# Lake Wequaquet

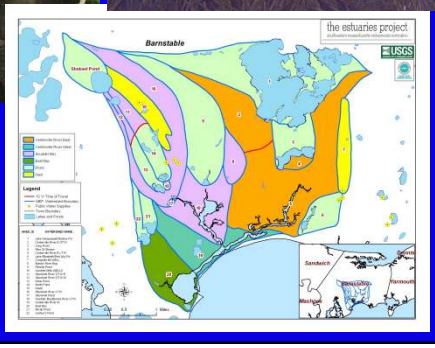
## Water Quality Trend Analysis

Lake Wequaquet
Protective Association
June 9, 2013

Ed Eichner
Senior Water Scientist
Coastal Systems Program
University of Massachusetts Dartmouth
School of Marine Science and Technology

# Lake Wequaquet

# Lake Wequaquet




# Lake Wequaquet

## Management Steps

1985-1986: Monthly water quality sampling and diagnostic assessment (IEP/KV, 1989)

1993: Wequaquet Lake Protective Association formed

1996: High water levels (Eichner and others, 1998)

2001: 1st PALS Snapshot (continue through 2012)

2004: Public sewers proposed (Tighe & Bond, 2004)

2007: Summer sampling and diagnostic assessment (Eichner, 2009)

2010: Town began regular monthly summer sampling of lake (through 2012)

2010: Town completed aquatic plant survey (Lycott Environmental, 2010)

2011: Management RFP by Town

# PALS Snapshots

- 12 years of donated lab services by SMAST
- 126 - 195 Cape Cod ponds sampled every year
- Assess regional status of pond water quality and springboard to prioritizing more refined sampling



## Available Data

Figure II-1. Lake Wequaquet Bathymetry and Water Quality Sampling Stations

1985-86 KV/IEP
Oct 1985 – Sept 1986
Mostly monthly, twice a month during summer
All 5 stations

2007 SMAST/CCC
May 2007 – Nov 2007
Mostly twice a month May to Sept
All 5 stations

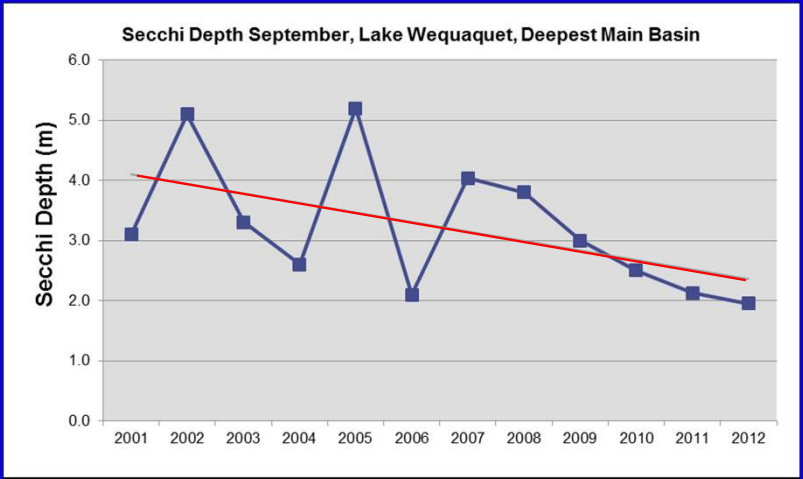
2010-12 Town
Monthly June to Sept
All 5 stations

2001-2012 PALS
Annually; mostly in Sept
Deep W2 and Bearses W5

# Pond Water Quality

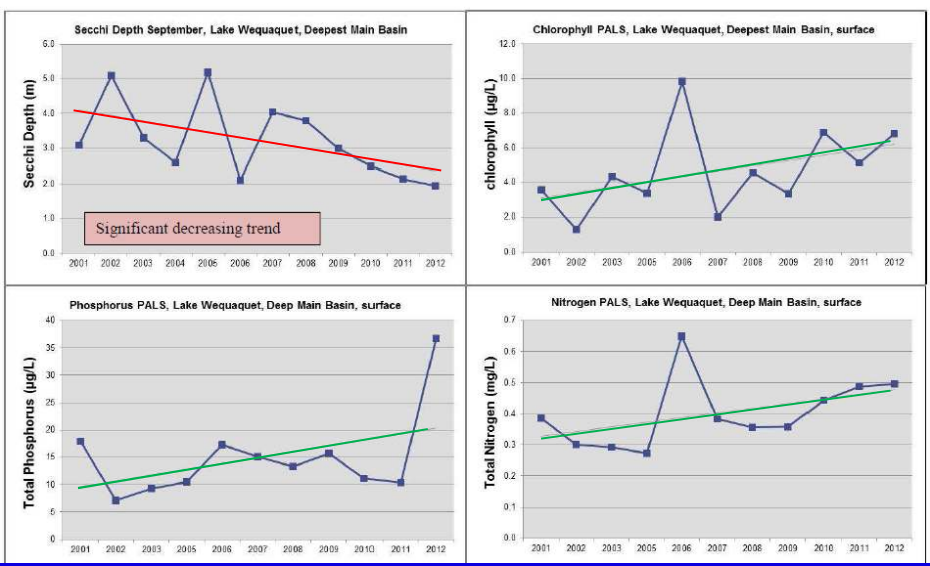
- Phosphorus (P) is key nutrient in freshwater ponds
- Too much P overwhelms ecosystem:
  - 1st impact increased TP concentration;
  - 2nd impact loss of clarity (algal growth);
  - 3rd impact falling dissolved oxygen concentrations (worst close to bottom)
- Ponds >9 m generally thermally stratify
- Most Cape ponds have good shallow conditions, problems generally exist below the surface

## Secchi/Clarity: Deep Basin (W2)

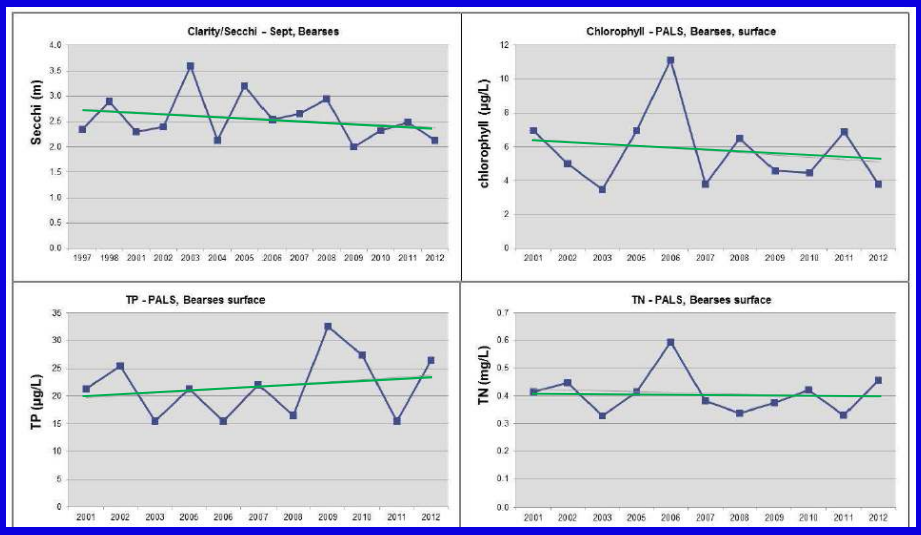



Statistically significant ($\rho<0.05$) decreasing trend
Trend = -0.6 ft every year

## Deep Basin (W2): other trends




## Bearses Pond (W5): trends




No significant September trends, but significantly ($\rho<0.05$) decreasing clarity in July and August

## Comparison of Averages

| Measure | Station # | Station Location | Units | AVERAGES 1986 IEP/KV summer avg | 2007 SMAST summer avg | AVG | 1985/86 Whole IEP/KV avg | 2001 to 2012 avg | AVG | 2001 to 2007 avg | 2010 to 2012 avg | AVG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Clarity | 1 | Main | meters | 4.09 | 3.56 | ▼ | 4.11 | 3.29 | ▼ | 3.82 | 2.29 | ▼ |
| | 5 | Bearses | meters | 3.51 | 2.88 | ▼ | 3.41 | 2.83 | ▼ | 3.39 | 2.29 | ▼ |
| | 3 | South | meters | 5.00 | 3.57 | ▼ | 4.59 | 3.33 | ▼ | 4.19 | 2.54 | ▼ |
| | 4 | Gooseber | meters | 5.24 | 3.28 | ▼ | 4.66 | 2.93 | ▼ | 3.36 | 2.42 | ▼ |
| Surface Chloro-phyll | 1 | Main | µg/L | 3.0 | 3.1 | ▲ | 2.9 | 5.4 | ▲ | 3.4 | 7.5 | ▲ |
| | 5 | Bearses | µg/L | 3.3 | 4.7 | ▲ | 3.2 | 5.2 | ▲ | 5.0 | 5.4 | ▲ |
| | 3 | South | µg/L | 2.5 | 3.5 | ▲ | 2.8 | 3.3 | ▲ | 2.9 | 3.6 | ▲ |
| | 4 | Gooseber | µg/L | 2.8 | 4.8 | ▲ | 2.5 | 3.9 | ▲ | 3.9 | 3.8 | ▼ |
| Surface Total P | 1 | Main | µg/L | 11.0 | 20.6 | ▲[3] | 26.3 | 19.2 | ▼ | 16.5 | 22.7 | ▲ |
| | 5 | Bearses | µg/L | 10.4 | 24.5 | ▲[3] | 30.8 | 20.4 | ▼ | 21.4 | 18.7 | ▼ |
| | 3 | South | µg/L | 7.8 | 20.6 | ▲[3] | 26.2 | 20.5 | ▲ | 18.5 | 21.6 | ▲ |
| | 4 | Gooseber | µg/L | 11.0 | 20.2 | ▲[3] | 30.7 | 22.2 | ▼ | 19.2 | 24.3 | ▲ |
| Surface Total N | 1 | Main | mg/L | 0.47 | 0.41 | ▼ | 0.47 | 0.45 | ▼ | 0.40 | 0.51 | ▲ |
| | 5 | Bearses | mg/L | 0.38 | 0.43 | ▲ | 0.52 | 0.44 | ▼ | 0.44 | 0.46 | ▲ |
| | 3 | South | mg/L | 0.30 | 0.45 | ▲ | 0.35 | 0.46 | ▲ | 0.42 | 0.48 | ▲ |
| | 4 | Gooseber | mg/L | 0.28 | 0.46 | ▲ | 0.43 | 0.48 | ▲ | 0.43 | 0.51 | ▲ |

## Balance between nutrient additions: External and Internal


Watershed

MEP: 7% BO addition
Suggest little new N addition
SMAST: P budget in balance
Suggest little P addition from travel time

Internal Sediments

SMAST: pond system retaining ~50% of P added
Change in sediment conditions could add internal P; need more refined monitoring to see

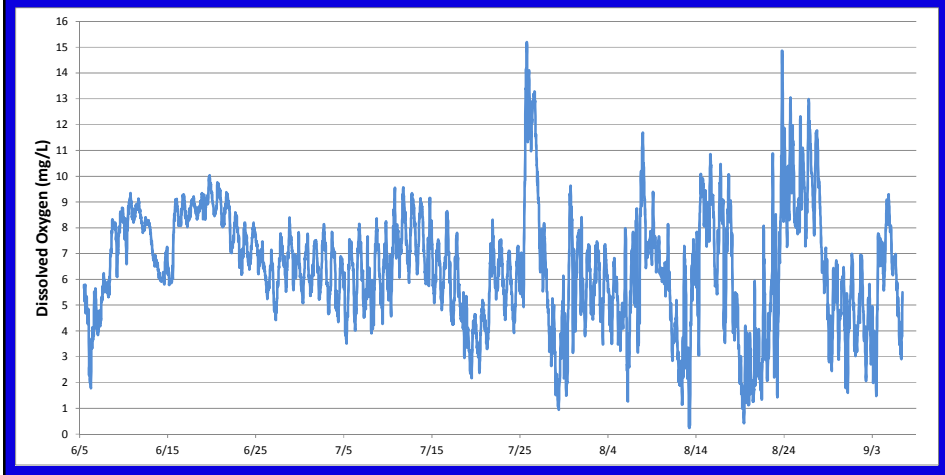
Lake Wequaquet
Water Quality Assessment

# Recommendations

- Collect and test lake sediment cores
- Conduct a refined aquatic plant survey
- Establish a regular monitoring program
- Develop a management plan

## Benefits of continuous monitoring

Measurement of temporary, but important changes
Measurement of changeable conditions



Lake Wequaquet
Water Quality Trend Analysis

# Conclusions/Next Steps

- Water quality conditions are worsening
- Source is unclear
- Additional assessment data to clarify: sediment and/or continuous sampling

**Coastal Systems Program**
**University of Massachusetts Dartmouth**
*Science for Management*

# *Questions & Discussion*

Coastal Systems Program:

Brian Howes
Ed Eichner
Roland Samimy
David Schlezinger
David White
Dale Toner
Sara Sampieri
Jen Antosca
Mike Bartlett

Contact:
Ed Eichner
Coastal Systems Program
SMAST, UMASS Dartmouth
eichner@comcast.net
home office: 508-775-9080
Cell: 508-737-5991