

Metadata

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Authors	
Authors 1	
Author Name	McCullough, Greg

Field	Value
Type of Name	Personal
Email	greg.mccullough@gmail.com
Affiliation	Centre for Earth Observation Science - University of Manitoba
ORCID ID	
Authors 2	
Author Name	Page, Stephan J.
Type of Name	Personal
Email	Stephen.Page@dfo-mpo.gc.ca
Affiliation	Fisheries and Oceans Canada
ORCID ID	
Authors 3	
Author Name	Hesslein, Raymond H.
Type of Name	Personal

Field	Value
Email	hesslein@mymts.net
Affiliation	Freshwater Institute - Fisheries and Oceans Canada
ORCID ID	
Authors 4	
Author Name	Stainton, Michael P.
Type of Name	Personal
Email	
Affiliation	Freshwater Institute - Fisheries and Oceans Canada
ORCID ID	
Authors 5	
Author Name	Kling, Hedy J.
Type of Name	Personal
Email	hedy.kling8@gmail.com
Affiliation	Algal Taxonomy and Ecology Inc.

Field	Value
ORCID ID	
Authors 6	
Author Name	Salki, Alex G.
Type of Name	Personal
Email	
Affiliation	Freshwater Institute - Fisheries and Oceans Canada
ORCID ID	
Authors 7	
Author Name	Barber, David G.
Type of Name	Personal
Email	david.barber@umanitoba.ca
Affiliation	Centre for Earth Observation Science - University of Manitoba
ORCID ID	

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Name	Hydrological forcing of a recent trophic surge in Lake Winnipeg

Field

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Description

Nutrient enrichment leading to eutrophication of lakes is frequently attributed to increasing anthropogenic loading to the watershed. We use a phosphorus mass balance model to demonstrate that a discharge increase in a major tributary contributed more than increased anthropogenic loading to a recent sudden doubling of total phosphorus (TP) and a shift to a cyanobacteria-dominated plankton population in Lake Winnipeg. Runoff from the Red River watershed rose abruptly during the mid-1990s. The decadal mean discharge has since been more than 50% higher than for any previous decade in the century-long record. Widespread spring flooding has become common. TP concentration roughly doubles during floods, magnifying the effect of higher runoff on downstream phosphorus loading. Concentrations of both dissolved and particulate phases are raised by flooding. Over 90% of dissolved phosphorus downstream of flooded farm land in one tributary was in the form of highly bio-available orthophosphate. From 1994 to 1999, TP in the lake rose from less than 30 to more than 50 mg m⁻³. It has since remained over 50% higher than before the mid-1990s. We use the phosphorus model to demonstrate that the change in Red River discharge alone would have caused a sustained 32% increase compared to when phosphorus was first routinely monitored in the 1970s, while direct increases in the rate of anthropogenic loading alone would have caused only a 14% increase. It required both increased loading to the land and higher runoff to produce the observed increase in TP in the lake.

Format

HTML

Resource Category

documents