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# **Algal Blooms in Ontario Lakes**

Muskoka Stewardship Conference  
Bracebridge, Ontario, April 27, 2013

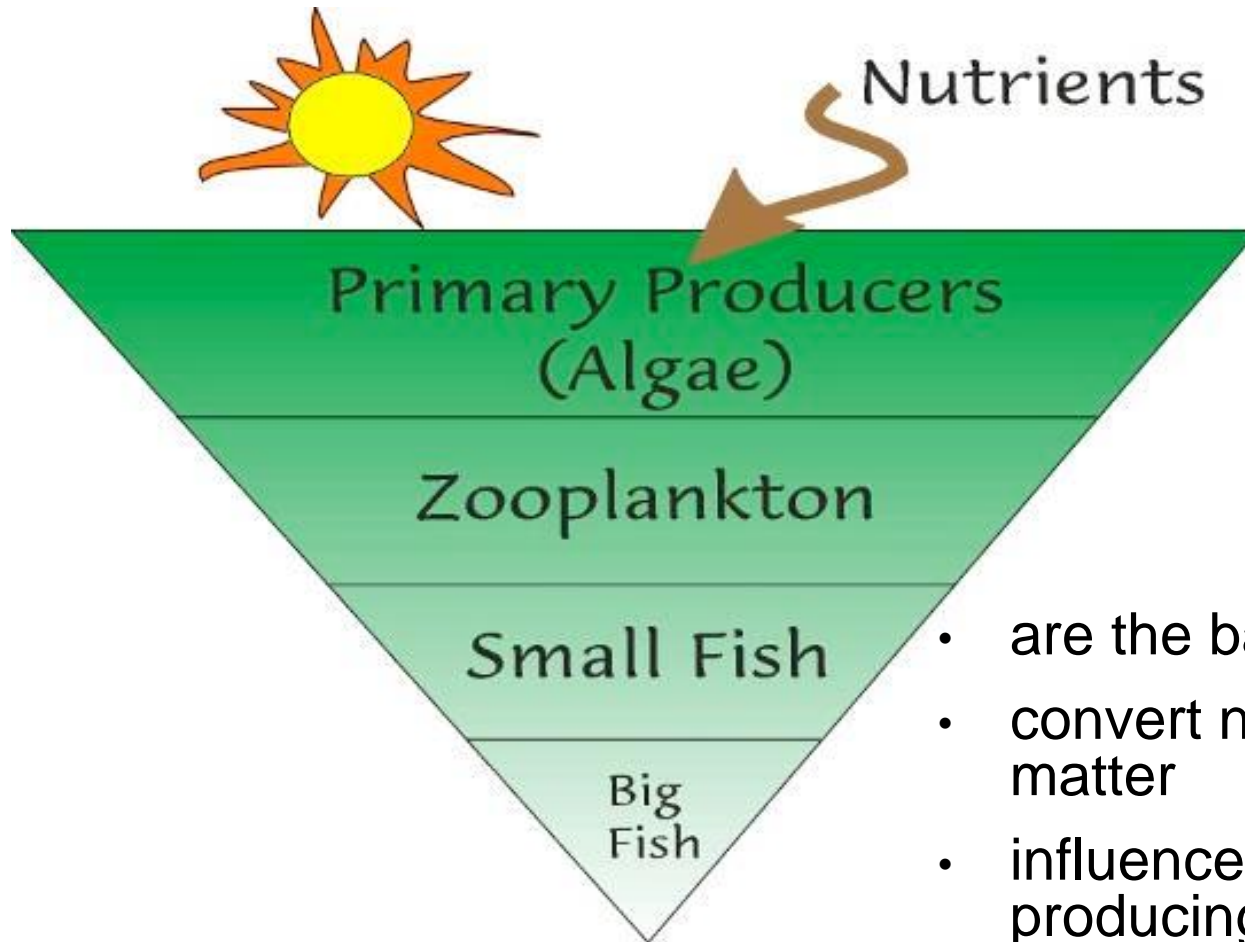
# What is algae?

## Algae are

- aquatic organisms that resemble plants
- require nutrients & light to grow
- found in all water bodies
- thousands of species
- range from microscopic to 10m+
- many different types
  - attached
  - free-floating



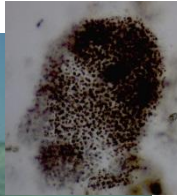
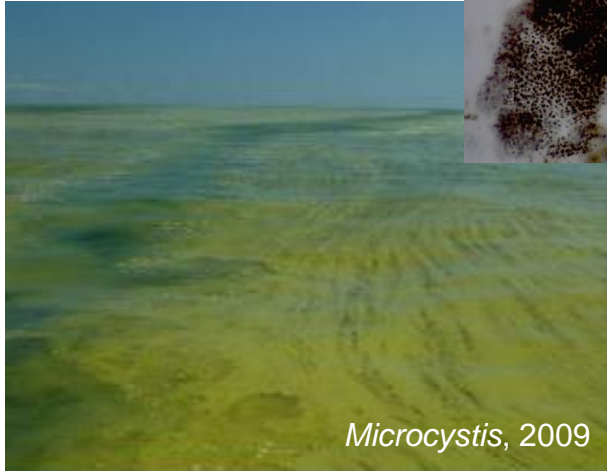
# Algae is an important part of the ecosystem



## Algae

- are the base of the food chain
- convert nutrients to organic matter
- influence our atmosphere by producing oxygen

# Algal blooms



## What is a “bloom”

- excessive growth of one or more species of algae

## Algal blooms can

- impact water colour (green, brown, yellow, red)
- reduce water clarity and oxygen levels
- cause unpleasant tastes & odours
- produce toxins



## Bloom forming conditions include

- sufficiently high levels of nutrients in the water or sediments
- calm weather
- strong sunlight
- high air & water temperatures
- these conditions usually occur from summer to fall

# Why are algal blooms a concern?

## Aesthetic issues

- blooms can produce unpleasant tastes & odours
- decomposing algae can cause shoreline fouling
- blooms may impact recreational activities & property values

## Drinking water & industrial water use issues

- blooms can impact maintenance or treatment for water taking
- taste & odour can affect public perception of drinking water safety
- small systems with modest treatment facilities may not be able to effectively treat water during blooms

## Human health issues

- algal toxins can impact humans
- toxins can also impact our pets, livestock, waterfowl & other animals





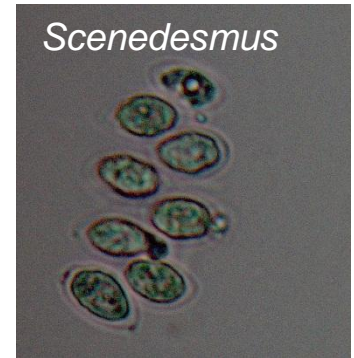
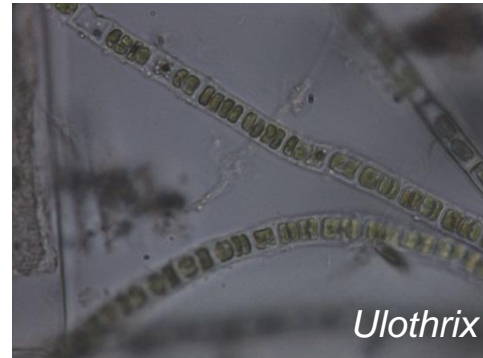
# Algal groups that commonly form blooms

## Green algae

- chlorophytes
- includes filamentous algae like *Cladophora*
- do not produce toxins
- can cause beach fouling & odour issues
- may be associated with bacteria



## Examples



# Filamentous green algal blooms:





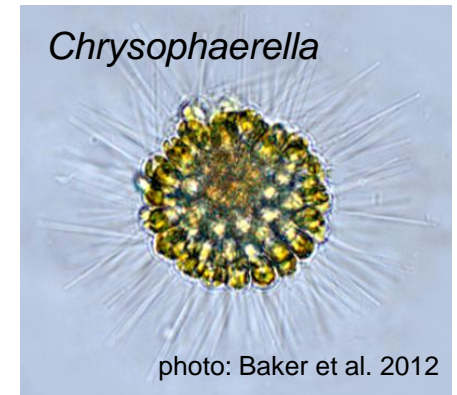
# Algal groups that commonly form blooms

## Golden-brown algae

- chrysophytes
- generally in low nutrient lakes
- increasing in Ontario
- can cause taste & odour problems

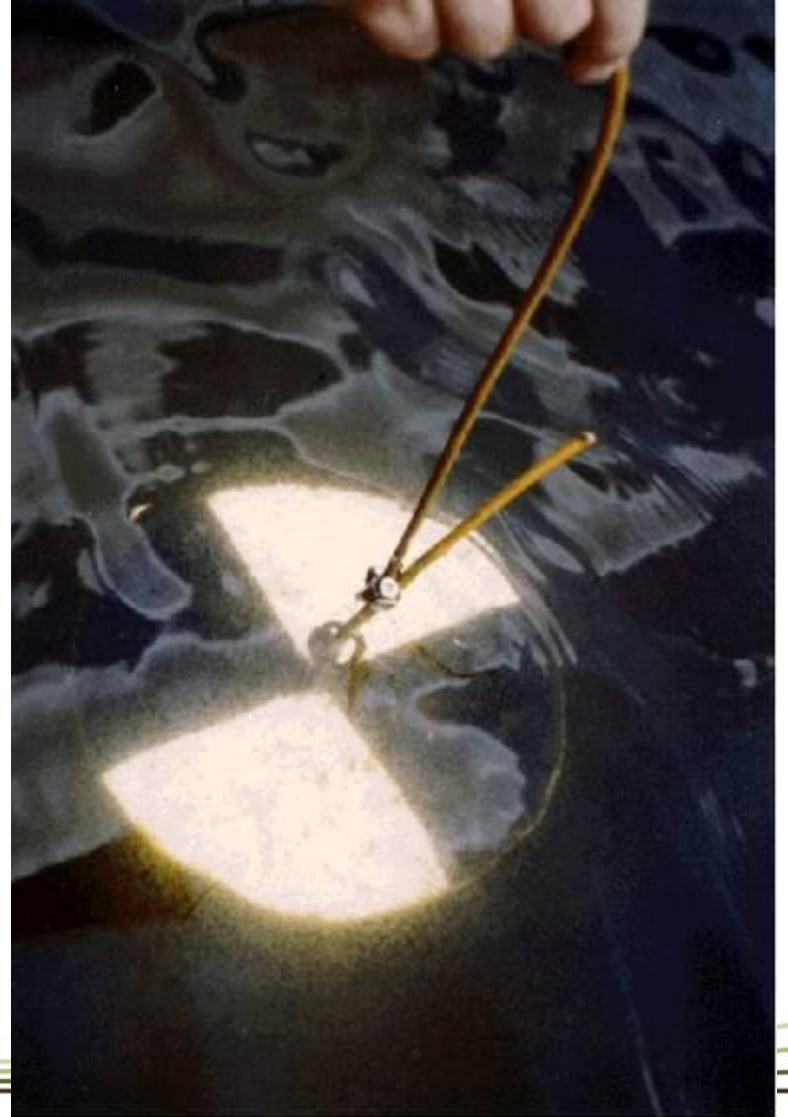


## Examples





# Golden-brown algal blooms:



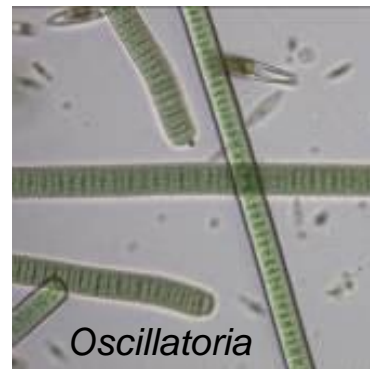
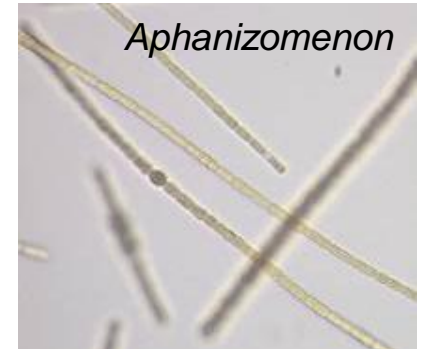
# Algal groups that commonly form blooms

## Blue-green algae

- cyanobacteria
- a type of photosynthetic bacteria
- called algae due to their ecology
- have inhabited the earth for > 2 billion yrs
- live in a wide range of environments



## Examples



# Blue-green algae (cyanobacteria)

Many species can produce toxins that can be released to the surrounding water when the algal cell is damaged or dies.

Toxins produced by blue-green algae can be classified as:

- hepatotoxins – affect the liver
- neurotoxins – affect the nervous system
- irritant toxins

When ingested, toxins can induce symptoms such as fever, diarrhea, abdominal pain, nausea & vomiting.

External contact with toxins during recreational activities, such as swimming, boating or water skiing, may result in itchy, irritated eyes & skin.








# Provincial algal bloom response protocol

## Ontario Ministry of the Environment Response Reference Guide

- ensures communication & collaboration among the various stakeholders
- MOE role is to gather, assess & provide basic scientific & technical information with which Health Units can assess risks to humans
- Health Unit makes decisions as to whether notification of the public is required & what actions should be taken

 Ministry of the Environment Ontario	<b>Reference Guide for Operations Division Staff Responding to Reports of Cyanobacterial (Blue-Green Algal) Blooms</b>	June 2007
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<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.	

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Reference Guide for Responding to Reports of Cyanobacterial (Blue-Green Algal) Blooms



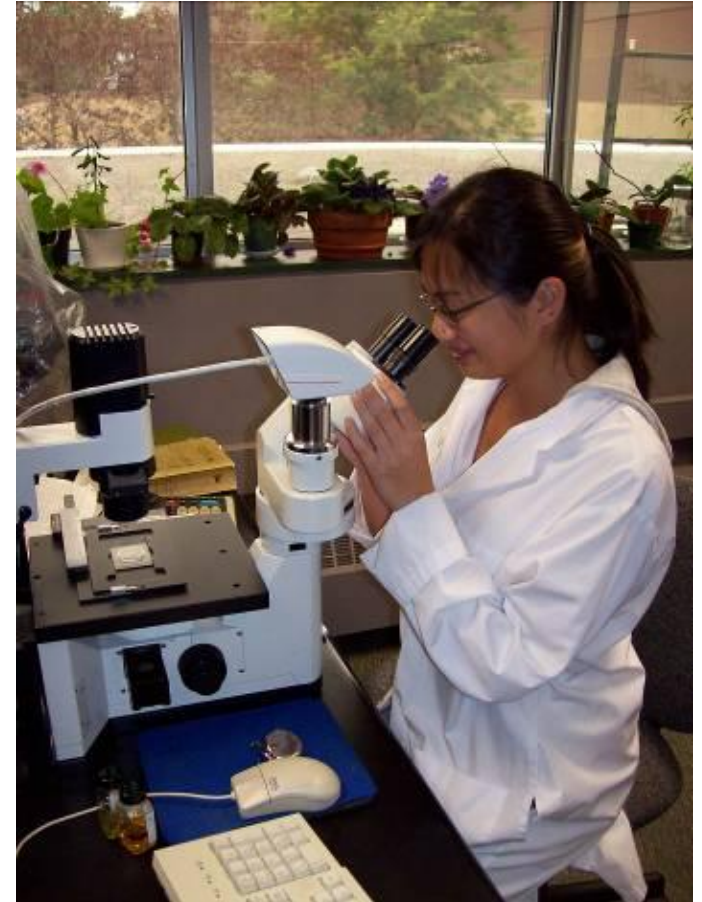
# Algal bloom response protocol

## MOE algal identification service

- rapid identification of blue-green algae
- identification of which algal species are “blooming” & whether these species have the potential to produce toxins

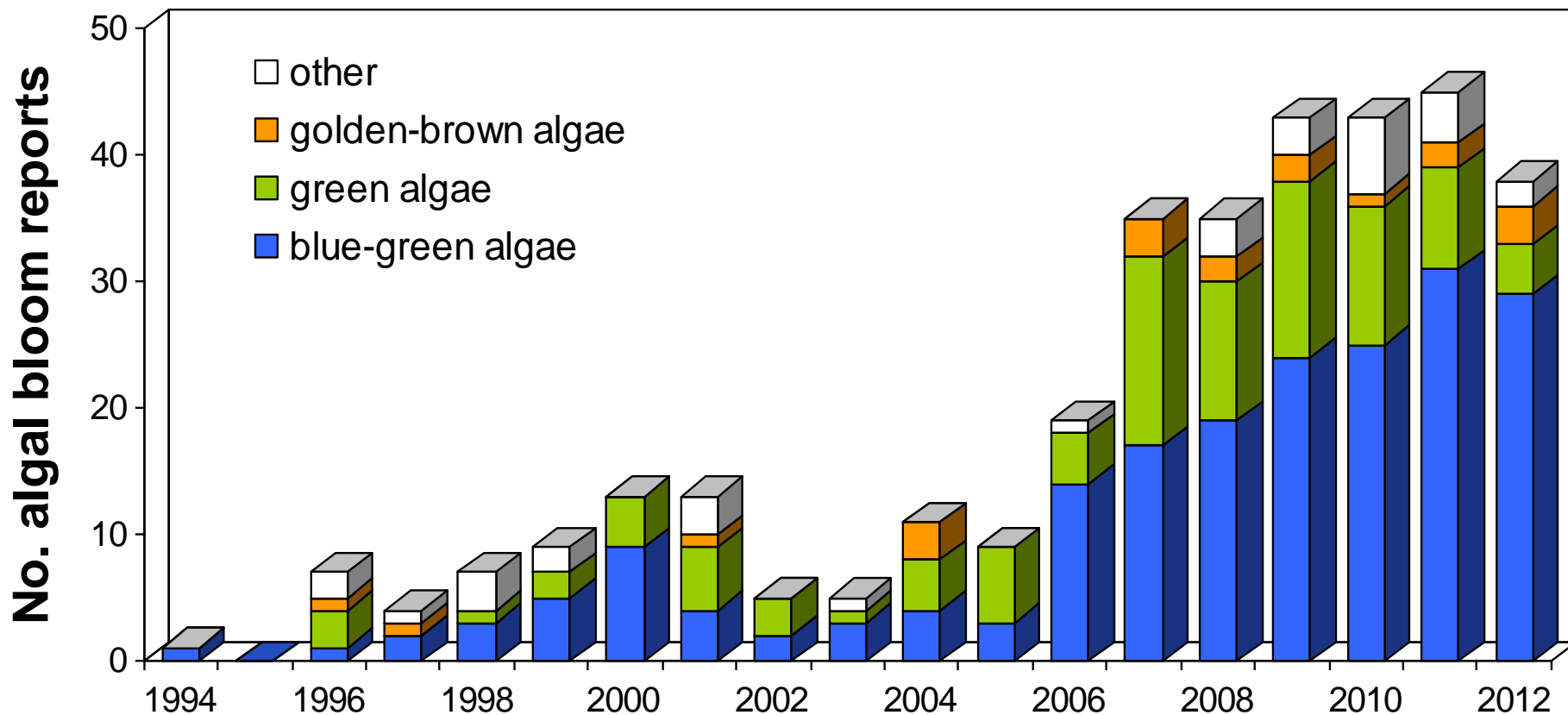
## MOE algal toxin analysis service

- testing for microcystin, a common algal toxin
  - ELISA & mass spectrophotometry
- several private labs have also been MOE accredited to screen drinking water for microcystins





# Algal bloom trends over time



↑ total, green & blue-green algae bloom reports from 1994-2012 ( $p < 0.001$ )

For more information see: Winter et al. (2011) Algal blooms in Ontario, Canada: Increases in reports since 1994. Lakes & Reservoir Management, 27:105-112.

# Cyano Bacterial Blooms

09 - 2012

Kenora

Thunder Bay

Timmins

Sudbury

North Bay

Sault Ste. Marie

Ottawa

Kingston

Toronto

Niagara Falls

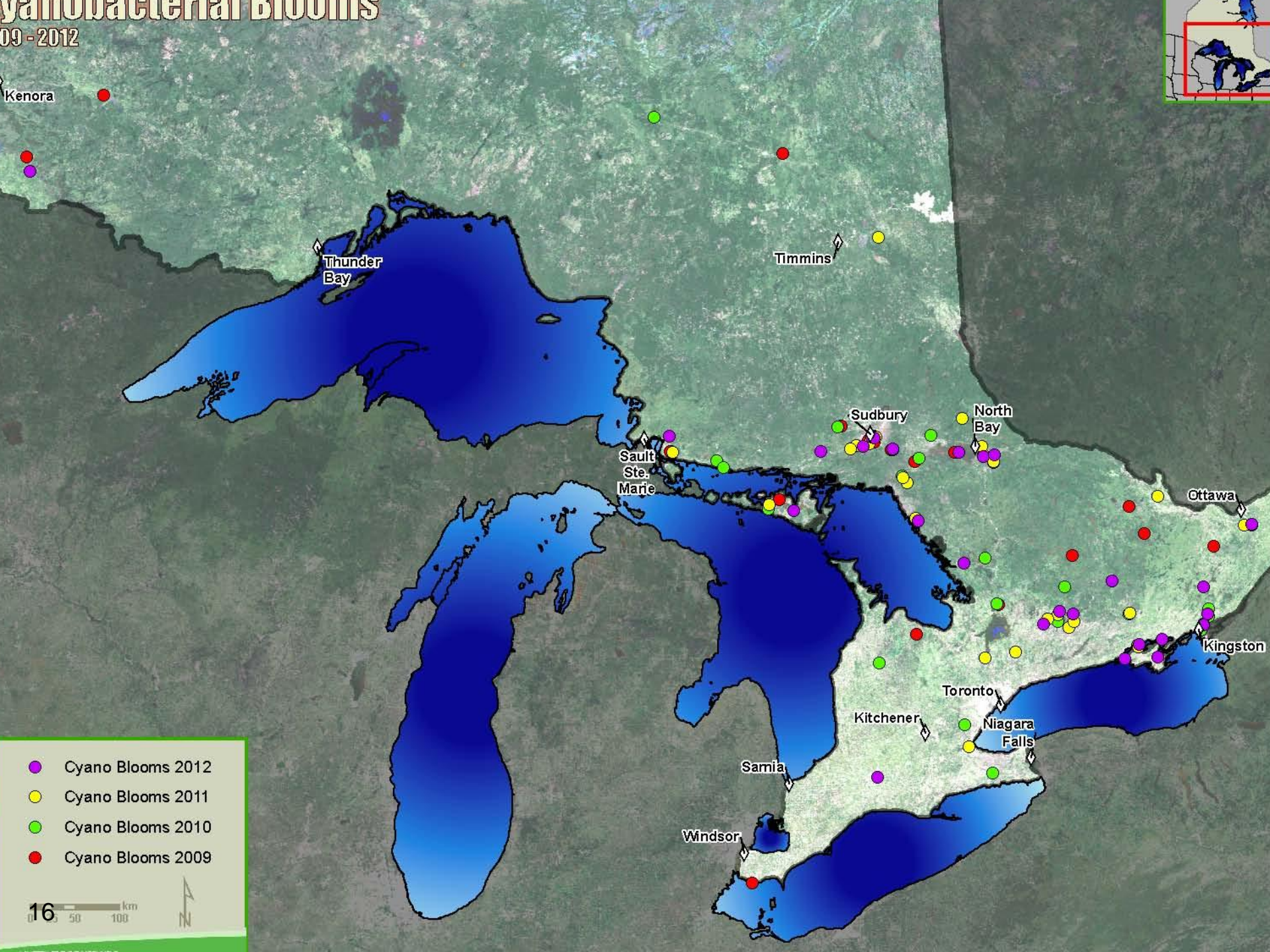
Kitchener

Samia

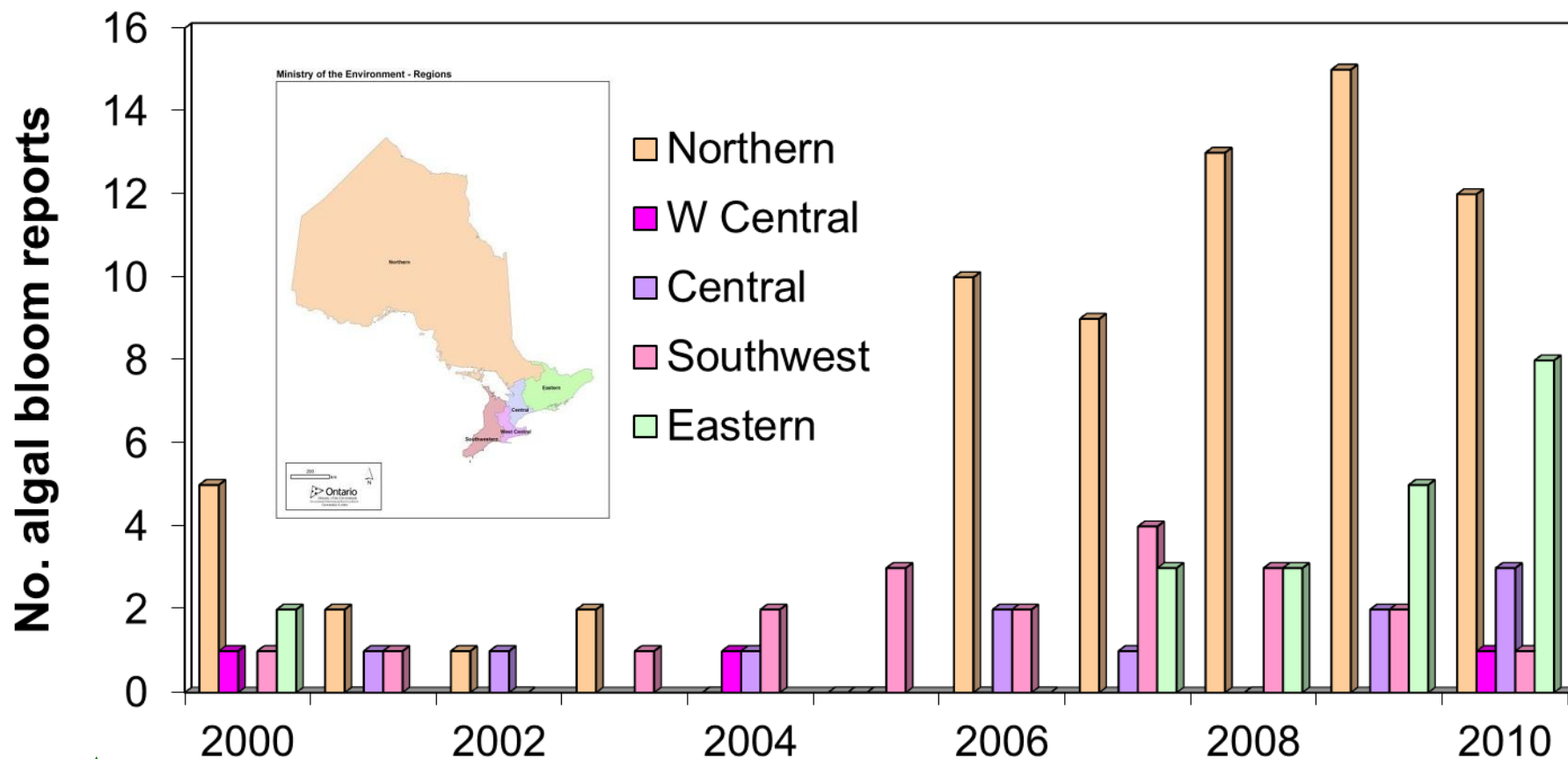
Windsor

- Cyano Blooms 2012
- Cyano Blooms 2011
- Cyano Blooms 2010
- Cyano Blooms 2009

16 50 100 km



# Blue-green algal bloom locations



↑ reports of total &/or blue-green blooms from 1994-2010 in all regions except West Central ( $p < 0.05$ )

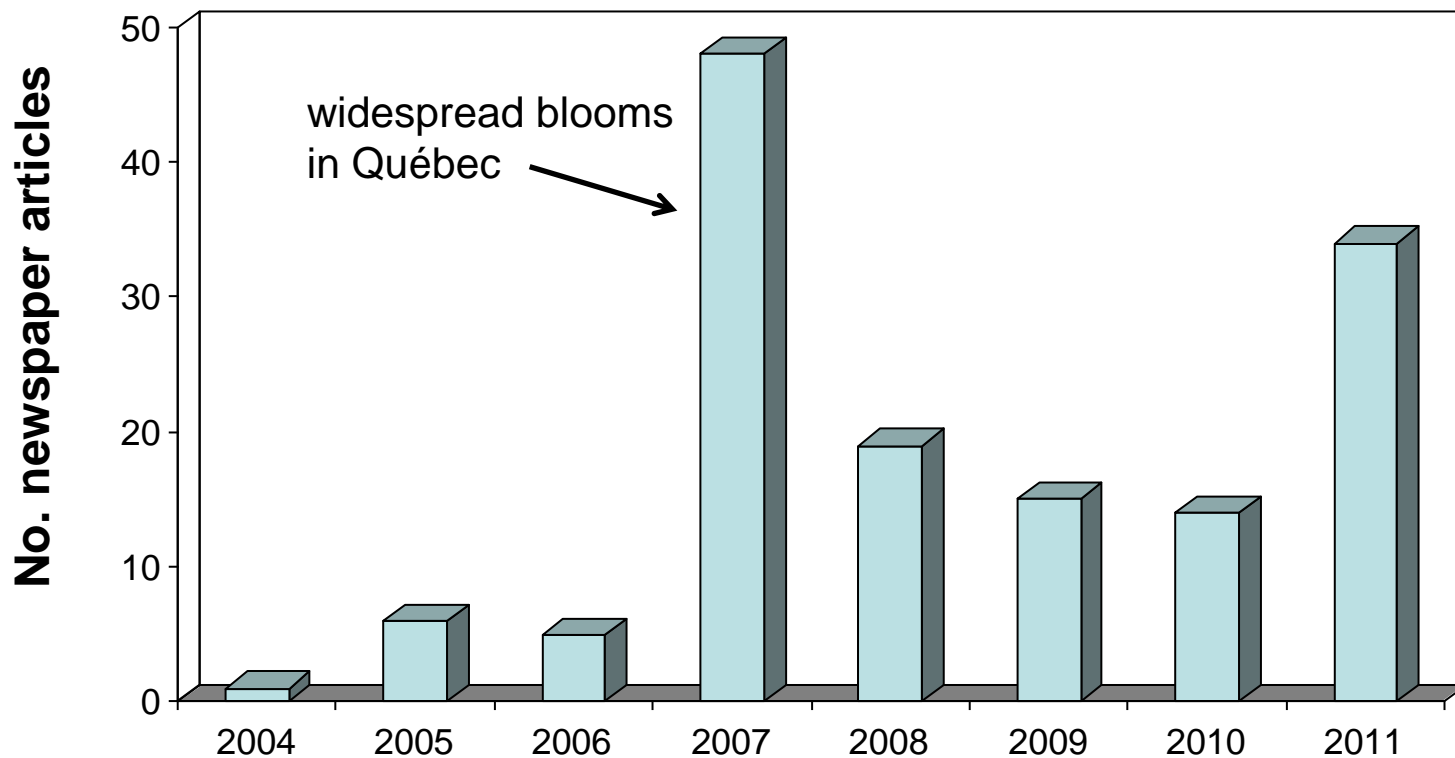
For more information see: Winter et al. (2011) Algal blooms in Ontario, Canada: Increases in reports since 1994. Lakes & Reservoir Management, 27:105-112.



# Why have bloom reports increased?

## 1) Increased public awareness of algal issues

- outreach & education efforts by government, conservation authorities & cottage associations
- increased media reports of algal blooms

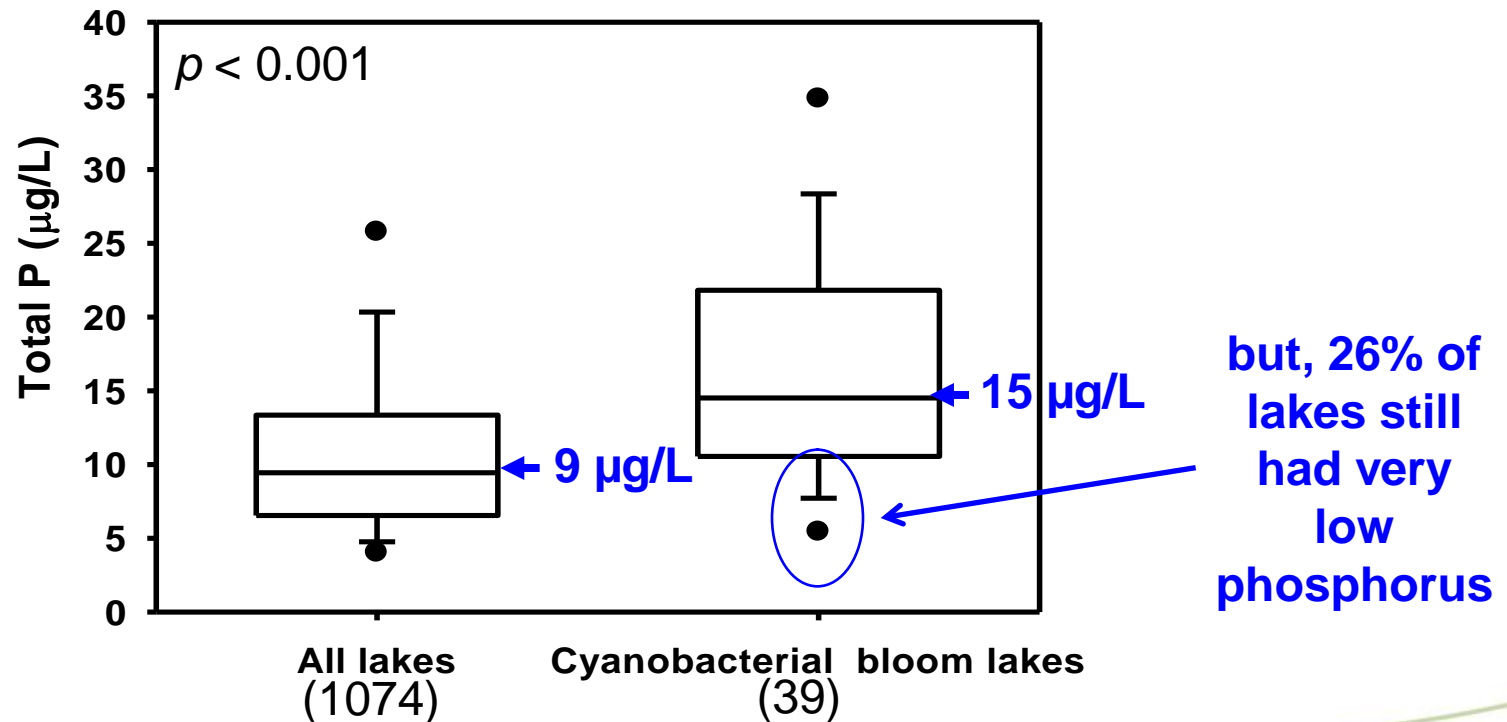


For more information see: Winter et al. (2011) Algal blooms in Ontario, Canada: Increases in reports since 1994. *Lakes & Reservoir Management*, 27:105-112.

# Why have bloom reports increased?

## 2) Increased nutrient inputs to lakes

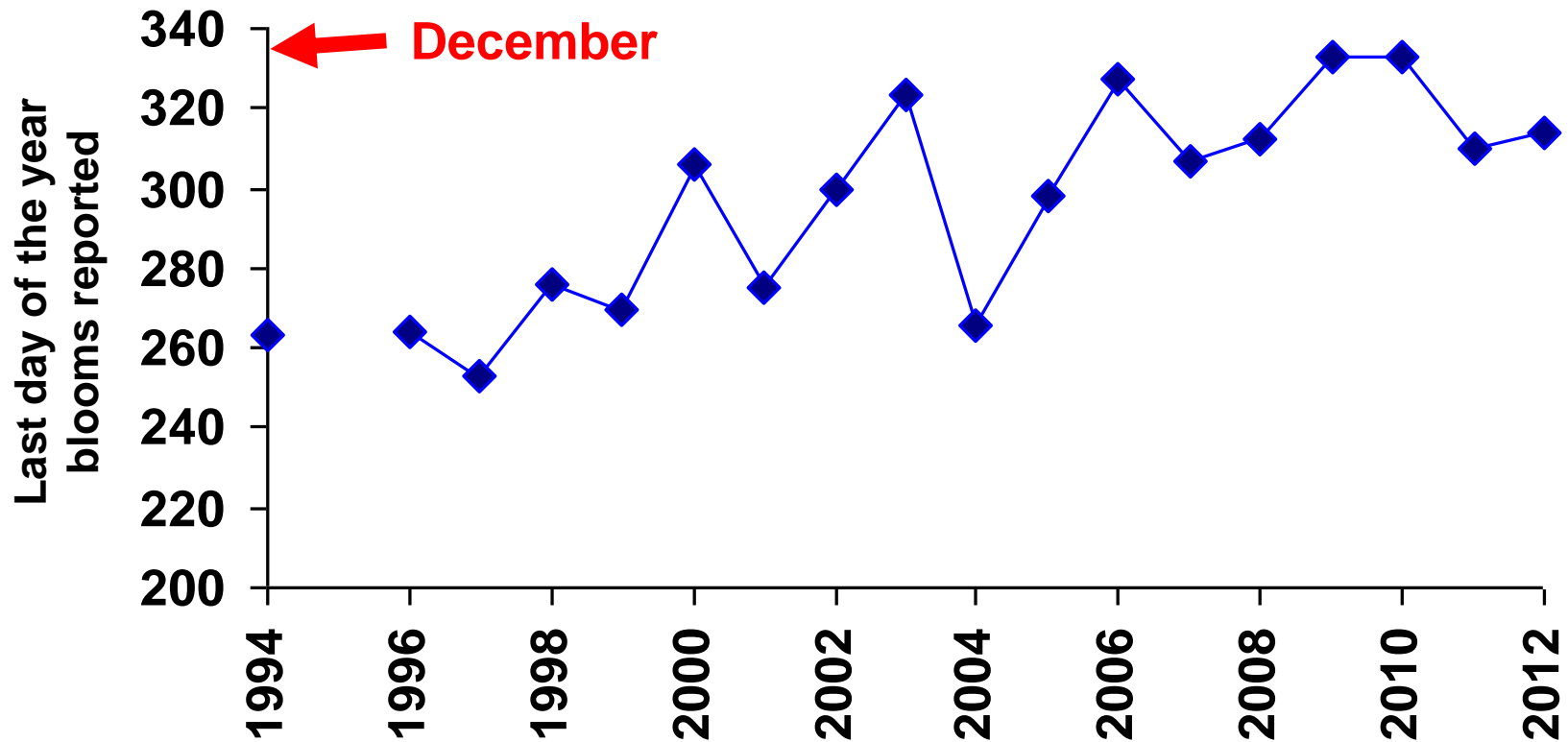
- enhanced human activity & development near lakes may be promoting algal growth
- spring total phosphorus was higher in bloom lakes than in a large set of Ontario lakes without reported blooms



For more information see: Winter et al. (2011) Algal blooms in Ontario, Canada: Increases in reports since 1994. Lakes & Reservoir Management, 27:105-112.

# Why have bloom reports increased?

## 3) Climatic changes may enhance conditions that support blooms



**blooms are being reported later into the fall now than in the 1990s ( $p < 0.001$ )**

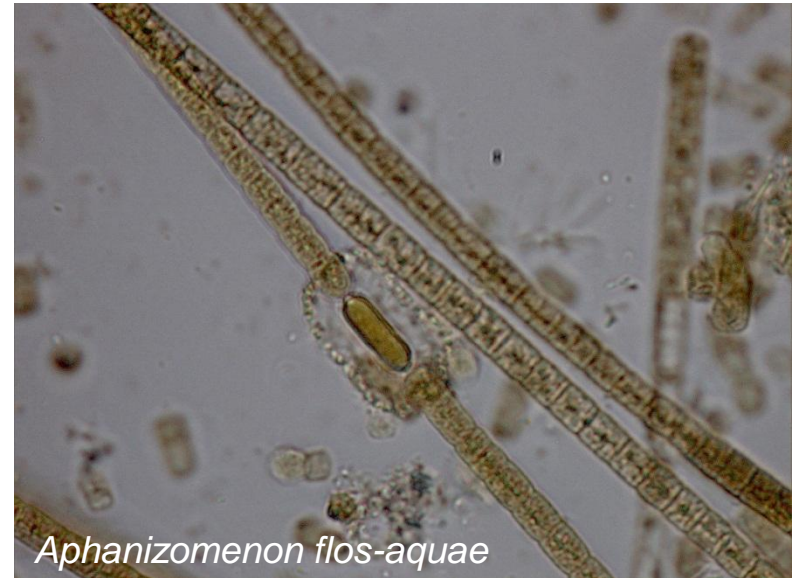
For more information see: Winter et al. (2011) Algal blooms in Ontario, Canada: Increases in reports since 1994. Lakes & Reservoir Management, 27:105-112.



# Linking climate change & algal blooms

## Blooms like it hot

- warmer water temperature
- less ice-cover & longer growing period
- longer stratification & less mixing
- higher nutrient loading
- precipitation changes
- longer residence time



## Warming benefits blue-green algae

- grow better than many other algae at high water temperatures
- can control their buoyancy by forming gas vesicles
- can accumulate at the surface & shade underlying algae
- nitrogen fixers

For more information see: Paerl & Huisman (2008) Blooms like it hot. Science, 320:57-58.

# What is the MOE doing about algal blooms?

## Blue-Green Algae Incidence Response

- MOE responds to reports of algal blooms & provides scientific & technical information to Health Units
- tracks the occurrence and prevalence of algal bloom reports throughout the province

## Drinking Water Surveillance Program

- Blue-Green Algae Toxins Survey
- algal toxins are monitored at a selection of municipal drinking water facilities

## Nutrient Reduction

- legislation (e.g., Nutrient Management Act, Ontario Water Resources Act) & numerous programs have been implemented to reduce nutrient loading to Ontario waterbodies

## Research & Monitoring

- MOE partners with government, universities, NGOs, & other stakeholders on numerous efforts to understand algae & the factors that promote algal blooms

# What should you do if you suspect a blue-green algal bloom?

**Call the Spills Action Centre**  
**1-800-268-6060**



## **Blue-green algal blooms can**

- make the water look like bluish-green or green paint or pea soup
- fresh blooms can smell like newly mown grass
- older blooms can smell like rotting garbage



# Take a precautionary approach

**Health risks are reduced simply by avoiding exposure**

## **In the event of a bloom:**

- do not drink, touch or cook with untreated water
- do not swim or bathe in untreated water
- avoid eating fish, particularly the viscera & organs, caught from bloom areas
- do not boil the water or use chlorine, herbicides, copper sulphate or other algaecides
  - these can break open the cell walls & release more toxins
- do not rely on jug filtration systems
  - these do not fully protect against algal toxins
- use alternative water sources
- contact your local Health Unit for bloom warnings, swimming advisories & more information on health risks

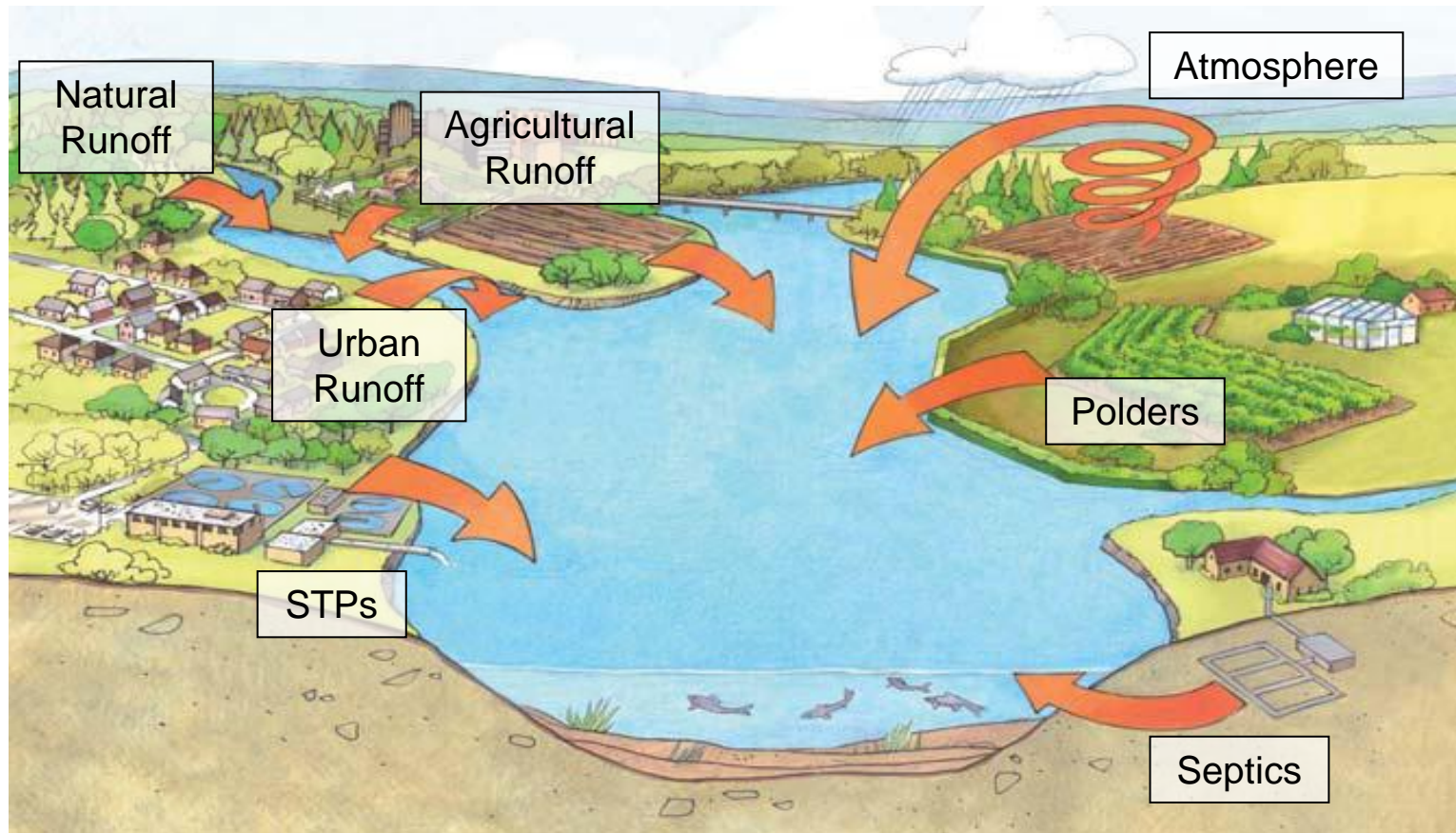
# Can my drinking water contain algal toxins?

**If drinking water is obtained from a water source during a blue-green algal bloom then it is possible the water may contain algal toxins**

- usually people won't drink this water due to its unsightly appearance & smell but sometimes it is hard to tell if the water is contaminated
- appreciable levels of toxins are extremely rare in treated water
  - Ontario Drinking Water Quality Standard for the algal toxin microcystin-LR is a maximum acceptable concentration of 0.0015 mg/L (O. Reg 169/03, schedule 2)
- treatment of drinking water may be effective when algal cells are removed through specialized filtration systems
  - large treatment systems are more likely to have these capabilities

# How do we control algal blooms?

## Prevention rather than remediation





# What can you do to protect Ontario's lakes & rivers?

## Everyday ways to reduce nutrients

- use phosphate-free household cleaning products, detergents and personal hygiene products
- use phosphorus-free fertilizer on lawns
- retain natural vegetation along shorelines
- reduce agricultural runoff (e.g., setbacks, minimize fertilizer use)
- maintain septic systems
- reduce vehicle emissions & wash your car on pervious surfaces like grass
- pick up pet wastes



# Where can I get more information about algal blooms?

## **MOE Blue-Green Algae Factsheets ([www.ene.gov.on.ca](http://www.ene.gov.on.ca))**

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

## **Health Canada *Water Talk* document**

- <http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/cyanobacter-eng.php>

## **Local Health Unit**



# Thank you, Questions?

**For more information please email:  
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