



# **Algae Blooms in Ontario's Lakes:**

## **Analyzing the trends**

**Jenny Winter,**

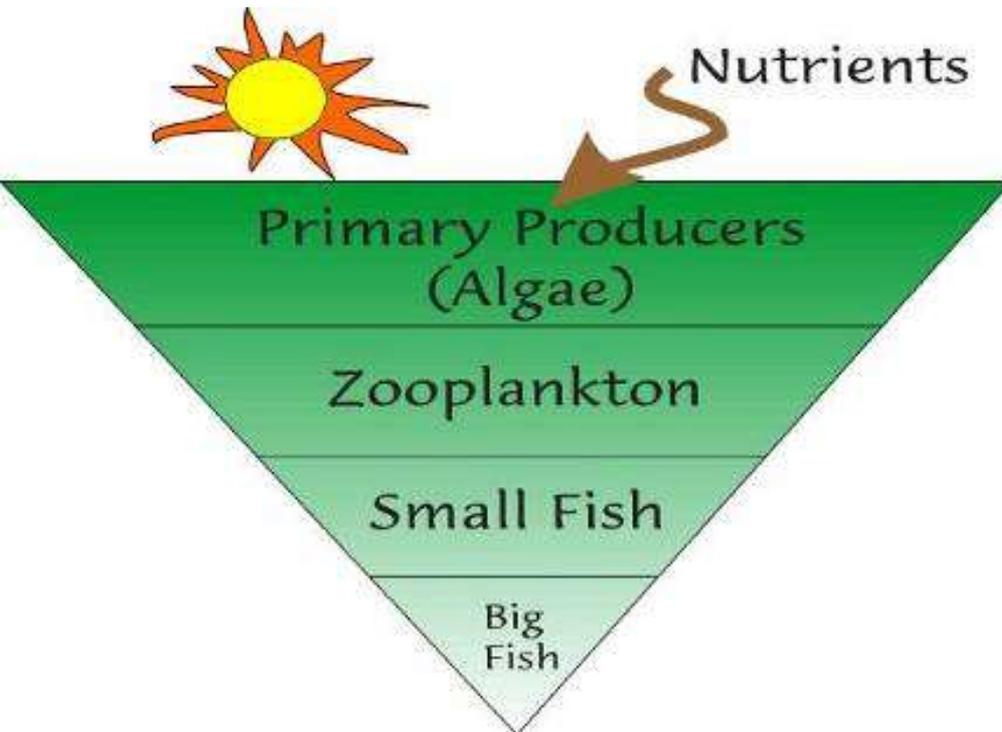
Ministry of the Environment

# What are Algae?

- Small, mostly microscopic plants
- Live in virtually all water bodies
- Free floating, some attached to rocks, lake bottom, etc.
- Thousands of species
- Many different habitats and habits
- Similar to other terrestrial plants in that they require nutrients and light and they grow better when it is warm



# What are Algae?



- Algae are an important part of lake food webs
- Necessary part of ecosystem integrity
- Influence our atmosphere by producing oxygen and converting carbon into organic compounds

# Algal Blooms



- A “bloom” is the excessive growth of one or more species of algae (including cyanobacteria)
- Blooms can...
  - Impact the appearance of water, result in unpleasant tastes or odours, reduce water clarity, colour the lake a vivid green, brown, yellow, or red, deplete oxygen levels, may produce toxins (cyanobacteria)
- Less likely to occur in deep lakes with lower total phosphorus (TP)
- Most occur in shallow lakes or bays with moderate to high amounts of total phosphorus

# Algal Blooms

## Filamentous Green Algae

- do not produce toxins
- e.g., *Cladophora*, *Spirogyra*, *Zygnema*, *Mougeotia*



## Golden algae (chrysophytes)

- found in low nutrient lakes
- becoming a dominant member of the algal community in lakes throughout Ontario
- cause taste and odour in water



# Blue-green algae (cyanobacteria)

- Have inhabited the earth for over 2 billion years
- Are a type of photosynthetic bacteria (the term algae is applied because of their ecology)
- Inhabit a wide variety of environments
- Under favourable conditions can rapidly reproduce to form a bloom



# Blue-green algae that bloom in Ontario lakes

*Anabaena*



*Aphanizomenon*



*Microcystis*



*Oscillatoriales*



- *Oscillatoria*,  
*Planktothrix*

*Gloeotrichia*



# Blue-green algae (cyanobacteria)



- Toxins which are formed at all stages of the organisms' growth are released to the surrounding water upon the cell death.
- Toxins can affect the health of humans, livestock and household pets.
- Although there are relatively few reports of human illness, these toxins can induce symptoms such as fever, diarrhea, abdominal pain, nausea and vomiting.
- External contact during recreational activities, such as swimming, boating or water skiing is more common and may result in itchy, irritated eyes and skin.

# Blue-green algae (cyanobacteria)

Bloom forming conditions include:

- sufficiently high levels of nutrients (water or sediments)
- calm weather
- strong sunlight
- high air and water temperatures
- relatively shallow water.



These conditions usually occur from mid summer into fall.

# Climate change and algal blooms

**“Nutrient overenrichment... has promoted the growth of cyanobacteria... Climate Change is a potent catalyst for further expansion of these blooms”**

**Paerl & Huisman (2008) Blooms like it hot. *Science*. 320 (5872): 57-58.**



# Algal bloom response

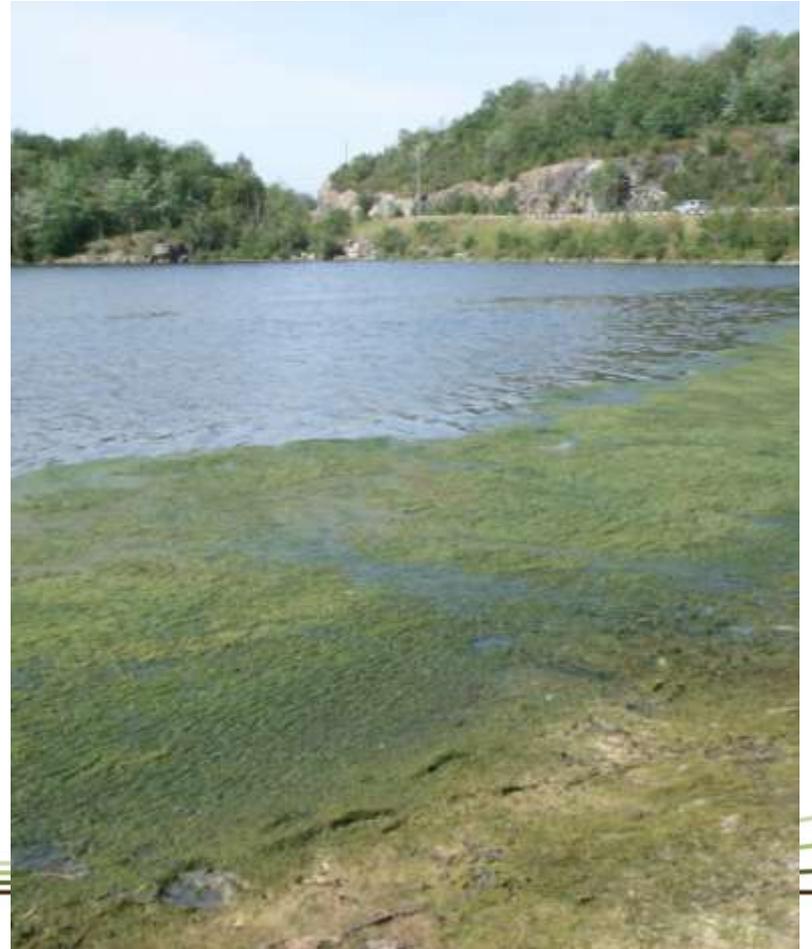
## MOE Response Reference Guide

- Ensures communication and collaboration among the various stakeholders
- MOE role is to gather, assess and provide basic scientific & technical information with which the Health Unit can assess risks to humans
- Health Unit makes decisions as to what actions should be taken

Ministry of the Environment Ontario		Reference Guide for Operations Division Staff Responding to Reports of Cyanobacterial (Blue-Green Algal) Blooms	June 2007
<b>Lead Branch / Region</b> Eastern Region, Operations Division			
<b>Description of Purpose of Reference Guide</b> The Reference Guide is for use by Operations Division staff responding to reports of blue-green algal blooms, and is to be read in conjunction with Drinking Water Management Division's Cyanobacteria (Blue-Green Algae) Incident Response – Program Delivery Communications Protocol (June 2005). The Guide provides an overview of the roles and responsibilities of the Ministry's Operations, Drinking Water Management and Environmental Sciences and Standards Divisions, and the Health Units.			
<b>TABLE OF CONTENTS</b>			
1.0 Purpose	.....	3	
2.0 Scope	.....	3	
3.0 Background	.....	3	
4.0 Response Priority Setting	.....	4	
<b>ROLES &amp; RESPONSIBILITIES</b>			
5.0 OPERATIONS DIVISION	.....	5	
5.1 District Office	.....	5	
5.1.1 Incident Report and Initial Evaluation	.....	6	
5.1.2 Preliminary Notifications	.....	6	
5.1.3 Field Investigation	.....	6	
5.1.4 Notification of Results	.....	6	
5.1.5 Collaboration and Monitoring	.....	7	
5.1.6 IDS Documentation and Termination of Incident	.....	7	
5.1.7 Issues Management, Communications Plan & Briefing Material	.....	7	
5.2 Regional Technical Support Section	.....	8	
5.2.1 Field Investigations, and Collaborations & Monitoring	.....	8	
5.2.2 IDS Documentation	.....	8	
5.3 Spill Action Center (SAC)	.....	8	
5.3.1 Incident Report Intake	.....	8	
5.3.2 IDS Documentation	.....	8	
6.0 DRINKING WATER MANAGEMENT DIVISION	.....	8	
Monitoring Ministry-Regulated Drinking Water Facilities	.....	8	
6.1 SDWB	.....	8	

Reference Guide for Operations Division Staff Responding to Reports of Cyanobacterial (Blue-Green Algal) Blooms 1 of 10

# Filamentous green algae:



# Chrysophyte (golden algae) blooms



# Cyanobacteria



# Cyanobacteria



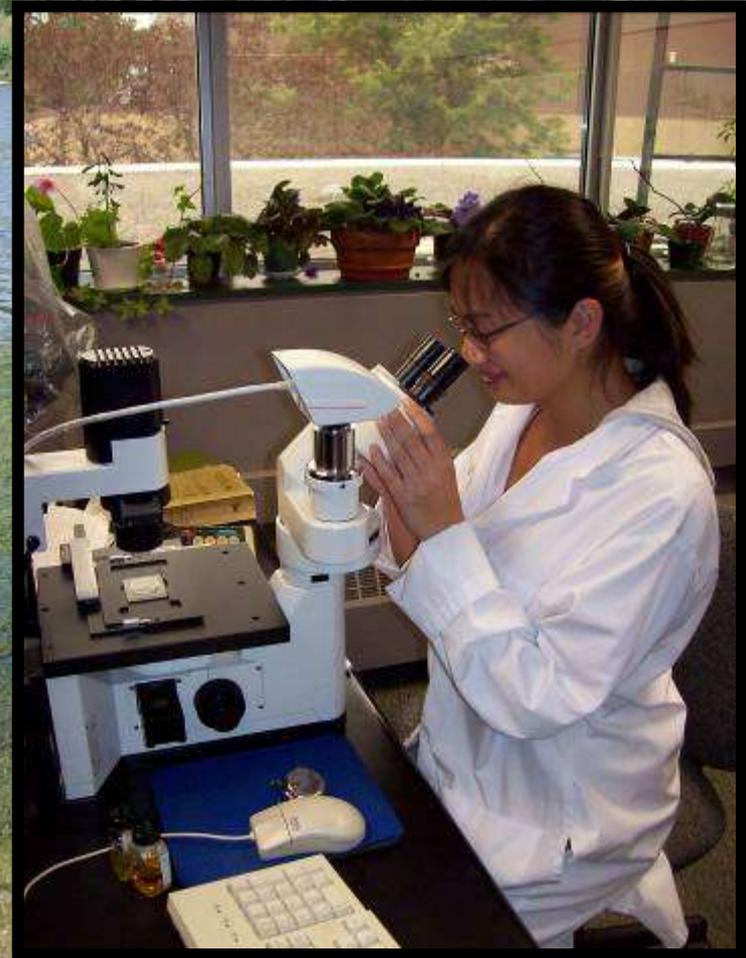
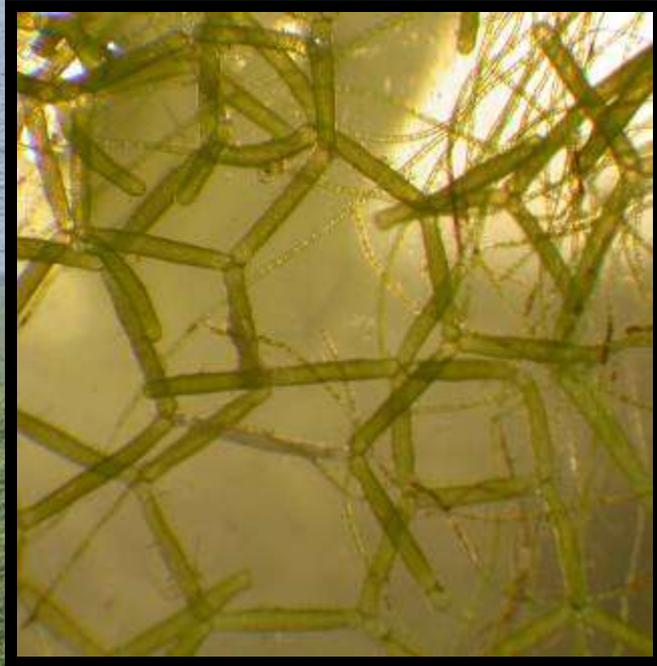
# Cyanobacteria



# Cyanobacteria



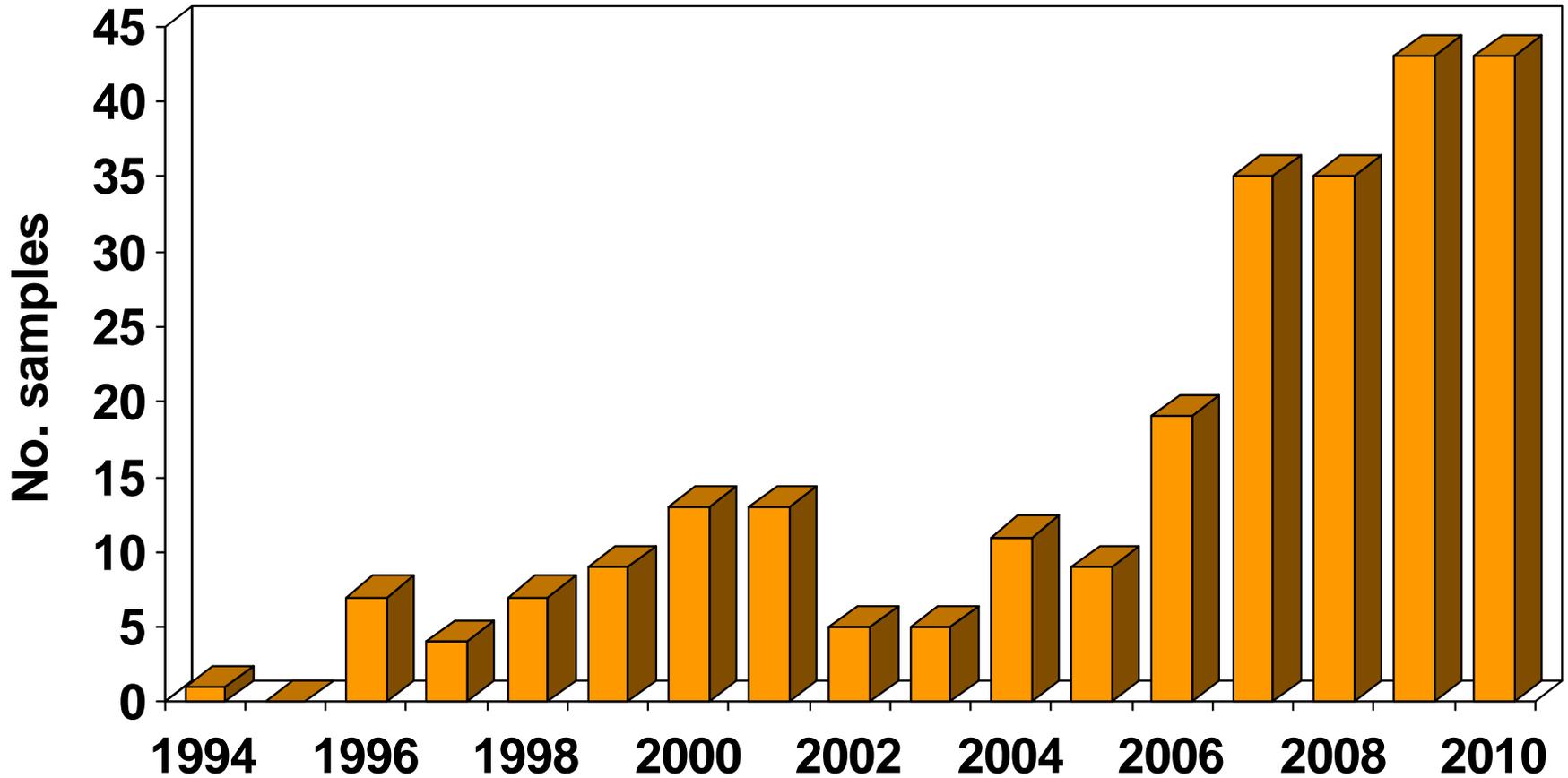
# Algal bloom identification service



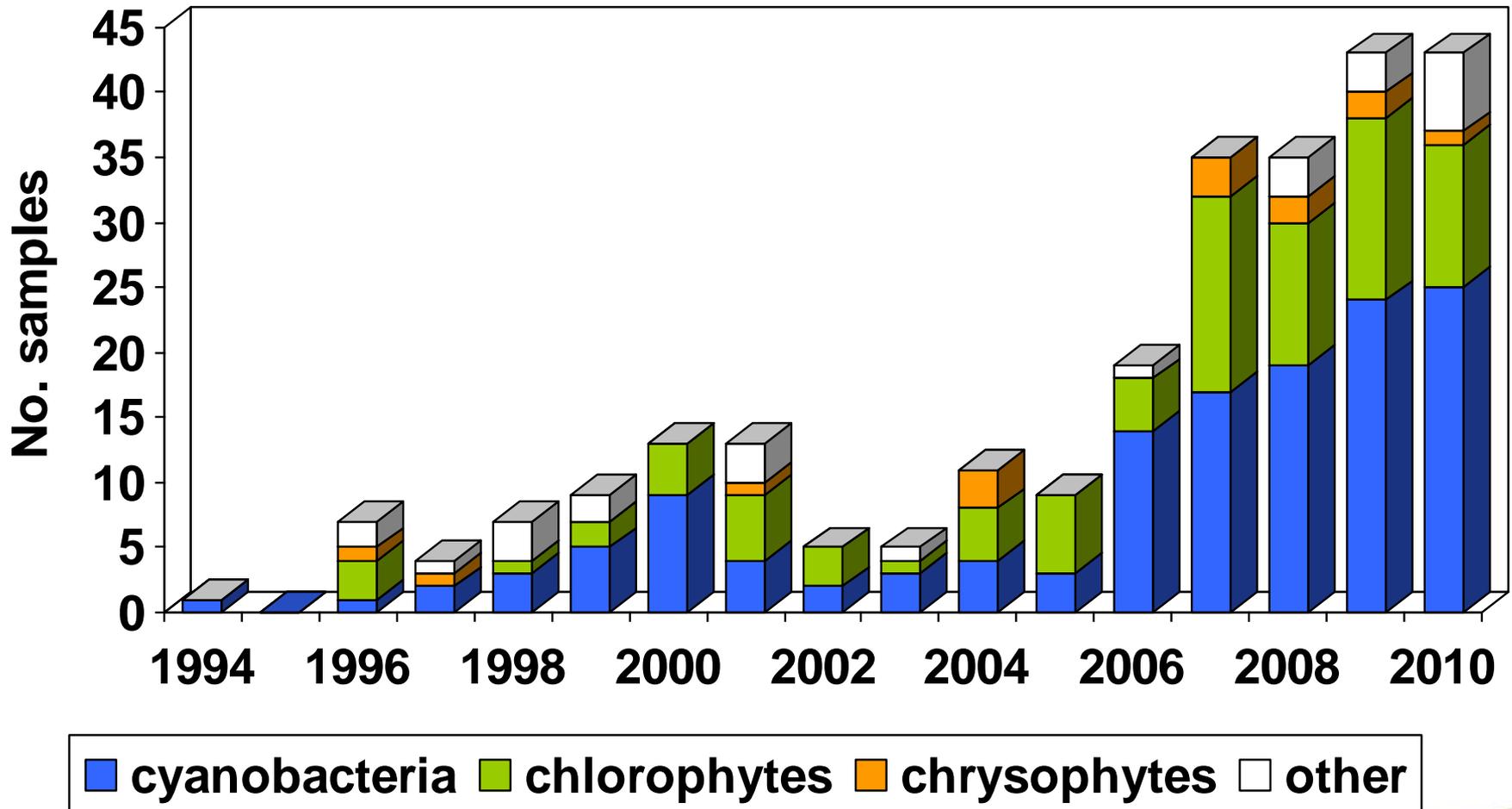
## Questions asked in algal bloom report analysis:

- 1) Is the frequency of bloom reports in Ontario lakes increasing?
- 2) Is the frequency of cyanobacterial bloom reports in particular increasing?
- 3) What MOE regions are the bloom reports coming from?
- 4) Is the timing of bloom reports changing?

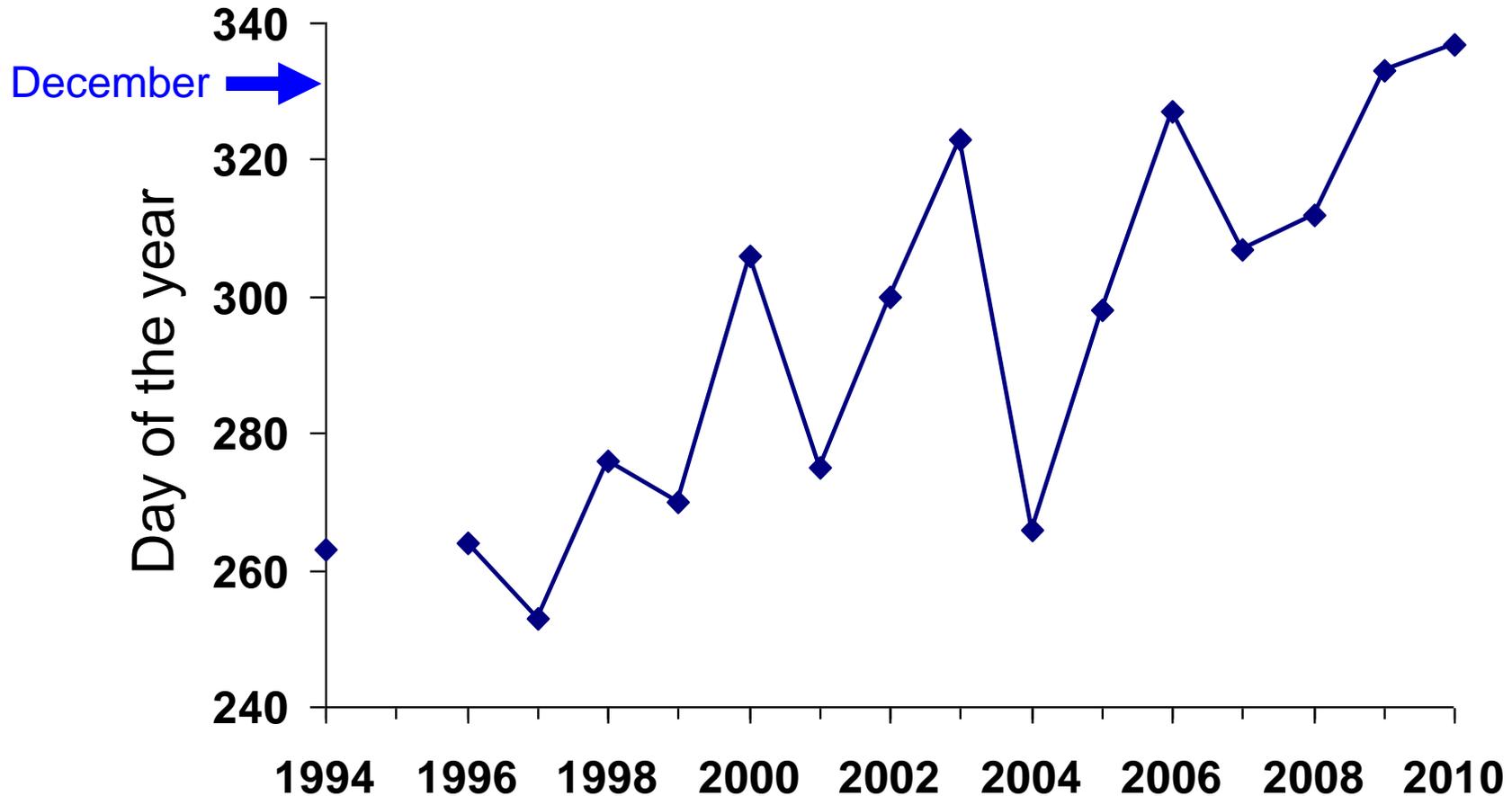
# Number of algal bloom reports / year (1994 to 2010)



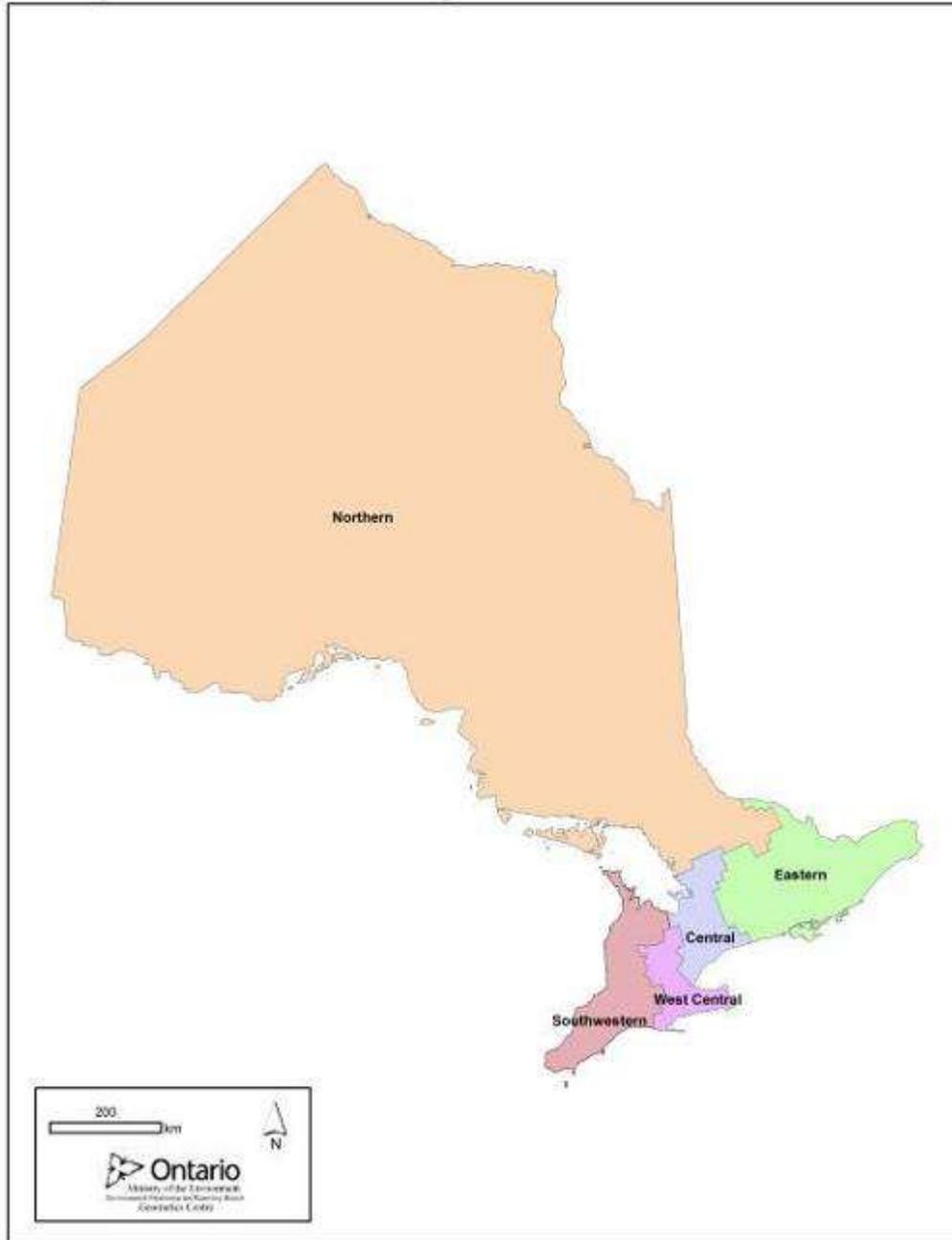
# Number of unique algal bloom reports / year (1994 to 2010) broken down by the dominant algal type



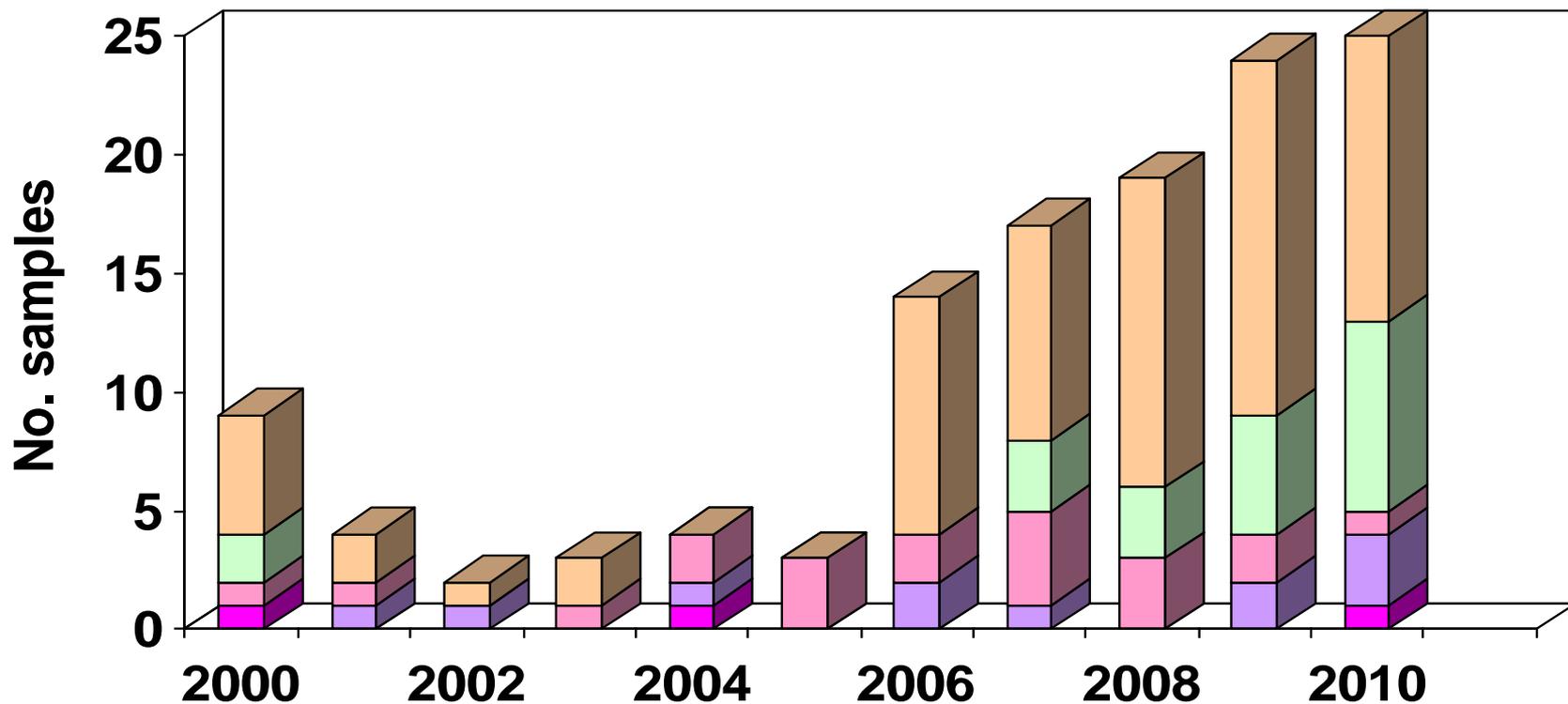
# The last day of the year that bloom samples were submitted from 1994 to 2010



# Ministry of the Environment - Regions

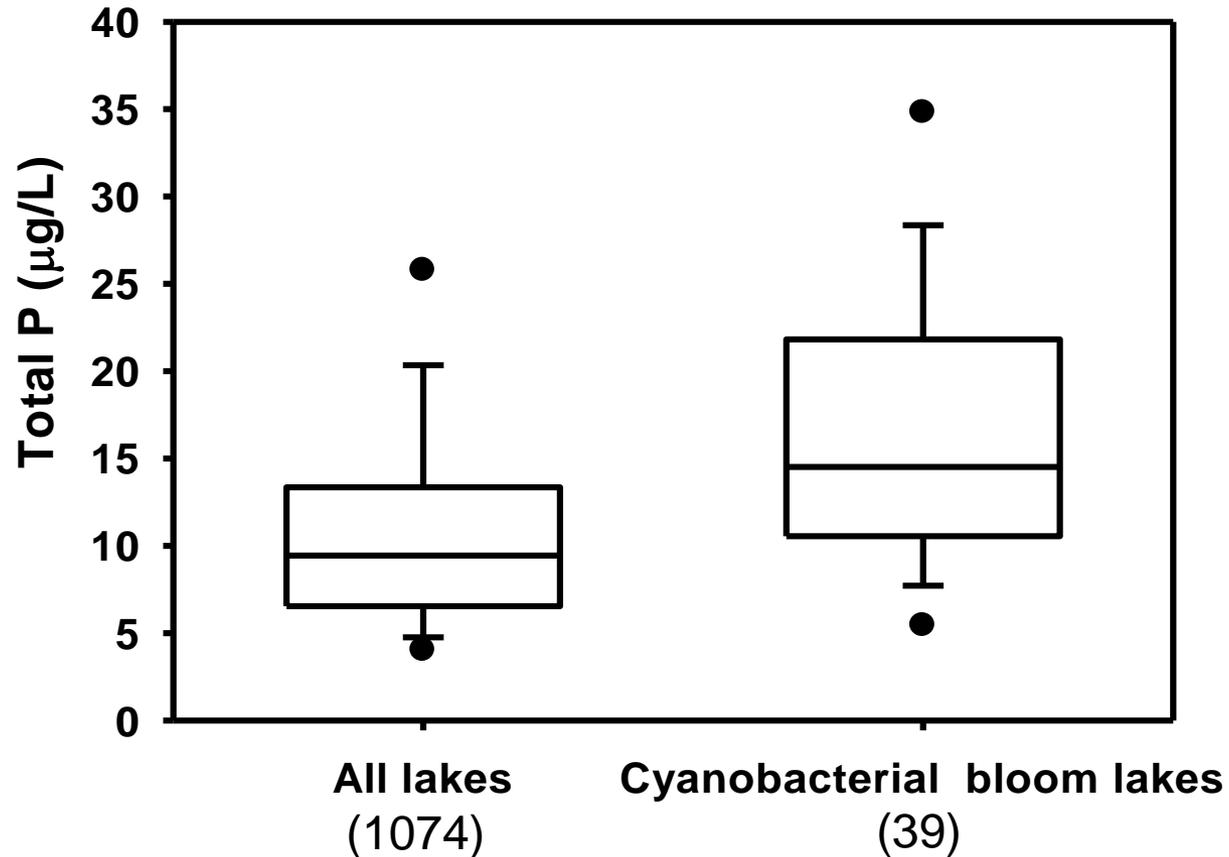


# Number of reports / yr in which cyanobacteria confirmed, by MOE region (2000 to 2010)



West Central Central Southwest Eastern Northern

# Spring total P concentrations in Lake Partner Program lakes 2002 to 2009 – all lakes and those in which cyanobacterial blooms were reported



# Conclusions



- There were increases in the number of algal bloom reports since 1994.
- The greatest increase was in reports of cyanobacterial blooms.
- Most of the blooms were reported from MOE's Northern Region.
- A subset of the lakes with cyanobacterial blooms had higher spring P concentrations than lakes in a large MOE dataset.



# Conclusions & next steps



- Interpreting bloom reporting trends is complicated because public awareness and the accessibility of lakes play a role in whether or not blooms are reported.



- Overall, we need to improve our understanding of the interplay amongst stressors that promote blooms.



- Next steps include ...

Assessment of the land use around those lakes in Northern Region experiencing blooms of cyanobacteria in 2009 and 2010 compared with lakes without blooms

# Actions to reduce phosphorus inputs

## At home or at the cottage

- ✓ Switch to phosphorus-free cleaning products (dishwasher detergents and personal hygiene products)
- ✓ Have your septic system checked and cleaned every three to five years.
- ✓ Don't put garbage or food waste down the toilet.
- ✓ Compost your leaves and food waste to reduce the need for synthetic fertilizer.
- ✓ Leave your shoreline natural.

## On the water

- ✓ Be careful when using petroleum products around water. Wipe up any oil spills and dispose of used oil and antifreeze at a marina or gas station.
- ✓ Use phosphorus-free biodegradable soaps in your boat.
- ✓ When boating, do not produce a wake too close to the shore. It can cause erosion which can pollute the lake and threaten aquatic life.
- ✓ Take all your food leftovers back to the shore.

# Fact sheets

## Blue-Green Algae Fact Sheets

- General (PIBS# 5087)
- Cottagers/home-owners (PIBS #5088)
- Owners/operators of regulated DW systems (PIBS #5089)

## Algae Fact Sheets

- Green Facts – Bulletin #1: What are Algae? (PIBS# 4661)

Available in Publications Section on MOE web site ([www.ontario.ca](http://www.ontario.ca))

Algae in Muskoka factsheet at [www.muskokawaterweb.ca](http://www.muskokawaterweb.ca)

**Bloom reports** – to MOE District office or Spills Action Centre 1-800-268-6060