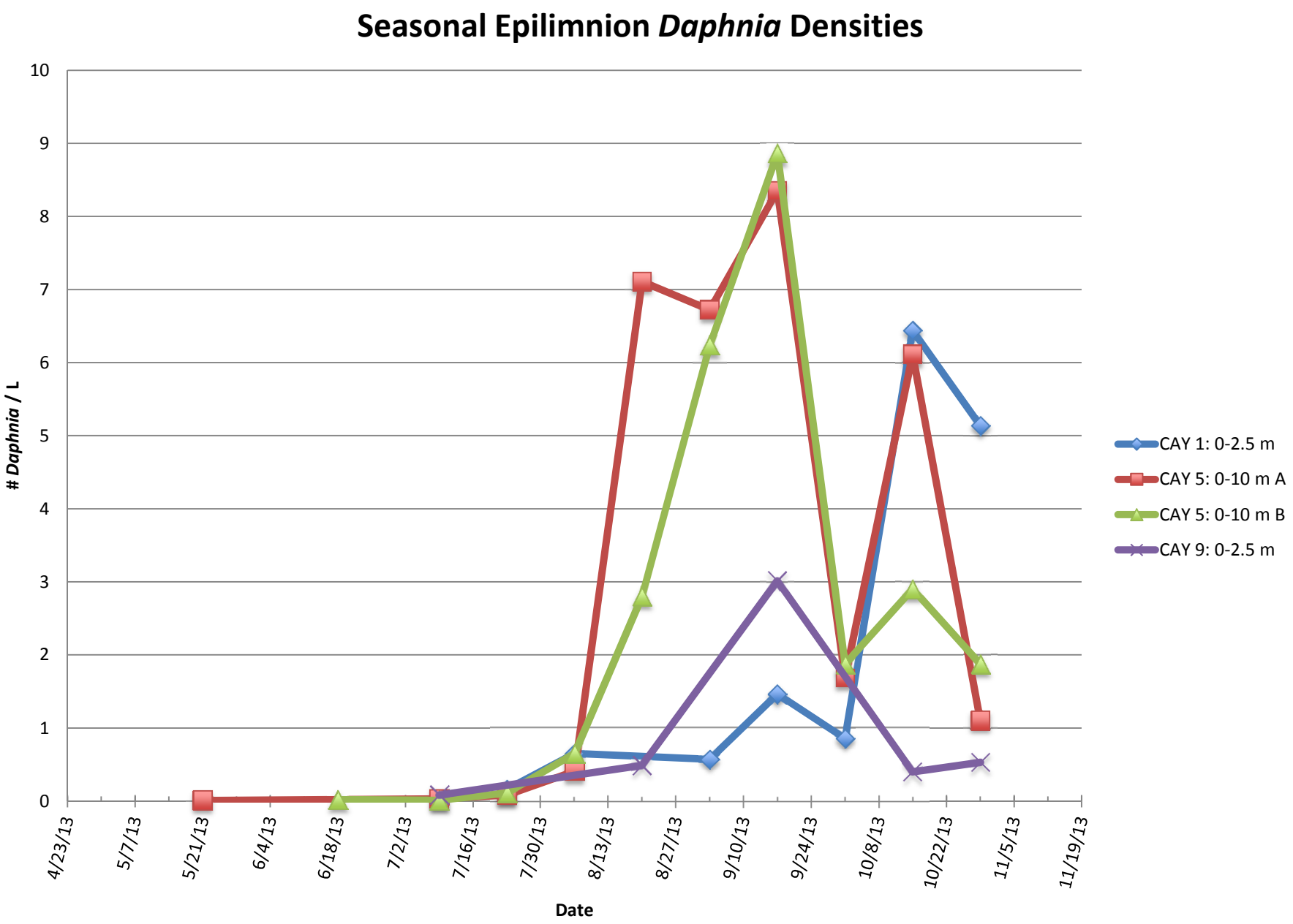
Zooplankton Sample Processing

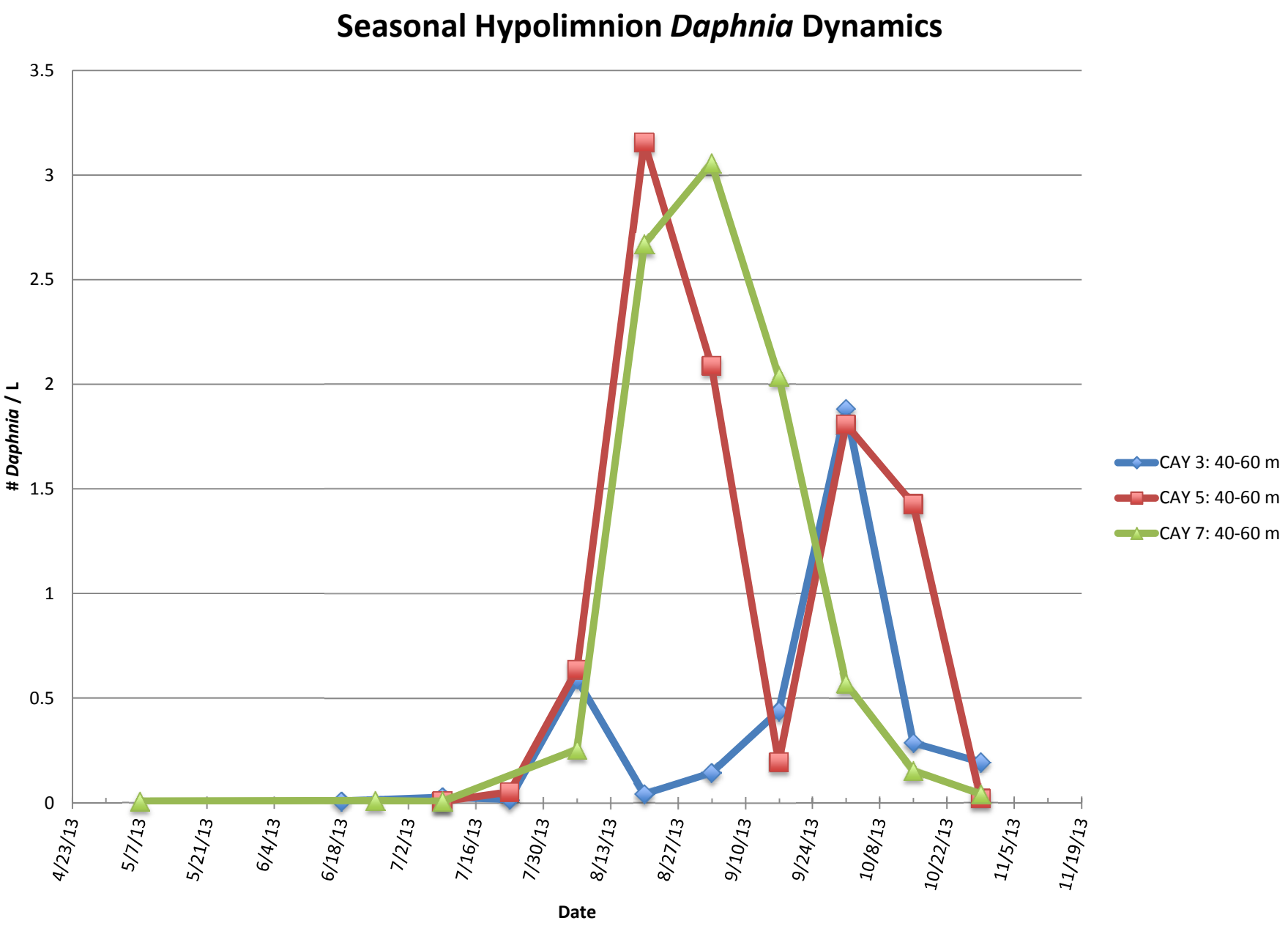
- Samples collected by UFI
- Preserved in 70% Ethanol
- 143 zooplankton samples counted
- Subsampled to a concentration at which 100 individuals of each dominant taxon were counted
- Measured 10 individuals of each taxon per sample (when possible) for biomass estimation
- 17 Crustacean taxa and 14 Rotifer taxa counted



Phylum / Subphylum	Class/Subclass/Order	Genera / grouping
Phylum: Rotifera	Class: Monogononta	*Ascomorpha* *Asplanchna* *Conochilus* *Kellicottia* *Keratella* *Ploesoma* *Polyarthra* *Synchaeta* *Trichocera*
Subphylum: Crustacea	Order: Cladocera	*Bosmina longirostris* (female, male) *Cercopagus pengoi* *Ceriodaphnia* (female, male) *Daphnia retrocurva* (female, male)
	Subclass: Copepoda Order: Cyclopoida	*Diacyclops thomasi* (female, male) *Paracyclops* sp. (female, male) Cyclopoid (C1-C4)
	Order: Calanoida	*Skistodiaptomus oregonensis* (female, male) Calanoid (C1-C5)
		Copepod nauplii pooled as single group

END


Seasonal Epilimnion *Daphnia* Densities
Daphnia / L
10
9
8
7
6
5
4
3
2
1
0
4/23/13
5/7/13
5/21/13
6/4/13
6/18/13
7/2/13
7/16/13
7/30/13
8/13/13
8/27/13
9/10/13
9/24/13
10/8/13
10/22/13
11/5/13
11/19/13
Date
CAY 1: 0-2.5 m
CAY 5: 0-10 m A
CAY 5: 0-10 m B
CAY 9: 0-2.5 m


Seasonal Hypolimnion *Daphnia* Dynamics
3.5
3
2.5
2
1.5
1
0.5
0
Daphnia / L
4/23/13
5/7/13
5/21/13
6/4/13
6/18/13
7/2/13
7/16/13
7/30/13
8/13/13
8/27/13
9/10/13
9/24/13
10/8/13
10/22/13
11/5/13
11/19/13
Date
CAY 3: 40-60 m
CAY 5: 40-60 m
CAY 7: 40-60 m