

Results of monitoring for gasoline & gasoline-derived compounds in Lake Tahoe, 2009-11

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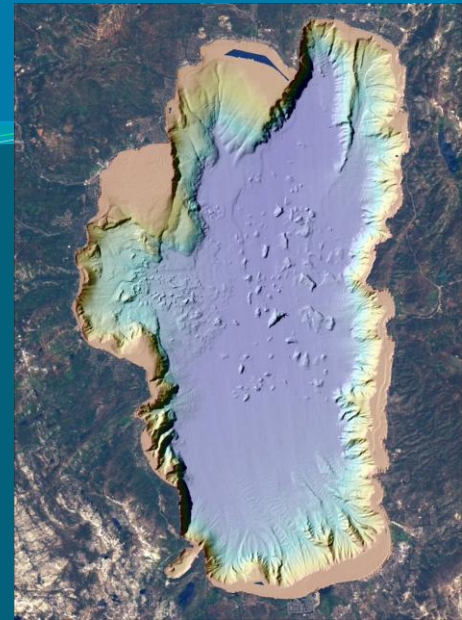
Carson City, NV



FUNDING SOURCES:

Cooperative Study:

- U.S. GEOLOGICAL SURVEY
- TAHOE REGIONAL PLANNING AGENCY



TRPA In-Kind Contribution:

Boat Crew
& staff



Outline:

- Background
- Historic Organics Sampling & significant Findings
- Project Objectives
- Compounds of Interest
- Sampling & Sites
- VOC Sampling Methods
- VOC Results
- PAH Sampling Methods
- PAH Results
- Plans

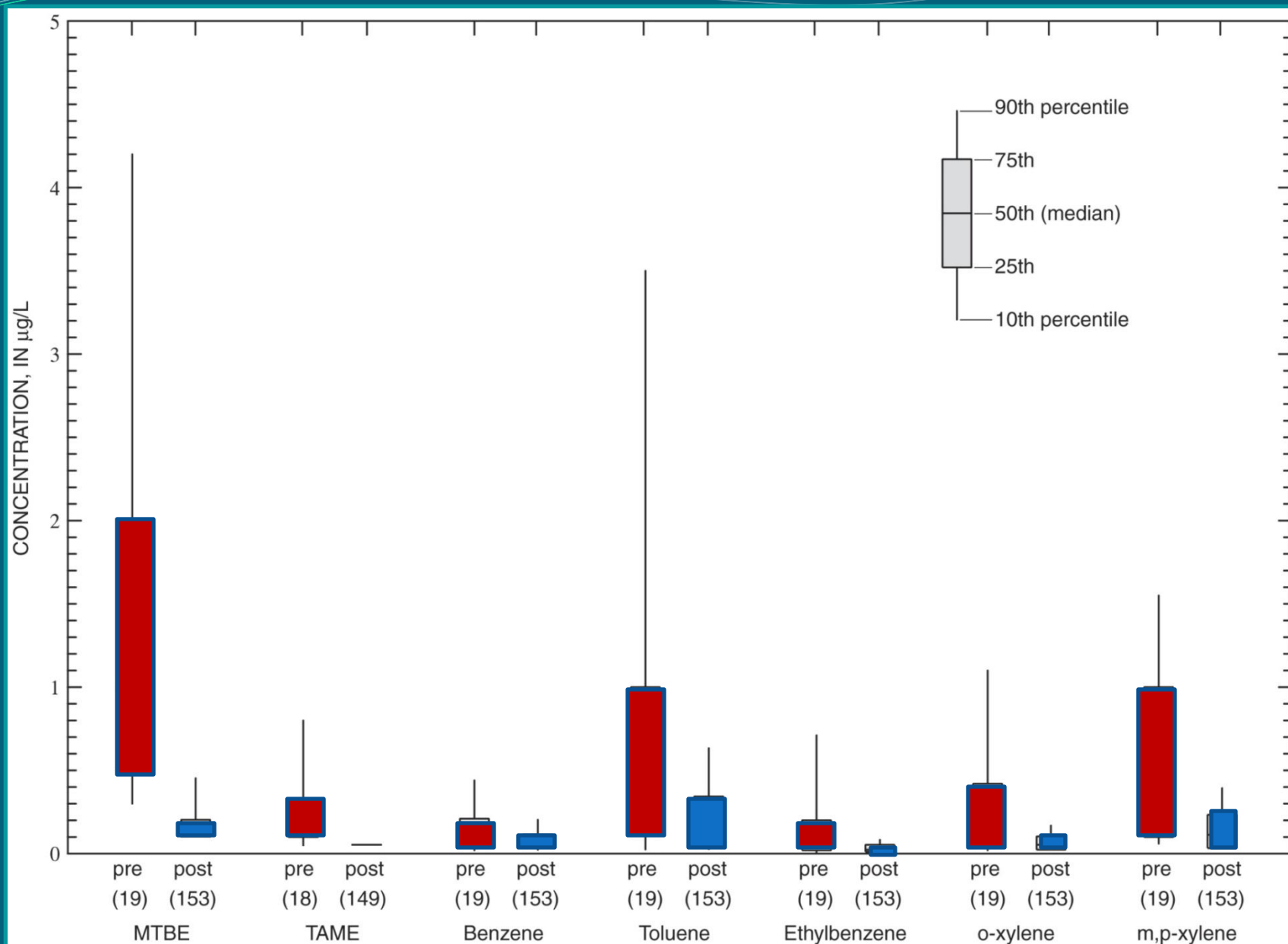


Historical Sampling & Findings:

Carbureted 2-Stroke Engines were banned in 1999 – this has greatly decreased gasoline compounds in Lake Tahoe



Pre/Post 2-Stroke Ban:



Lake Tahoe Organics Sampling:

Lake Tahoe

- 1999-2003
- 2005-07
- 2009-11

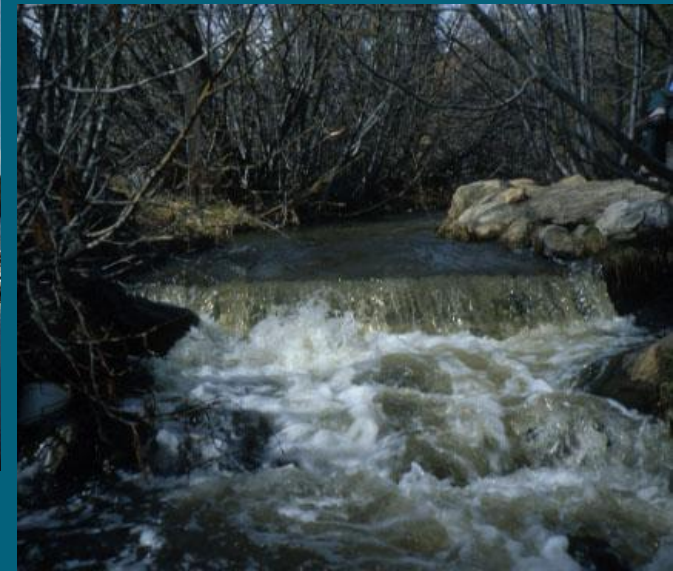


Streams:

- 1998
- 2002-03

Other Lakes:

- ❖ 1997-98



Monitoring Re-established again & part of Shorezone Water-Quality Monitoring Program

Increased to 20 sites-some in areas of potential buoy fields & piers



Recent Project Objectives:

1. Develop baseline conditions for gasoline-derived compounds, hydrocarbons (VOCs) and polycyclic aromatic hydrocarbons (PAHs)
2. Understand possible changes in water quality over time
3. Determine if possible mitigation measures are effective or need refinement.



Gasoline Compounds of Interest:

Hydrocarbons (VOCs):

- Gasoline Components:

BTEX- Benzene, Toluene, Ethylbenzene, & Xylene

Note Toluene – used as surrogate

- Gasoline Oxygenates:

MTBE, ETBE, TAME, DIPE

Polycyclic Aromatic Hydrocarbons (PAH's):

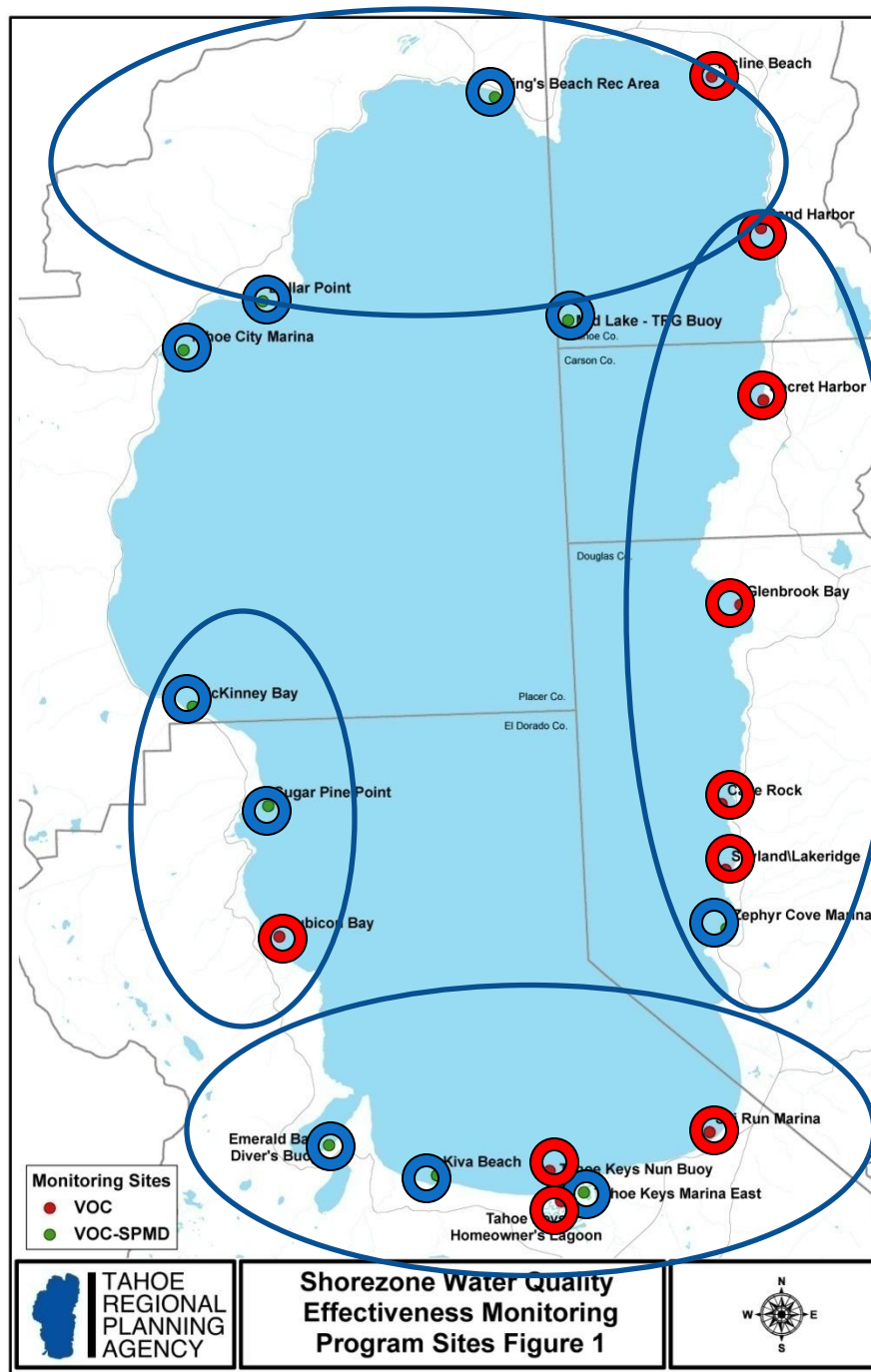
- Fluoranthene
- Pyrene
- Naphthalene
- others



Sites: 2009 & 2010:

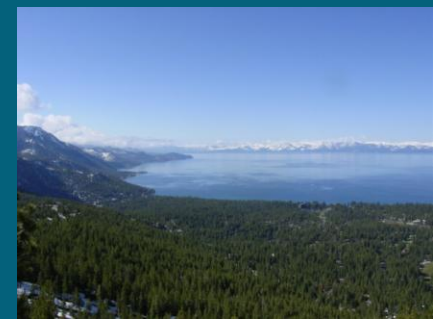
●-VOC

●-SPMD &
VOC



Sample periods: 2009

<u>No.</u>	<u>Time period -</u>	<u>Boat Usage -</u>	<u>Sample Type</u>
1.	Post Memorial Day	Light	VOC
2.	Pre 4 th of July	Medium	VOC + SPMD
3.	Post 4 th of July	Heavy	VOC
4.	Early August	Heavy	VOC + SPMD
5.	Mid-August	Heavy	VOC
6.	Post Labor Day	Heavy	VOC
7.	Early Fall	Light	VOC



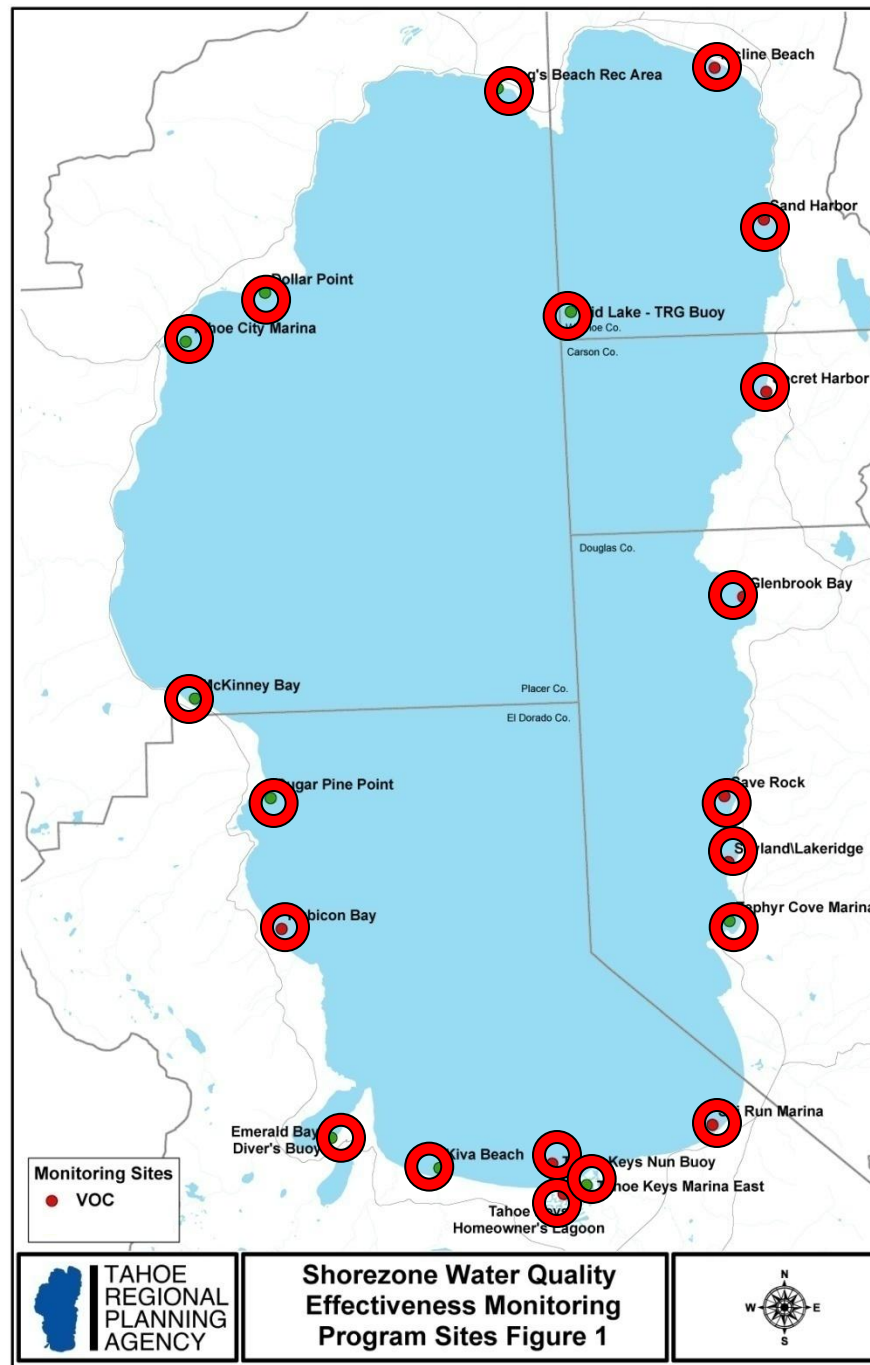
Sample periods: 2010

No. Time period - Boat Usage - Sample Type

1.	Early May	Light	VOC + SPMD
2.	Pre-Memorial Day	Light	VOC + SPMD
3.	Memorial Day	Light	VOC
4.	Pre 4 th of July	Medium	VOC + SPMD
5.	Post 4 th of July	Heavy	VOC
6.	Early August	Heavy	VOC + SPMD
7.	Mid-August	Heavy	VOC
8.	Post Labor Day	Heavy	VOC
9.	Early Fall	Light	VOC + SPMD

Sites: 2011

○-VOC only



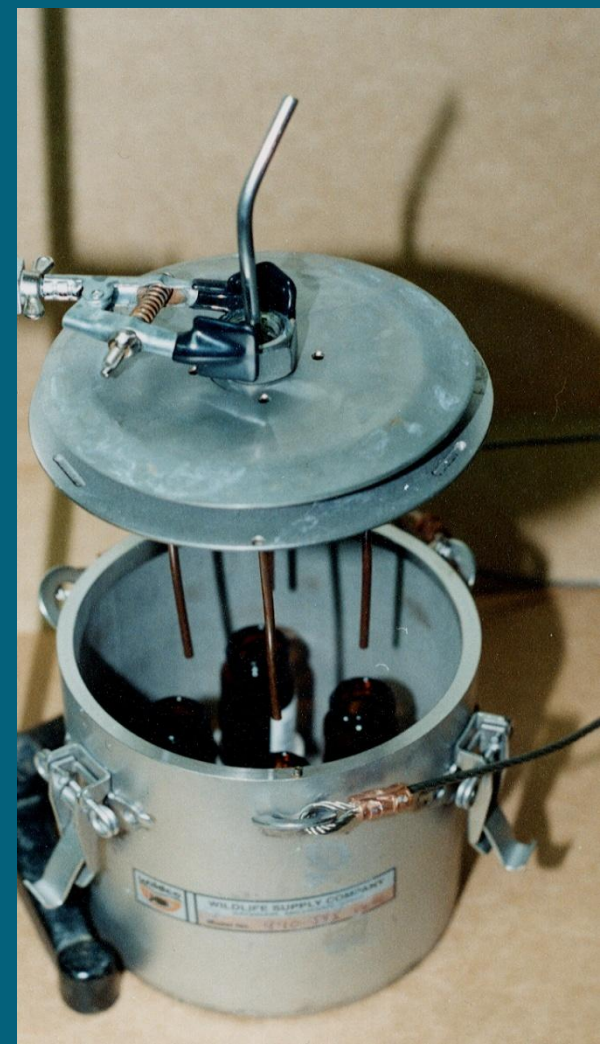
Sample periods: 2011

No. Time period - Boat Usage - Sample Type

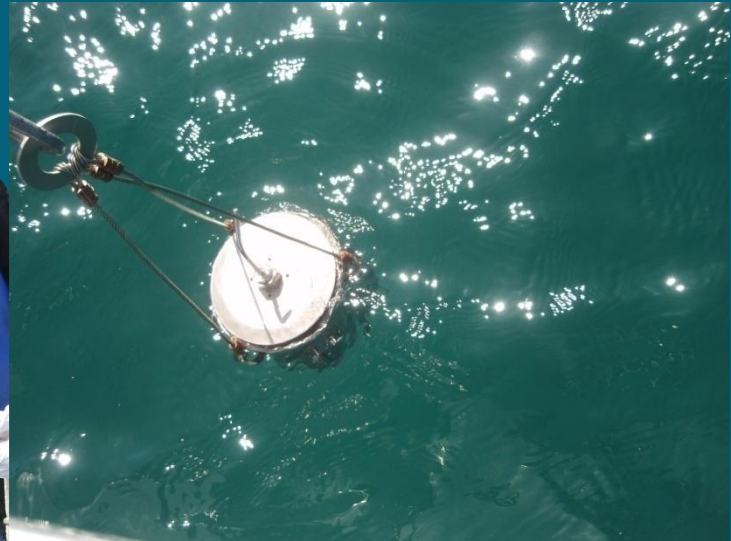
- | | | | |
|----|------------------------------------|--------------|-----|
| 1. | Pre Boating | Light | VOC |
| 2. | Post Memorial Day | Light | VOC |
| 3. | Post 4th of July | Heavy | VOC |
| 4. | Mid-August | Heavy | VOC |
| 5. | Post Labor Day | Heavy | VOC |
| 6. | Early Fall | Light | VOC |



Methods: Clean VOC Sampler & Load with 4 vials:



Methods: VOC Sampler lowered in Lake to 3 meters, until full



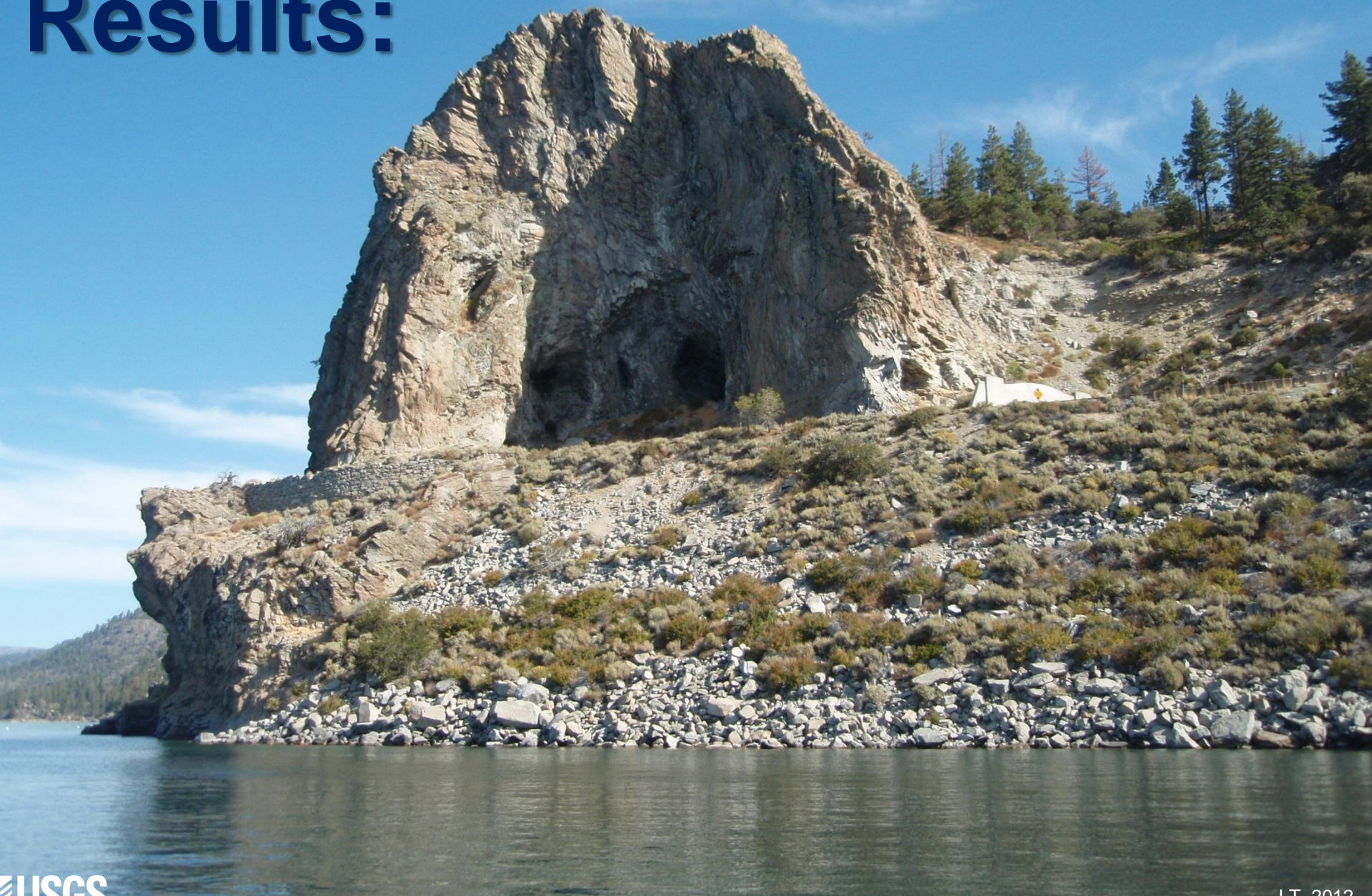
Methods: VOC Sample vials removed, acidified & sent via FEDX to USGS NWQL



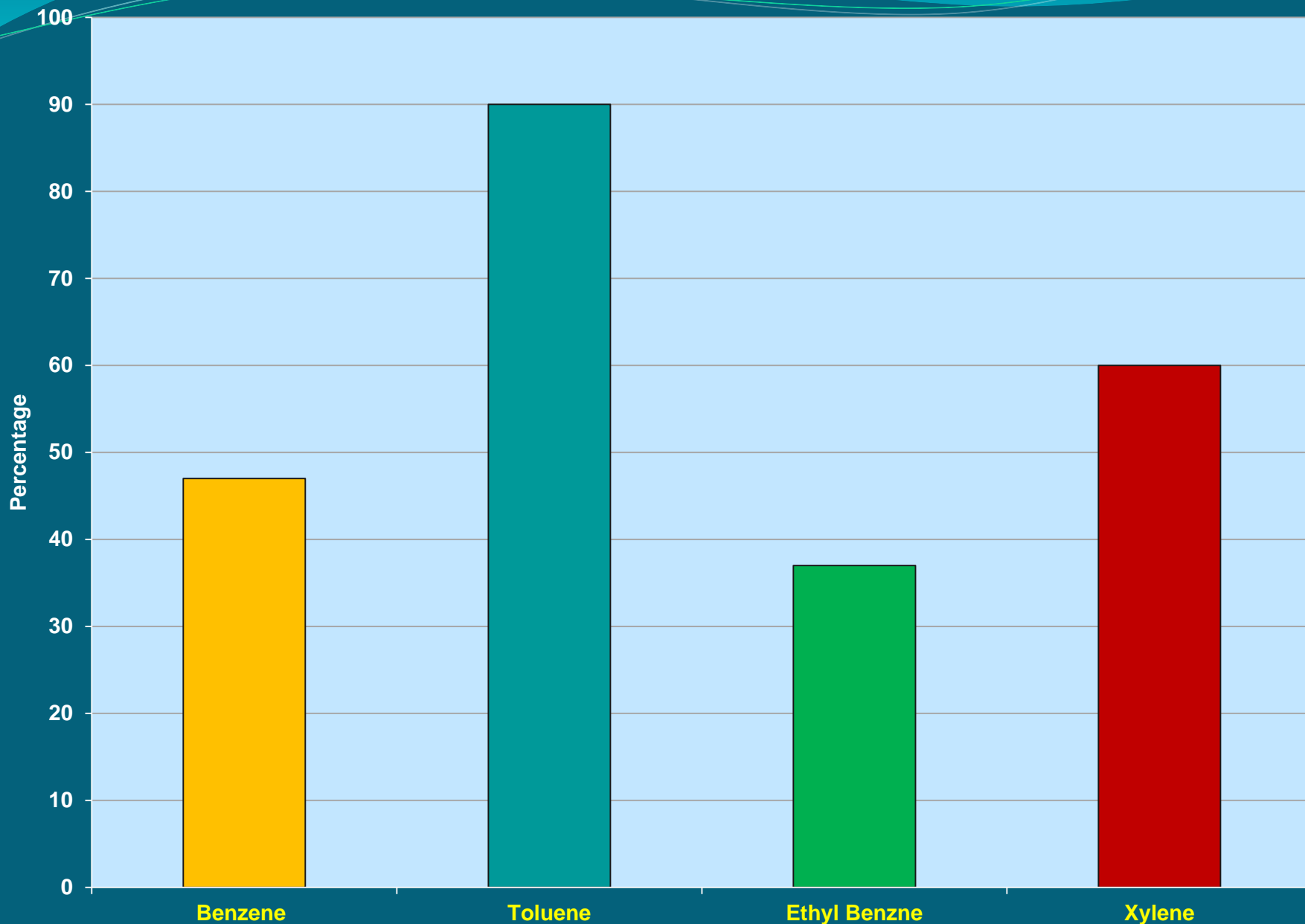
Methods - QA/QC

- Sampler/vials/equip sealed while engine on
- Wait period after engine shut off
- Wear new gloves every site
- Rinse sampler after each sample & clean daily
- Vary sampling order
- Obtain 10% QA/QC samples:
 - Replicates every round – vary location
 - Source Water Blank (USGS NWQL)
 - Field and Sample Blanks (VOC grade)

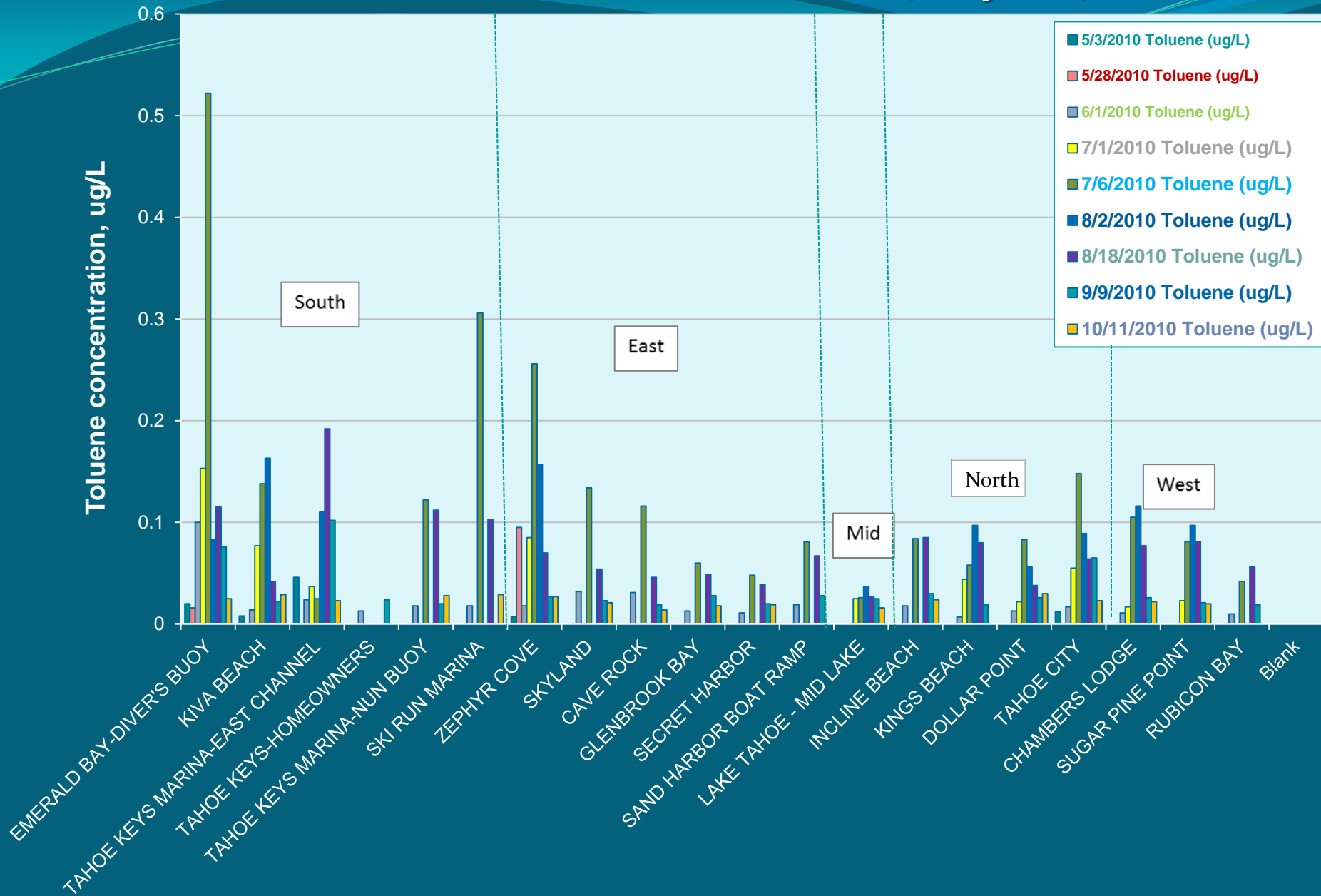
Results:



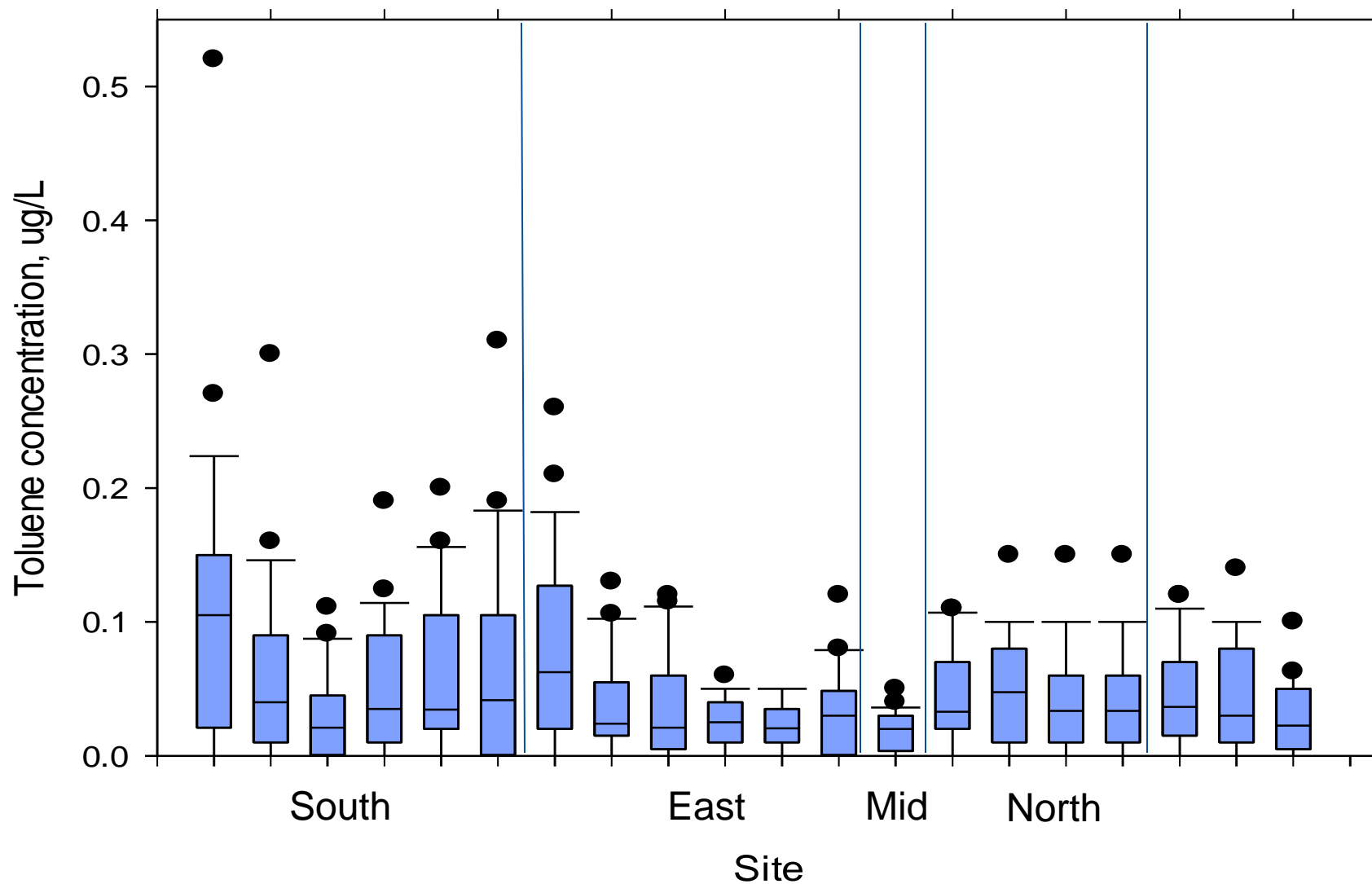
Lake Tahoe BTEX Percent Detections, 2010



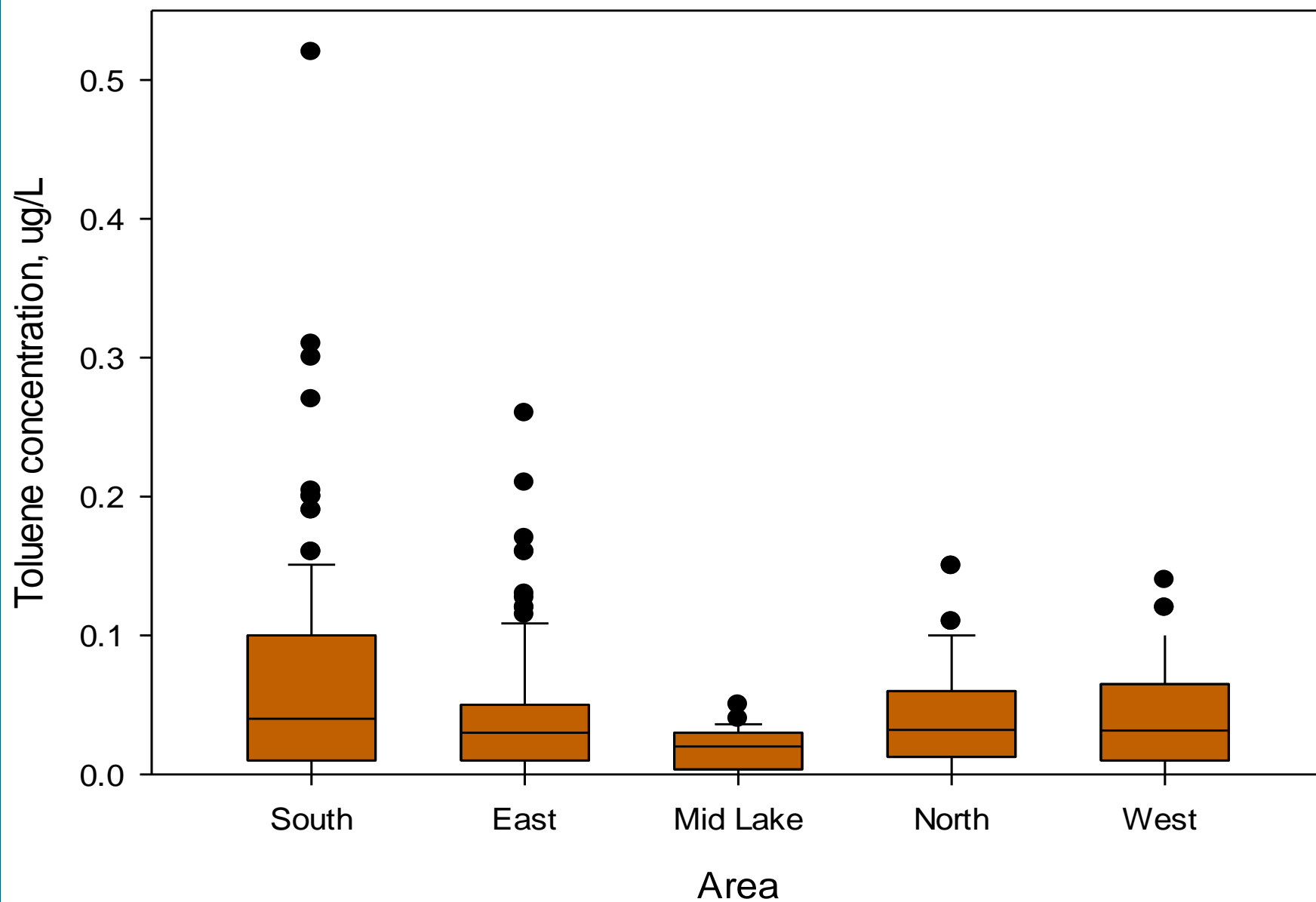
Lake Tahoe Toluene concentrations, May-Oct, 2010



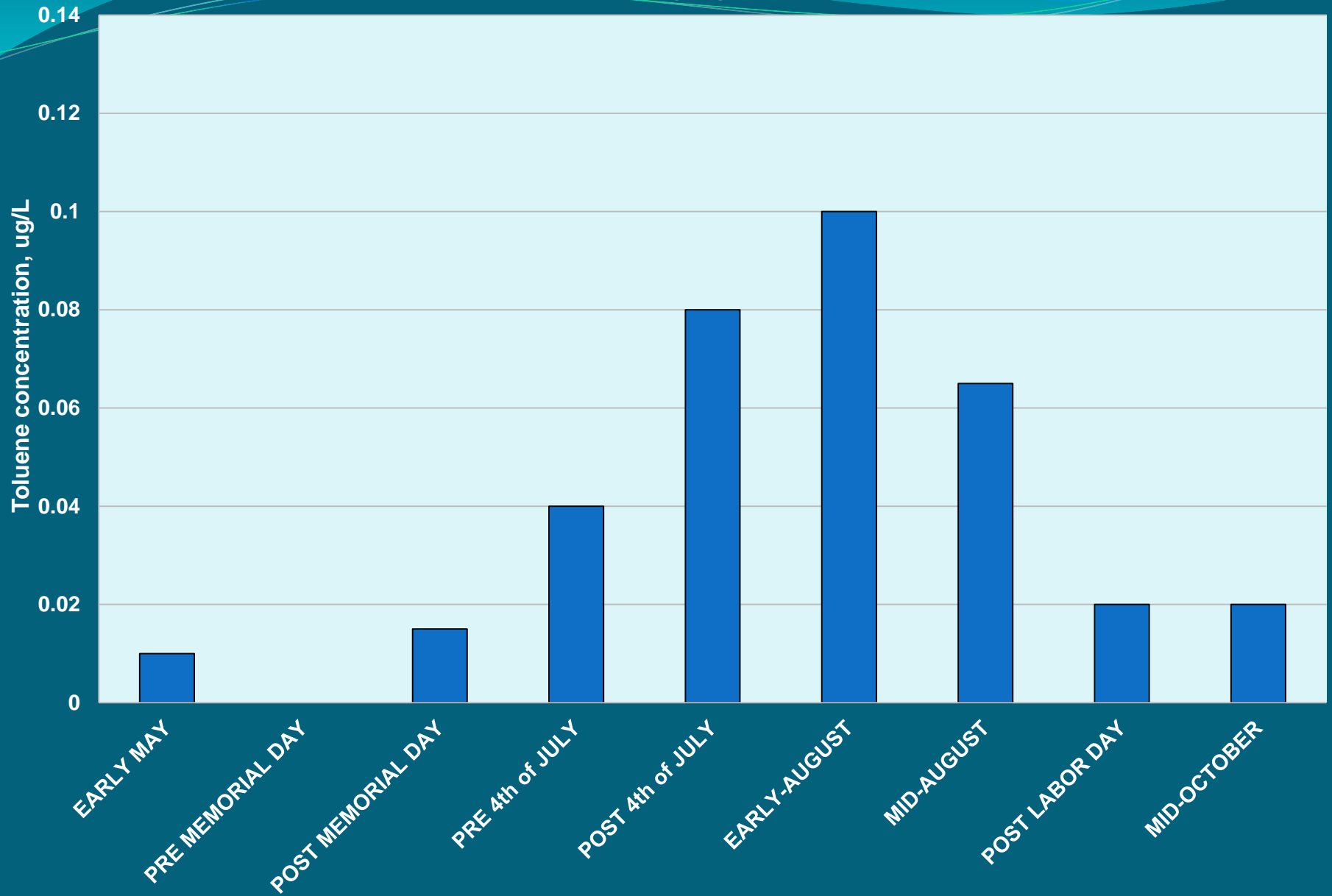
Lake Tahoe Toluene concentrations by site, 2009-11



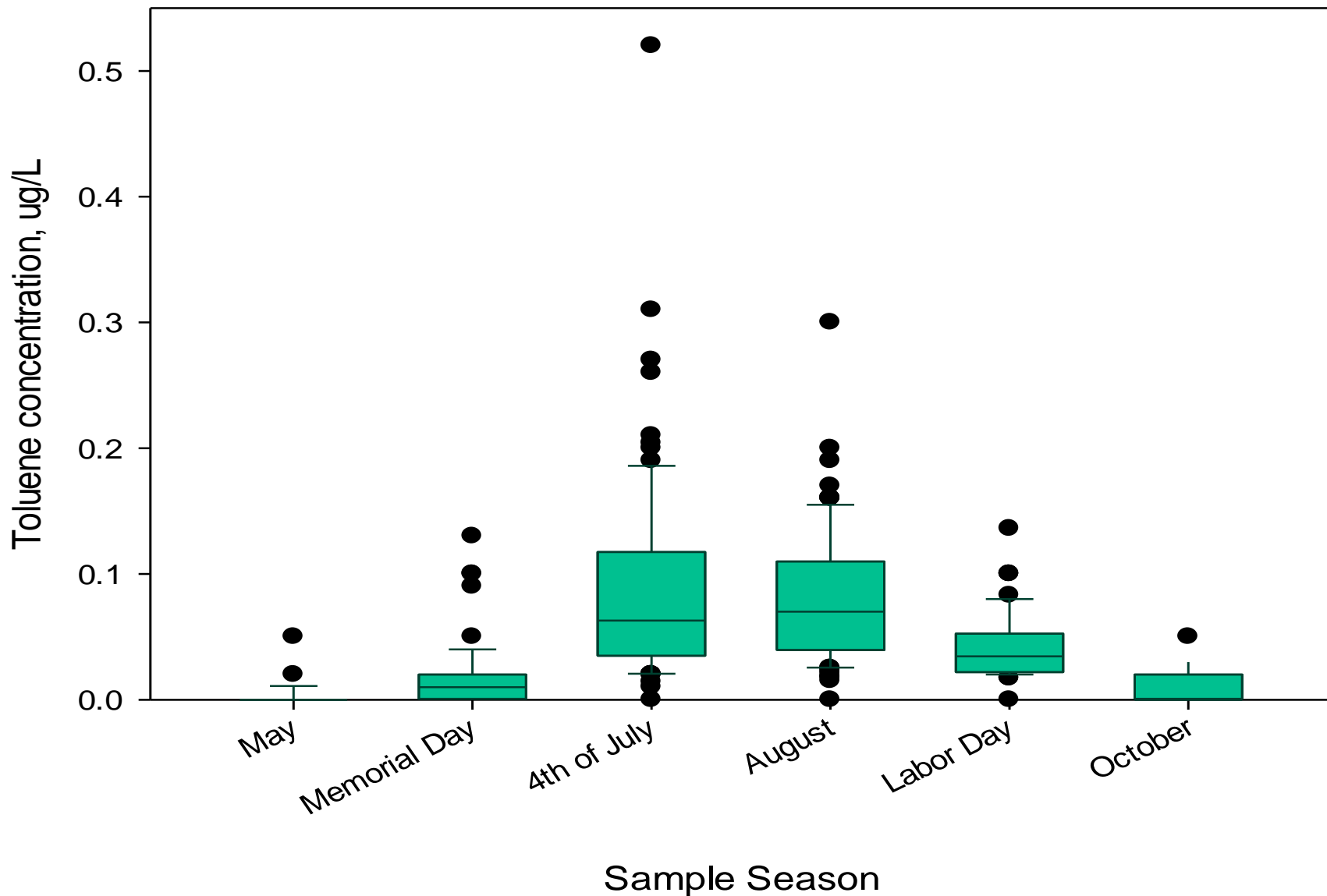
Lake Tahoe Toluene concentration by area, 2009-11



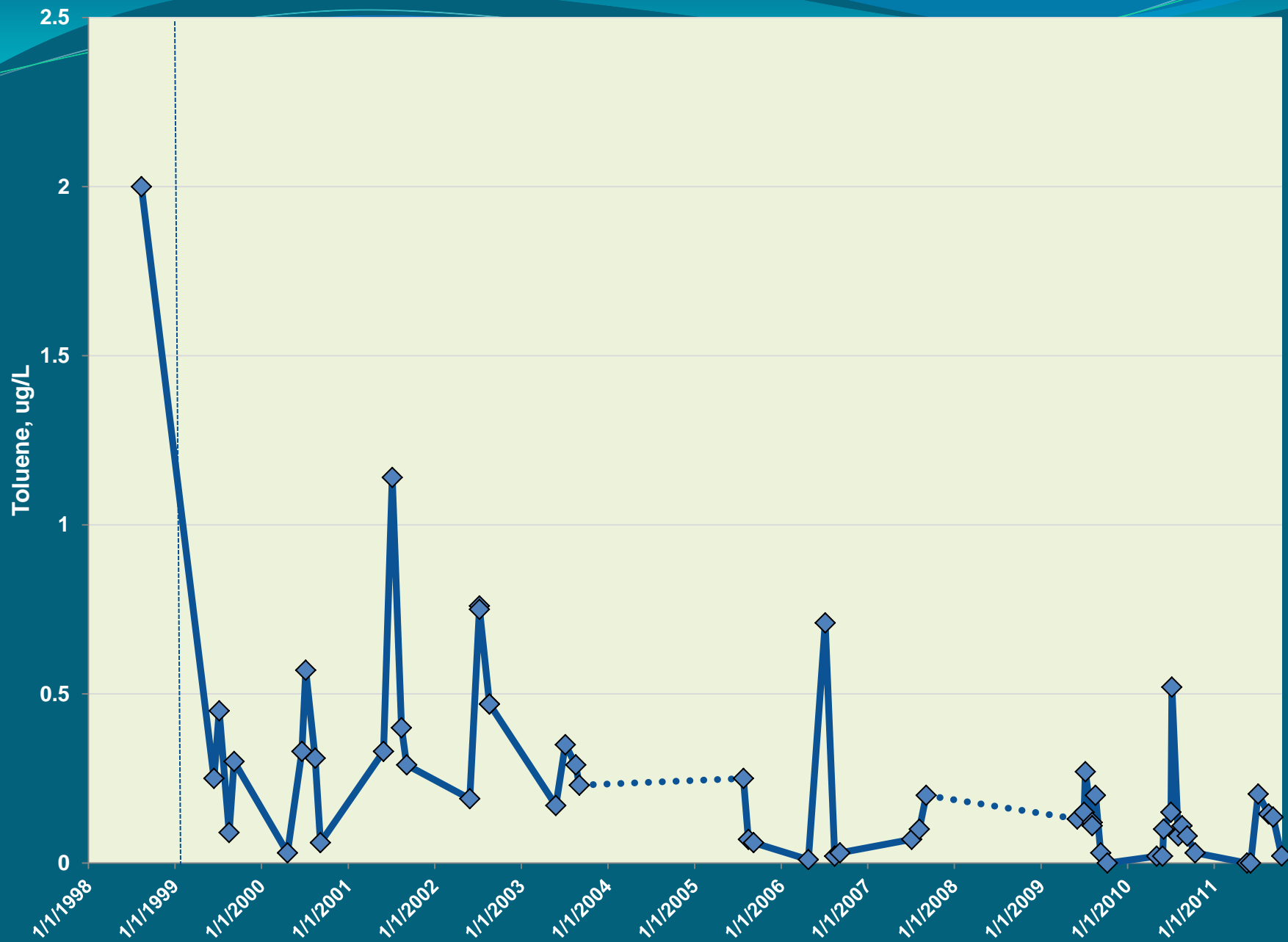
Lake Tahoe Median Toluene Concentration by Period, 2010



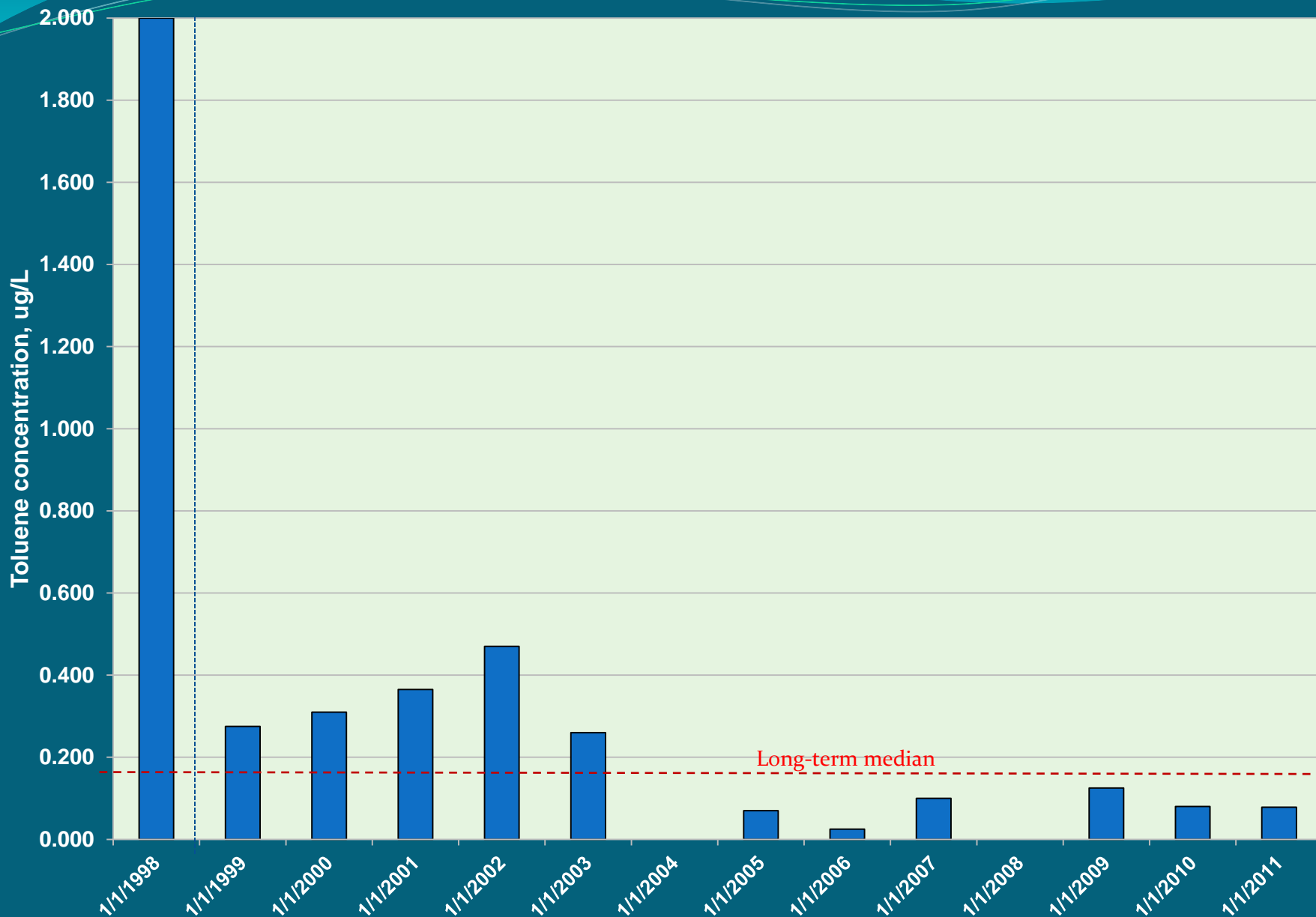
Lake Tahoe Toluene by Sample Season, 2009-11



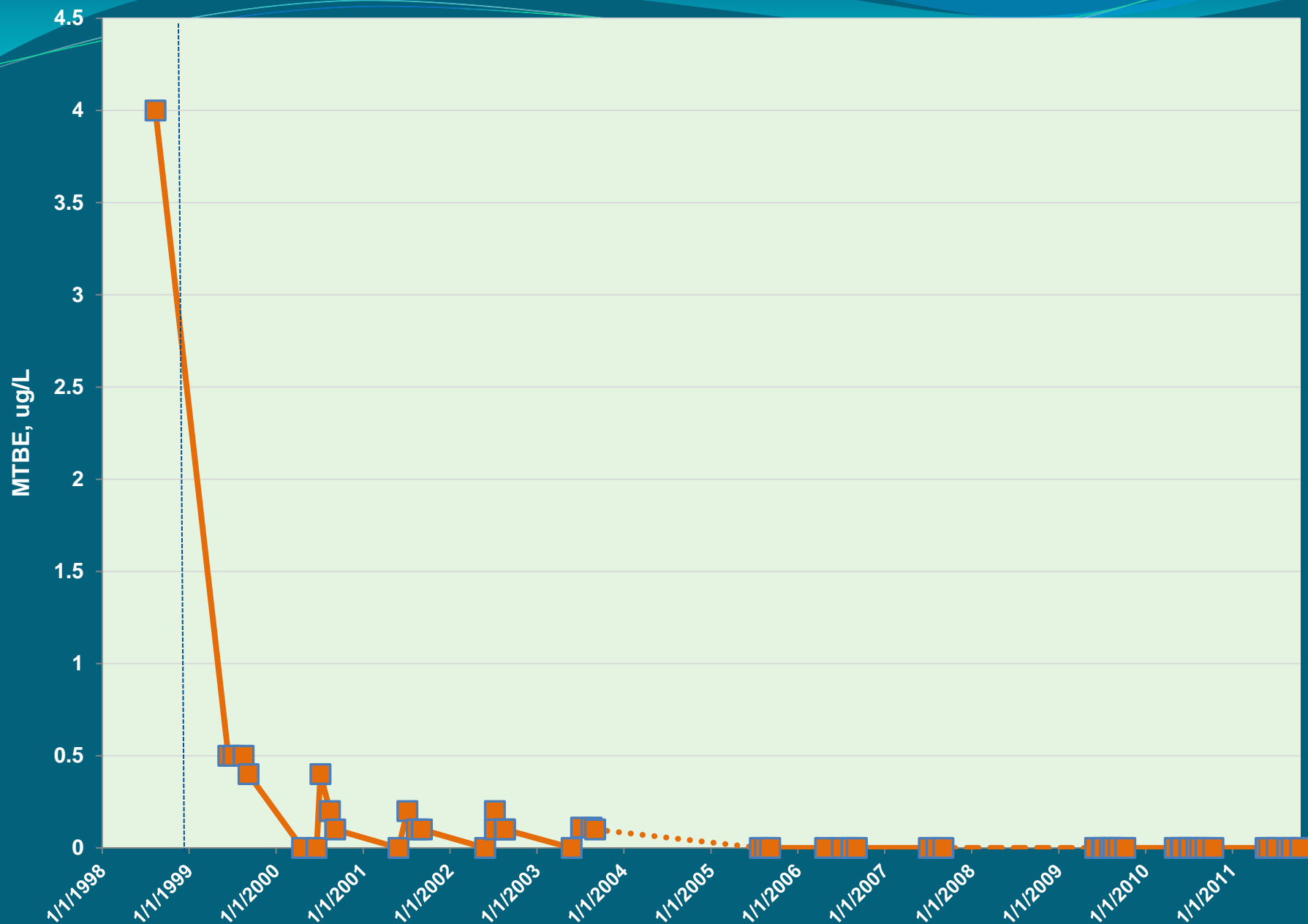
Lake Tahoe Emerald Bay Toluene concentrations, 1998-2011



Lake Tahoe -Emerald Bay Annual Median Toluene concentrations , 1998-2011



Lake Tahoe-Emerald Bay MTBE concentrations, 1998-2011



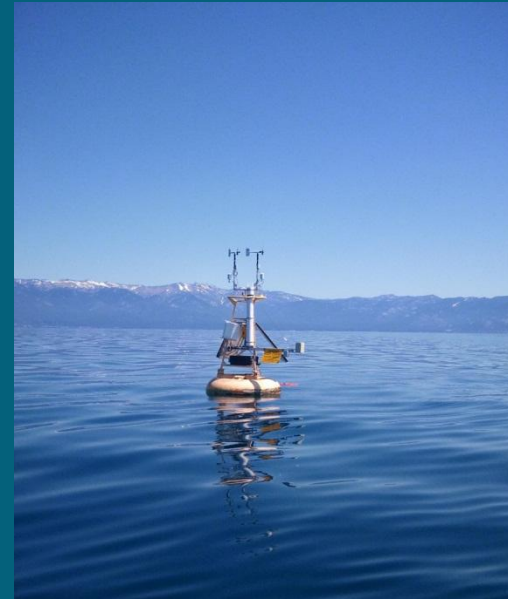
VOC Results:

- **Detections were low** for the most part.
- **VOC constituents detected:** BTEX, MTBE, & acetone. BTEX were detected at all 20 sites
- **Toluene detected in 90%** of the samples & ranged from <0.01 to 0.52 ug/L.
- **MTBE was detected** in only 2 samples and ranged from 0.03 to 0.15 ug/L.



VOC Results (cont):

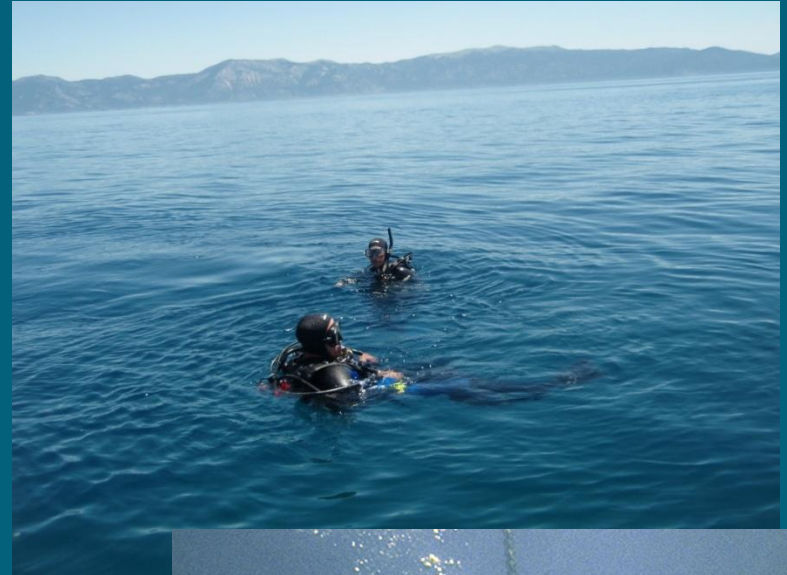
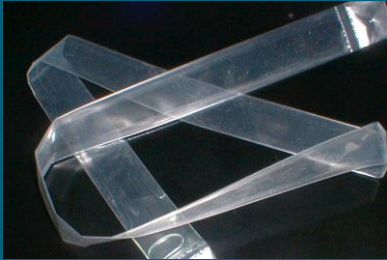
- **South Sites** had highest percentage (78%) of detections, maximum level of detections and highest medians.
- **Reference site; Mid-Lake; low**
- **Higher detections in 4th of July & August sample periods**
- **Lower detections in May & October sample periods**
- **Trends continue downward since 1999**



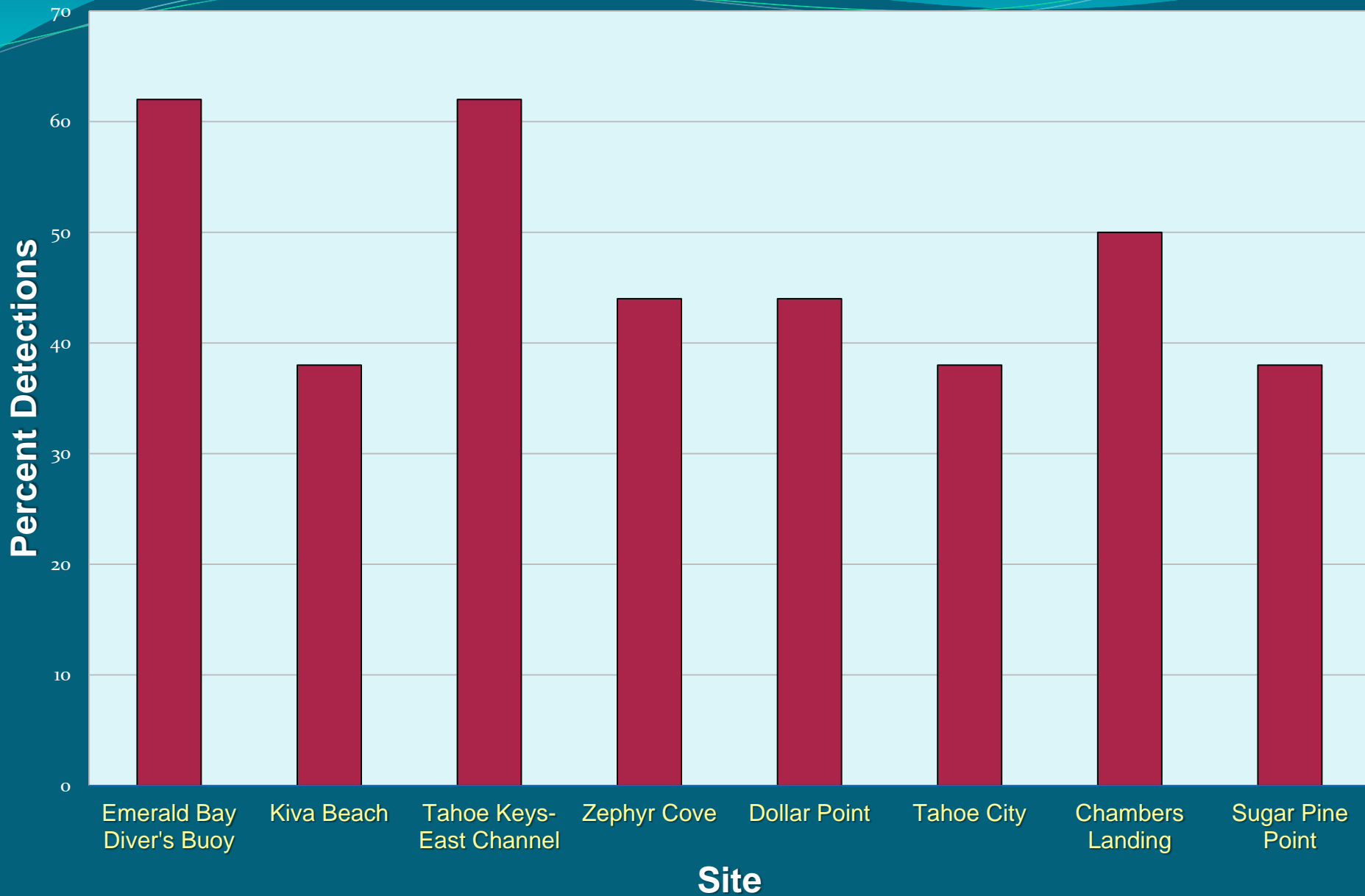
PAHs passively sampled using SPMDs - deployed & secured for ~30 days

SPMD: 3 Polyethylene Layflat Films

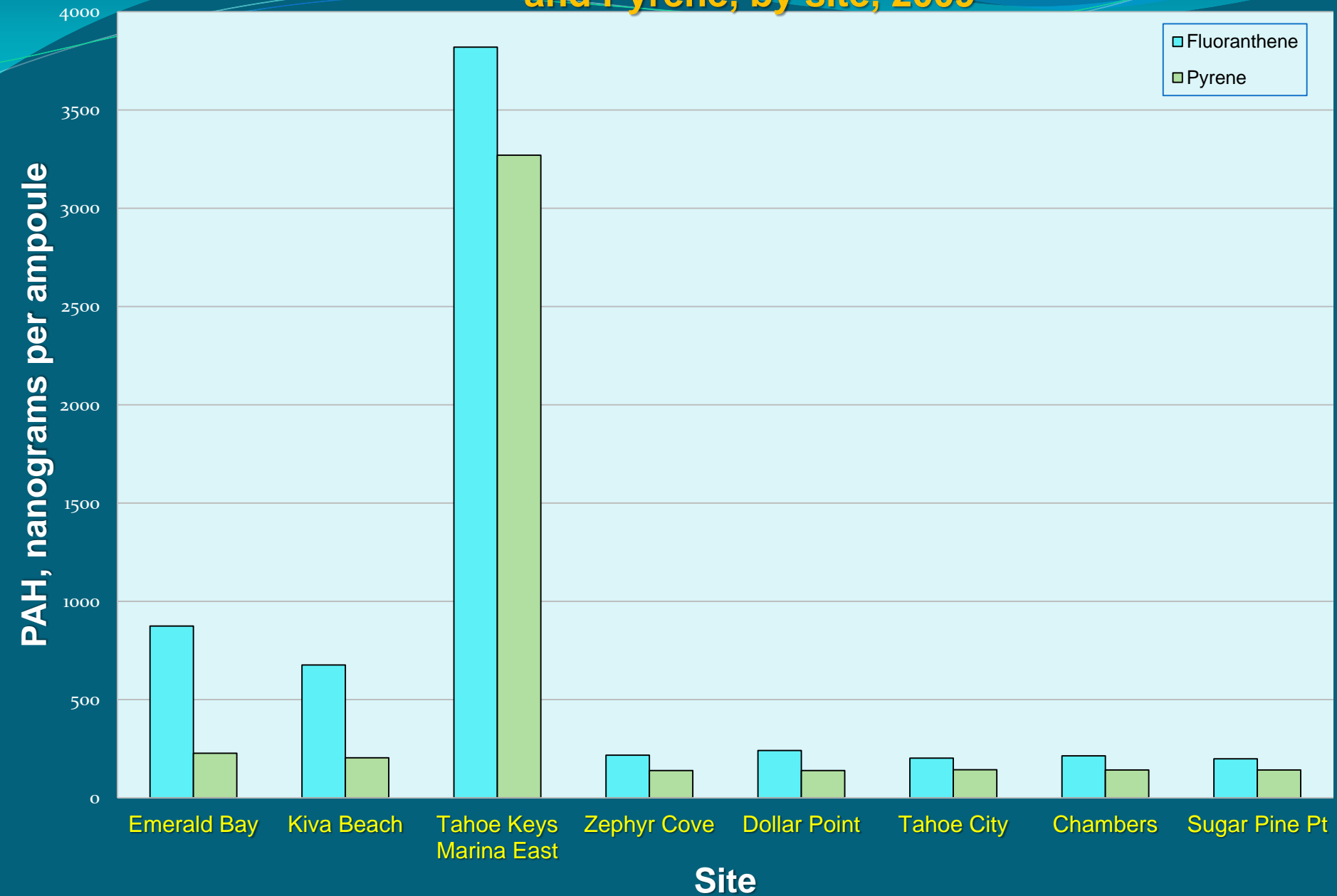
With Lipid
Triolein layer



Lake Tahoe Percent PAH Detections by Sampling Site, 2009

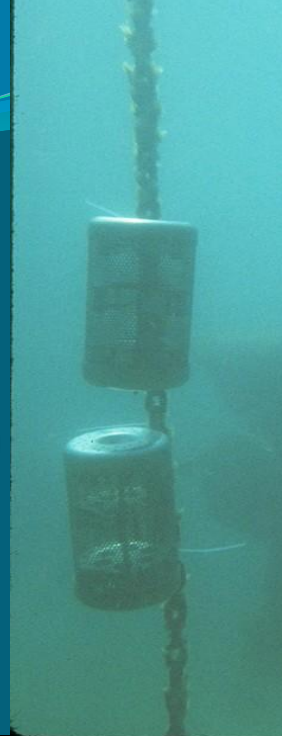


Lake Tahoe Results for Key PAH constituents, Fluoranthene and Pyrene, by site, 2009



SPMD-PAH Results:

- 13 PAH's detected at low levels – highest number of detections for, Acenaphthylene, Fluorene, Fluoranthene, Naphthalene, Phenanthrene & Pyrene
- Highest percent detections were at Tahoe Keys & Emerald Bay
- Fluoranthene & Pyrene were highest, in Tahoe Keys;



Future Plans:

- Sampling on hold for 2012 – due to budget constraints.
- Hope to re-establish cooperative USGS-TRPA base-line data collection network in 2013





Any Questions?