

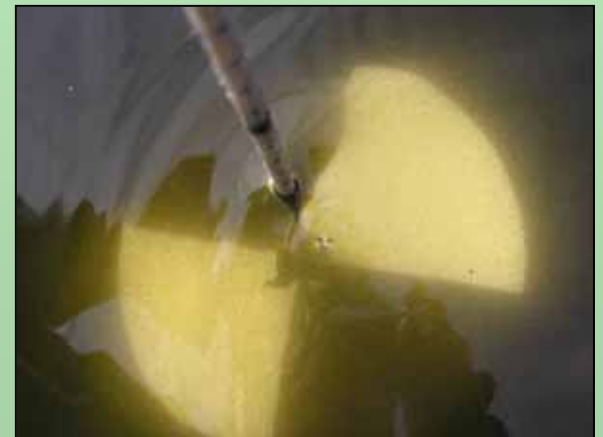
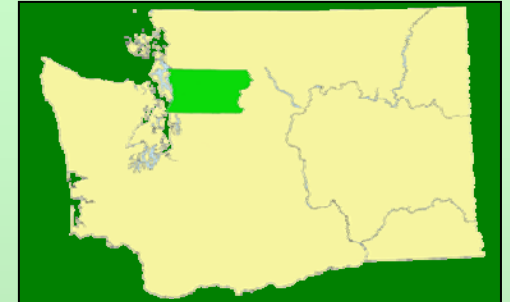
# SCREENING FOR ALGAL TOXINS IN VOLUNTEER-MONITORED LAKES



Gene Williams  
Snohomish County, WA  
2006 NWQMC

# Volunteer Lake Monitoring

- Snohomish County (WA) volunteer monitoring program
- Since 1992; currently 33 lakes
- Track lake health through:
  - water clarity
  - dissolved oxygen/  
temperature profiles
  - total phosphorus
  - chlorophyll *a*



# Blue-green Algal Blooms



- Occur regularly
- Usually in summer, but possible at any time



# Cyanophyta

## (Cyanobacteria or Blue–Green)

- Prokaryotes – bacteria
- Photosynthetic
- Fix-nitrogen
- Regulate buoyancy
- Form nuisance blooms
- Can produce toxins



# Toxic Blue-green Blooms

- Not all blooms are blue-greens; not all blue-green blooms are toxic
- Most toxic blooms occur in eutrophic lakes; but toxins may occur in any lake
- Mostly affect pets and livestock, but one human death in Wisconsin may be linked
- Signs of toxic blooms--  
dead fish; sick or dead pets; skin rashes

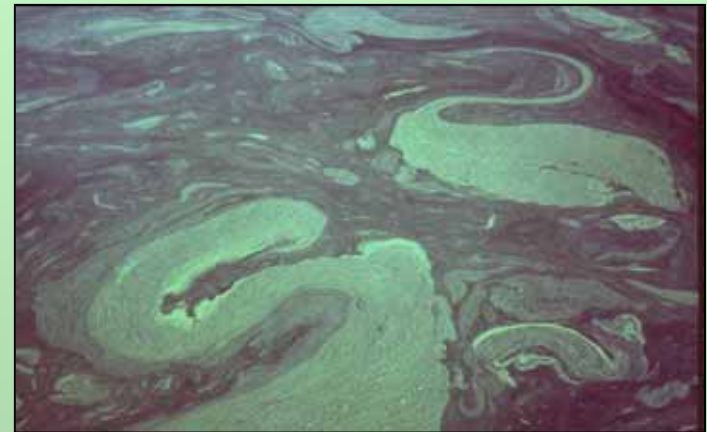


# Blue-green Algal Toxins

- Scientists uncertain what mechanisms or conditions trigger toxic blooms
- Toxins released from algal cells when bloom decomposes, algae are ingested, or algaecides break open cells
- Testing is the only way to identify toxic blooms, but definitive tests are expensive
- Level of concern is unclear  
(World Health Organization guideline—  
1 ppb for drinking water)

# Blue-green Algal Toxins

- Liver toxins (hepatotoxins), such as microcystin, are most common
  - Acute effects include vomiting, diarrhea, or death in a few days
  - Chronic effects include liver tumors
- Neurotoxins
  - Symptoms include weakness, convulsions, suffocation or death in a few hours



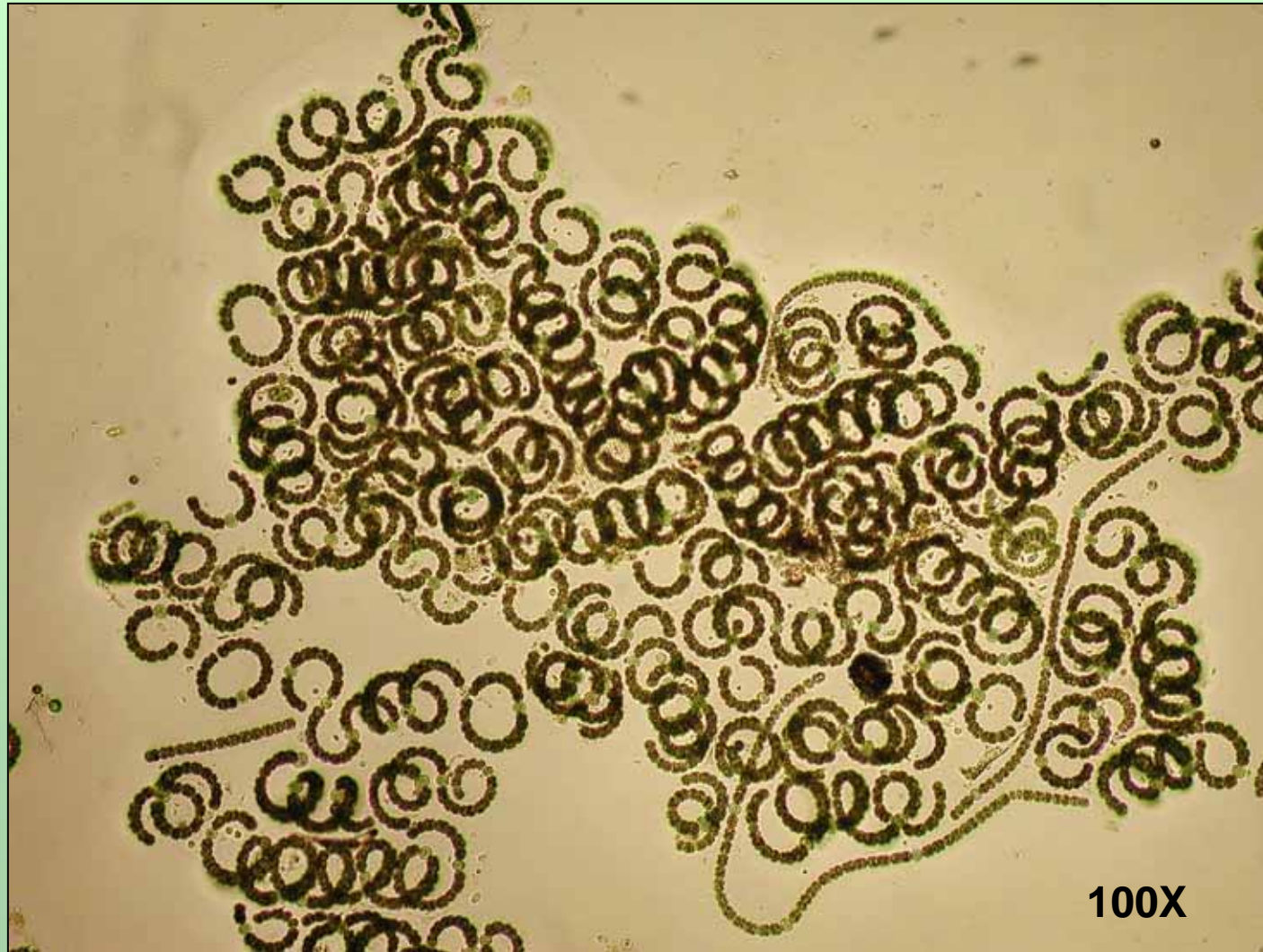
# Concerns about Toxic Algae in Snohomish County

- Growing reports in WA, U.S., world-wide
- Only one known episode locally (2000)
- Level of risk in Snohomish County or in any specific lake unknown
- Many lake residents withdraw lake water
- Animals and children may be at risk
- Desire to monitor if possible

# Focus on Annie, Fannie, & Mike

- Three genera of blue-greens are responsible for most blooms in Snohomish County:
  - *Anabena*
  - *Aphanizomenon*
  - *Microcystis*

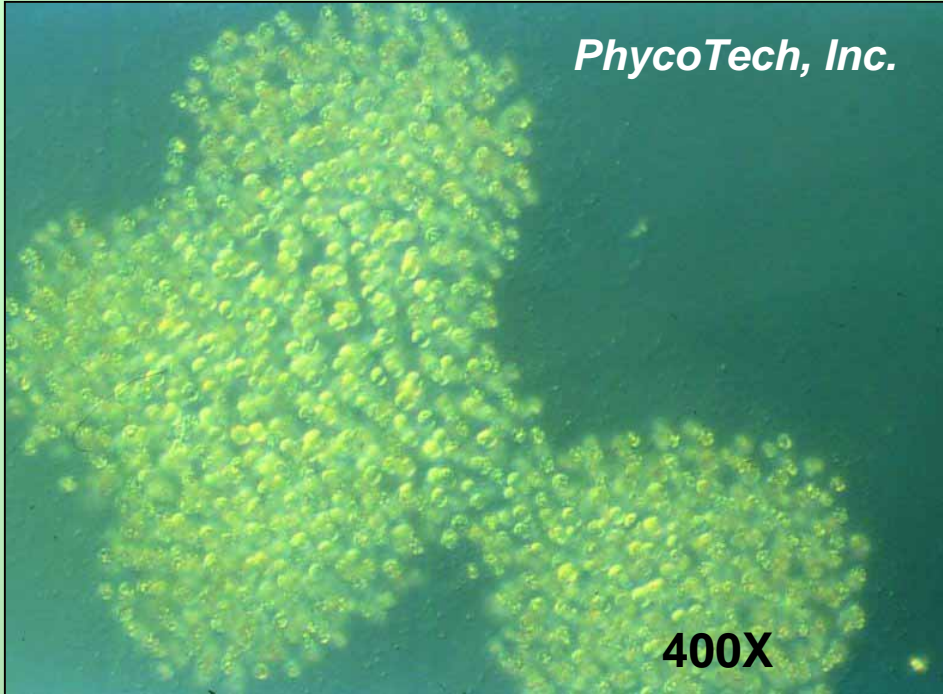
# *Anabena*



# *Aphanizomenon*

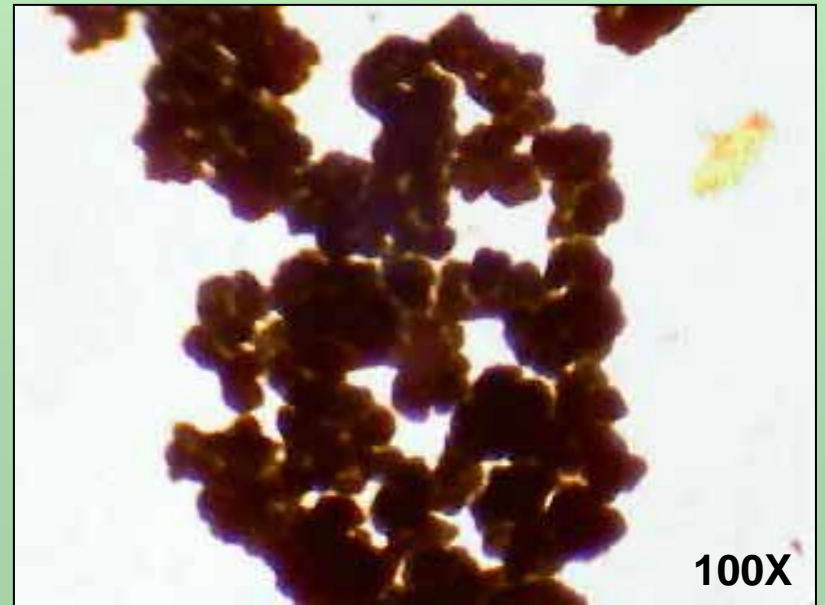


*PhycoTech, Inc.*



400X

# *Microcystis*



100X

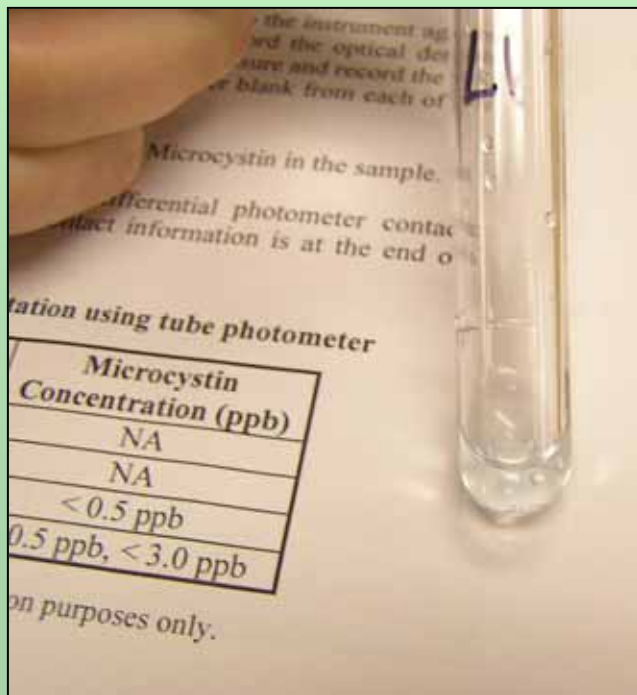
# 2005 Toxic Algae Screening

Goal—to identify potential toxic blooms

1. Volunteers collected samples monthly and whenever blooms observed
2. County staff examined samples to identify dominance by Annie, Fannie, or Mike



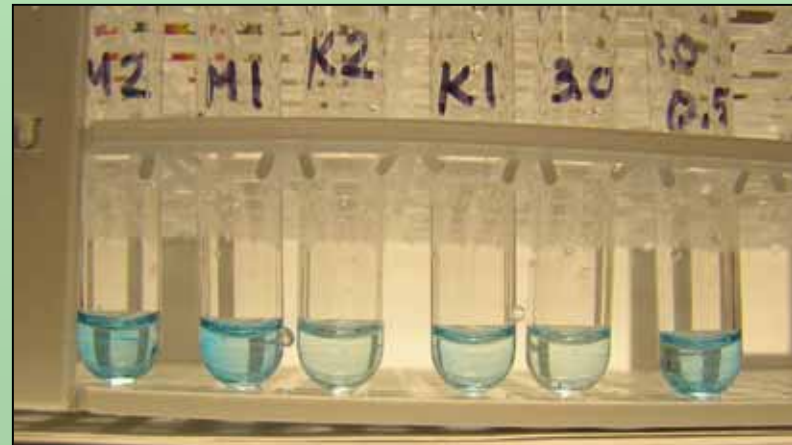
3. County staff collected new samples for analysis
4. Testing performed using EnviroLogix QuickTube™ Microcystin kits (ELISA)



5. Follow-up with Health District

# QuickTube™ Microcystin Kits

- Detect microcystin variants (hepatotoxin)
- Results semi-quantitative
- Standards for 0.5 ppb and 3.0 ppb
- Results read visually (color intensity) as <math><0.5\text{ ppb}</math>, 0.5 to 3.0 ppb, or > 3.0 ppb
- Samples can be diluted to extend range
- Do not detect other algal toxins

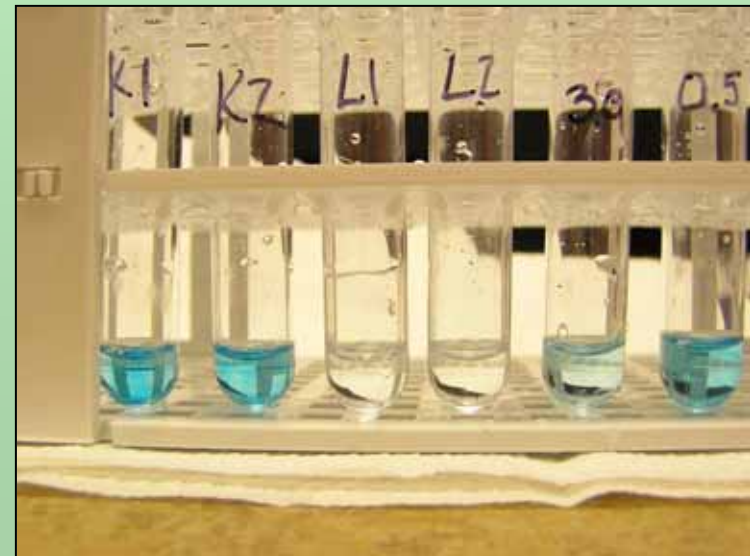


# Results from 2005 Monitoring

- Screened approximately 130 samples for blue-green algae
- Identified 13 lake samples showing Annie/Fannie/Mike dominance
- Testing revealed:
  - one lake with microcystin >3.0 ppb
  - two lakes with microcystin concentrations between 0.5 and 3.0 ppb

# Lake Loma Toxic Bloom

- Microcystin level substantially  $>3.0$  ppb
- *Microcystis aeruginosa* and *Aphanizomenon flos-aquae* dominant
- Secchi depth—1.0 m; chlorophyll *a*— $29 \mu\text{g/l}$ ; total phosphorus— $60 \mu\text{g/l}$
- No scum present



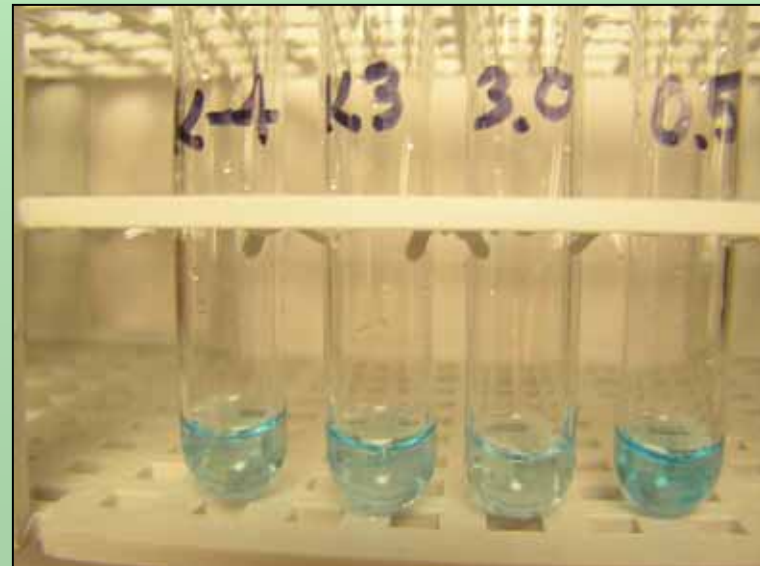
# Follow-up for Lake Loma

- County Health District posted the lake and distributed notices to all properties
- Significant media and public interest
- Lake re-tested 3 times; toxin concentrations fell to  $<0.5$  ppb in two weeks



# Follow-up for Other Lakes

- Lake Ketchum and Lake Cassidy (0.5 to 3.0 ppb)
  - Health District chose to take no action pending re-tests because unclear if toxin levels exceeded W.H.O. guideline (1.0 ppb)



# Conclusions from 2005

- Algal toxins are present in some Snohomish County lakes, even when scums are not apparent
- Screening with follow-up testing was effective as reconnaissance tool
- Close coordination with Health District is essential
- Convey clear, calm message—avoid water with scum (especially kids and pets); be cautious using lake water; be observant

- Continued public education necessary
- Lake residents encouraged to reduce nutrient sources as the best way to control algal blooms, including toxic blooms



# 2006 Plans

- Continue screening project as part of volunteer monitoring program
- Use photometer to more accurately distinguish color ranges; and/or use new EnviroLogix QuantiTube™ kits for quantitative results
- Confirm results with lab tests as needed

# Acknowledgements

- Volunteer lake monitors
- Snohomish Health District
- Heidi Reynolds, Snohomish County SWM
- Harry Gibbons, Tetra Tech, Inc.
- John Chamberlain, EnviroLogix
- Shawn Ultican, Kitsap County