NITROGEN MITIGATION BY OYSTER CULTURE STRIVING TO COMPLY WITH THE CLEAN WATER ACT

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Sengekontacket Pond

- Northern side of Martha's Vineyard
- 716 acres
- Watershed 4440 acres
- Impaired by excess nitrogen entering pond
- Mostly residential

Sengekontacket Pond

- Shared by two towns
  - Oak Bluffs
  - Edgartown
- Both towns have similar municipal aquaculture programs
- MA unique each town manages shellfish resources
- Supported by Martha's Vineyard Commission
  a regional planning agency

Excess Nitrogen Impacts

- Phytoplankton blooms
  - Populations dense enough to reduce light penetration and tint the water color
- Growth of seaweeds especially near shore
  - Green filamentous especially at fresh water seeps
  - Mat algae
- Decline of eelgrass meadows
  - Deeper meadows disappearing
  - Loss of area of refuge and forage
- Increase speed of eutrophication

Nitrogen Threshold

- MA Estuaries Project

  Pond was evaluated to determine the Total Maximum Daily Load (TMDL) of nitrogen for it to be considered a healthy pond (TMDL 11,051 kg/yr.)

  - This requirement is from the 1972 Clean Water Act

- MA Department of Environmental Protection
  - Has accepted the MEP results setting the goal
  - The towns must begin to lower the nitrogen contributions to meet the TMDL

Actions needed

- Recognize that the largest nitrogen source we can do something about is how we treat our own waste
- Reduce nitrogen at source
- Mitigate impacts of nitrogen
- Continue to monitor water quality
- Evaluate all alternatives
  - Sewering - will need to be part of the solution
  - Advanced enhanced septic systems (de-nite)
  - Increase tidal flushing of coastal ponds (where appropriate)
  - Permeable reactive barriers
  - Limit fertilizer use
  - Grow more shellfish

Grow more Shellfish

- Already grow
  - Quahogs
  - Bay Scallops
  - Steamer Clams
- Introducing Oysters!
  - popular
  - filter feeds
  - utilizes nitrogen
- 500,000 seed each town annually

Introduce Oysters

- Each town to get 500,000 seed oysters annually
- Grow through summer and over winter in cages
- Oysters are counted and seeded out early following summer
- Assume a high mortality rate of another 30%
- Yields 525,000 adults to be harvested annually

Desk Top Calculations

- For a Healthy Pond TMDL 11,051 kg/yr
- Current nitrogen entering pond 13,713 kg/yr
- At Build out estimated load 18,306 kg/yr

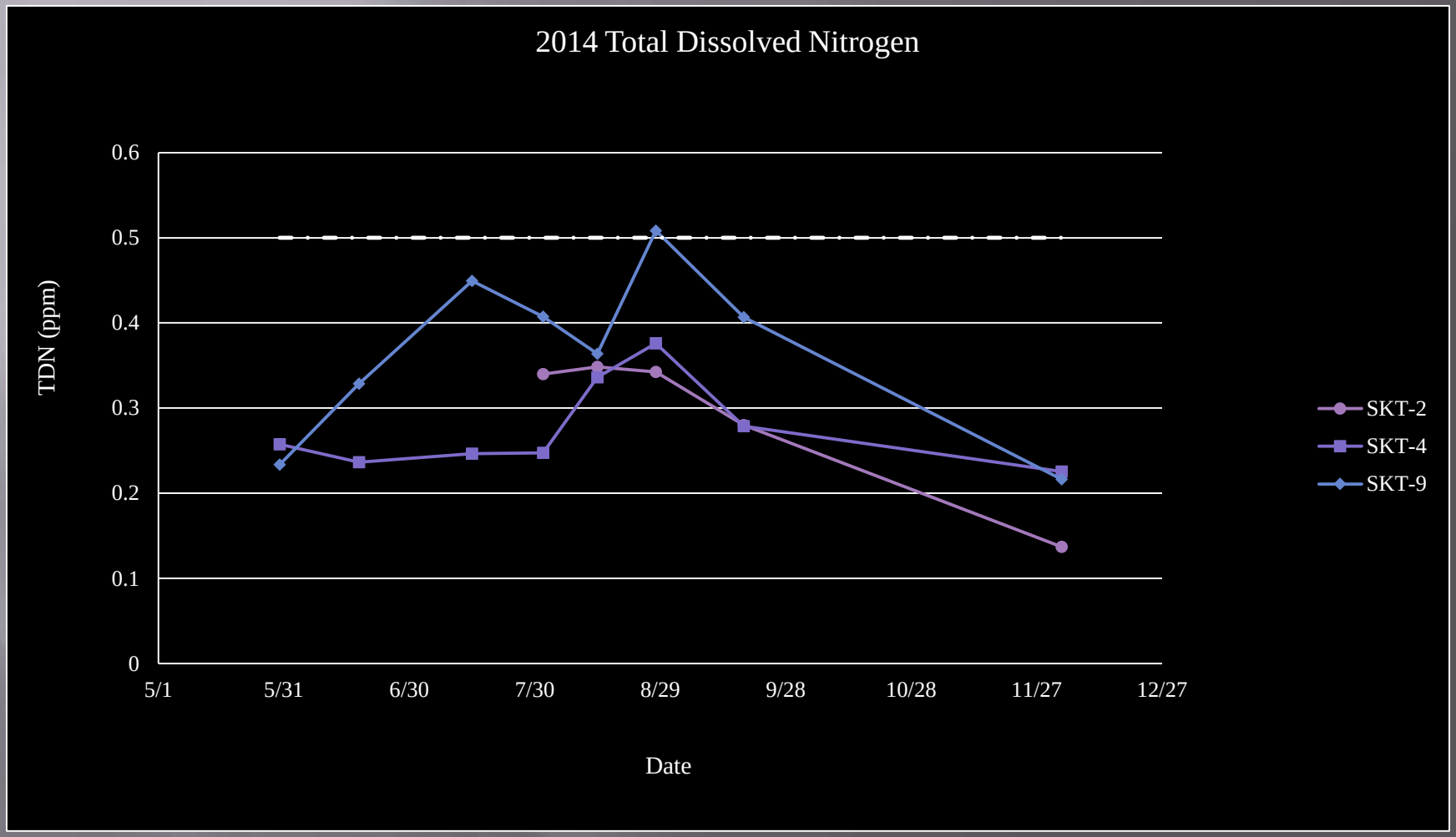
- MEP determined the excess load 2,662 kg

- From literature we find the oysters utilize nitrogen in their growth from 3-5 mg each
- 525,000 oysters times 3 mg/oyster
- 1,575,000mg N or 1,575 kg attenuated
- At 5 mg/oyster 2,625,000 mg or 2,625 kg

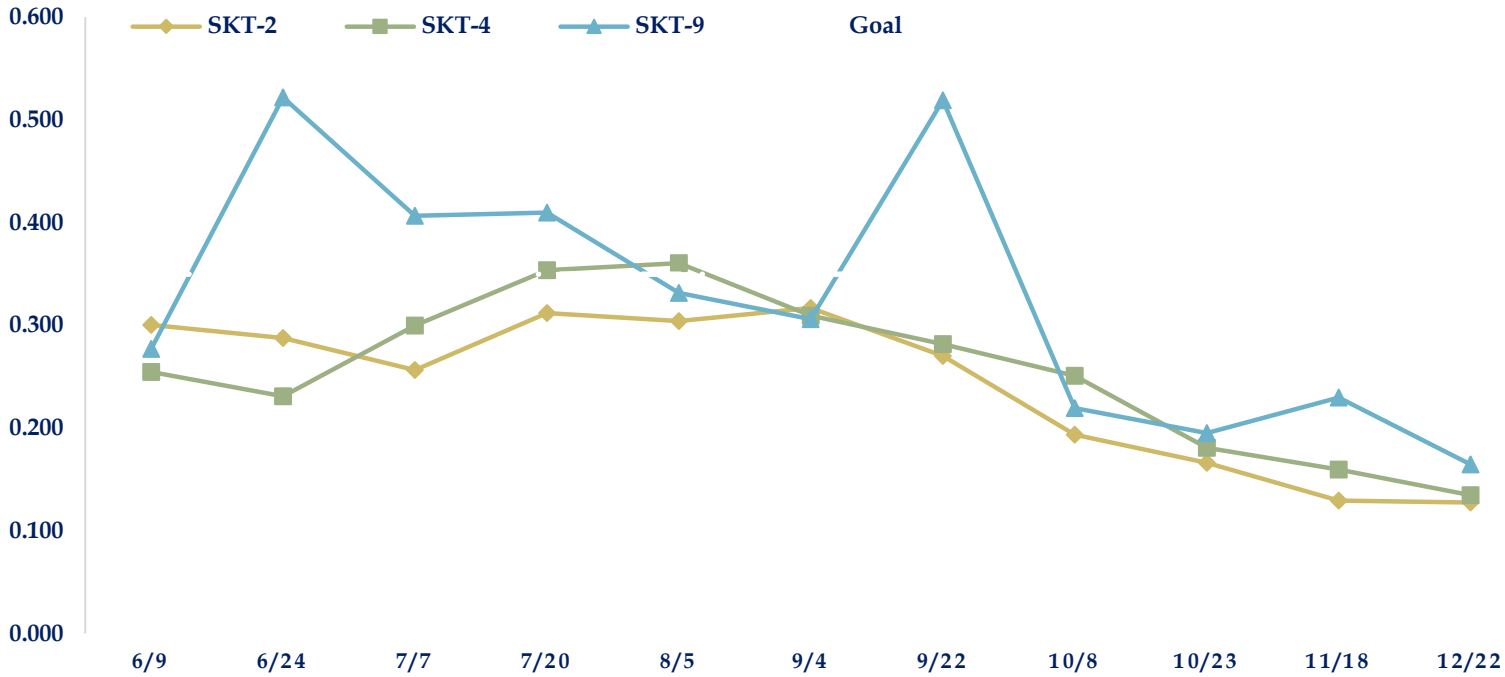
Pond has at least 2,662 kg excess N

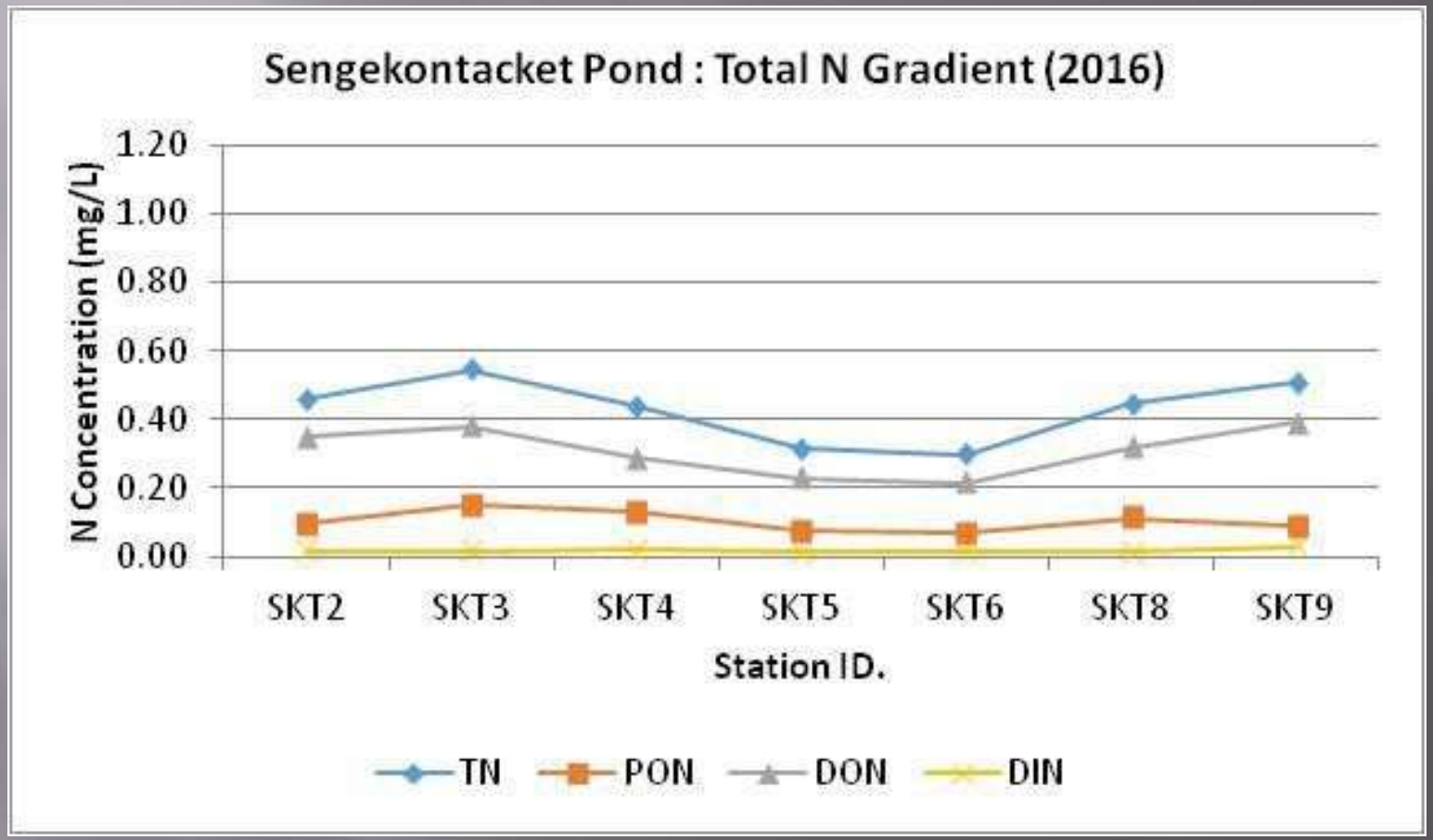
Water Quality Monitoring

- The Massachusetts Estuaries Project determined the healthy level 3.5mg/l
- Established a Sentinel monitoring site (SKT 4)
- Oyster mitigation project began in 2013


2014 Total Dissolved Nitrogen
TDN (ppm)
0.6
0.5
0.4
0.3
0.2
0.1
0
5/1
5/31
6/30
7/30
8/29
9/28
10/28
11/27
12/27
Date
SKT-2
SKT-4
SKT-9

TN SENGEKONTACKET 2015




Sengekontacket Pond : Total N Gradient (2016)
N Concentration (mg/L)
1.20
1.00
0.80
0.60
0.40
0.20
0.00
SKT2
SKT3
SKT4
SKT5
SKT6
SKT8
SKT9
Station ID.
TN
PON
DON
DIN

- Obviously we need to do more work
- The two towns are committed to continue raising the oysters each year
- We need to decide what our next steps are
- Consider other approaches to N mitigation