# INVASIVE SPECIES SURVEY:

## DIDYMO ALGAE 2014

**Prepared by:**
**Heather E Milligan**

Yukon
Environment
*Environnement*

**December 2015**

# INVASIVE SPECIES SURVEY:
# DIDYMO ALGAE 2014

## Yukon Department of Environment
## Fish and Wildlife Branch
## SR-15-01


## Acknowledgements

Shailyn Drukis, Ella Parker, Aven Knutson, Nigel Eckert, and Dennison Bohmer conducted fieldwork in 2014. Shailyn entered data and Aven Knutson identified didymo by microscope. Oliver Barker conducted fieldwork in 2010. Gerry Whitley, Bruce Bennett, Andrea Altherr, Aaron Foos, Lloyd Freese, and Dan Greenberg submitted samples.

Cover Photo: Carpenter Creek with didymo present. Photo taken by Aaron Foos.





Copies available from:

Yukon Department of Environment
Fish and Wildlife Branch, V-5
Box 2703, Whitehorse, Yukon Y1A 2C6
Phone (867) 667-5721, Fax (867) 393-6263
Email: environmentyukon@gov.yk.ca

Also available online at www.env.gov.yk.ca

Suggested citation:

MILLIGAN, H.E. 2015. Invasive species survey: Didymo algae 2014. Yukon Fish and Wildlife Branch Report SR-15-01. Whitehorse, Yukon, Canada.

## Summary

Didymo algae (*Didymosphenia geminata*) is a freshwater diatom that can form massive blooms with the potential to impact fisheries. Many jurisdictions consider didymo to be a non-native invasive species and have banned felt-soled wading boots to restrict the spread of the organism. New evidence suggests that it is native to southern Canada and that recent blooms may be due to the emergence of a new genotype or changing environmental conditions.

Although didymo is known to occur in Yukon, it is not clear if the species is native to Yukon, how widely it is distributed, or whether this distribution is changing.

To begin to answer these questions, Environment Yukon began recording observations of didymo in 2010 from opportunistic sampling and public submissions. This report summarizes the findings on the distribution of didymo algae.

## Key Findings

- Didymo algae is well established and occurs in all major watersheds in Yukon that we sampled (Yukon River, Alsek, Peel, and Liard drainages).
- Most observations of didymo blooms occurred in southern Yukon in the Yukon River and Alsek drainages.

page is intentionally blank

# Table of Contents



# List of Figures

## Introduction

Didymo algae (*Didymosphenia geminata*) is a freshwater diatom that can form massive blooms with the potential to impact fish habitat and fisheries. When individual cells form extracellular stalks, the organisms can group together in a continuous mat that covers stream bottoms (Taylor and Bothwell 2014). This didymo mat, also known as rock snot, is extremely slippery and gives the impression of polluted waters, thereby reducing the aesthetic qualities of pristine waters. In recent years, numerous observations of these mats in new areas generated global concern about the impact and spread of didymo.

Many jurisdictions consider didymo to be a non-native invasive species. Didymo blooms are thought to be caused by recent introductions by people using streams. Several jurisdictions (Alaska, Maryland, Missouri, Nebraska, Rhode Island, South Dakota, Vermont, Chile, and New Zealand) have passed legislation banning the use of felt-soled wading boots to restrict the spread of the organism.

New evidence suggests that didymo is native to some areas in southern Canada and that recent blooms may be due to the emergence of a new genotype that produces the mat-forming extracellular stalks or to changing environmental conditions (Taylor and Bothwell 2014). In particular, low levels of phosphorus in the environment has been hypothesized to induce algae blooms. Didymo may respond to low levels of phosphorus by increasing extracellular stalk production thus extending cells into the water column where they can more easily uptake phosphorus (Taylor and Bothwell 2014).

Environment Yukon conducted an assessment of aquatic invasive species to develop a framework for aquatic invasive species management and to better understand which species posed the highest risk to Yukon waters. Didymo, which is known to be present in Yukon waters, was the highest ranked species based on the likelihood of introduction, persistence, and ecological, economic and social consequences (Environment Yukon, In Prep).

Notwithstanding this assessment, it is not clear if didymo is native to Yukon, how widely it is distributed in Yukon, or whether this distribution is changing. To begin to answer these questions, Environment Yukon began surveying streams for didymo in 2010. In 2014, we extended this survey for didymo to better understand its distribution in Yukon and to collect genetic samples for further analysis on the origin of this species.

## Methods

Road accessible sites were surveyed in southern Yukon by a field crew. We primarily visited streams with rocky bottoms near highway crossings. Several samples came from opportunistic collections at non-road accessible sites and from

submissions by members of the public.

At each sample site, when time permitted, we recorded several habitat variables including accessibility, stream width, current speed, stream depth, pH, specific conductivity, water temperature, shade cover, and presence of didymo mats. We preserved a sample of the didymo or any other algae found at the site in 70% ethanol for identification and genetic sampling. We then disinfected footwear and equipment in diluted bleach.

Didymo presence was confirmed by compound microscopy using modified protocols from Kilroy (2007). Didymo observations were entered into a database that recorded opportunistic sampling, public submissions, and records from reports. The status of didymo was determined and classified as: not detected, present, bloom, or unconfirmed. Blooms were sites with mats of didymo covering rocks. Sites without didymo mats that had didymo identified in algal samples were defined as present. We also recorded public submissions that were not confirmed by microscopic analysis. The database, which includes observations from 1992 to 2014, is not presented here, but can be accessed by contacting Environment Yukon.

## Results and Discussion

We found didymo at 30 locations, indicating that the species is well established in Yukon (Figure 1). Didymo occurred in all of Yukon's major watersheds that we sampled: Yukon River, Alsek, Peel, and Liard drainages. Most observations of didymo blooms were from southern Yukon—in the Yukon River and Alsek drainages. The earliest documented cases of didymo in Yukon were from 1992 when didymo mats were found in the Yukon River near Whitehorse and in the Thirtymile section downstream from Lake Laberge (Barraclough 1992).

We confirmed that didymo occurs at 38% of the stream locations sampled in Yukon (bloom = 22, present = 8, unconfirmed = 1, total surveyed sites = 88). Didymo appeared to be located primarily in medium flow streams with rocky substrates in both easily accessible and inaccessible areas (Figure 2). Extracellular stalks were primarily associated with samples with noticeable didymo blooms (Figure 3).

We collected 9 genetic samples for further analysis on the origin of the species.

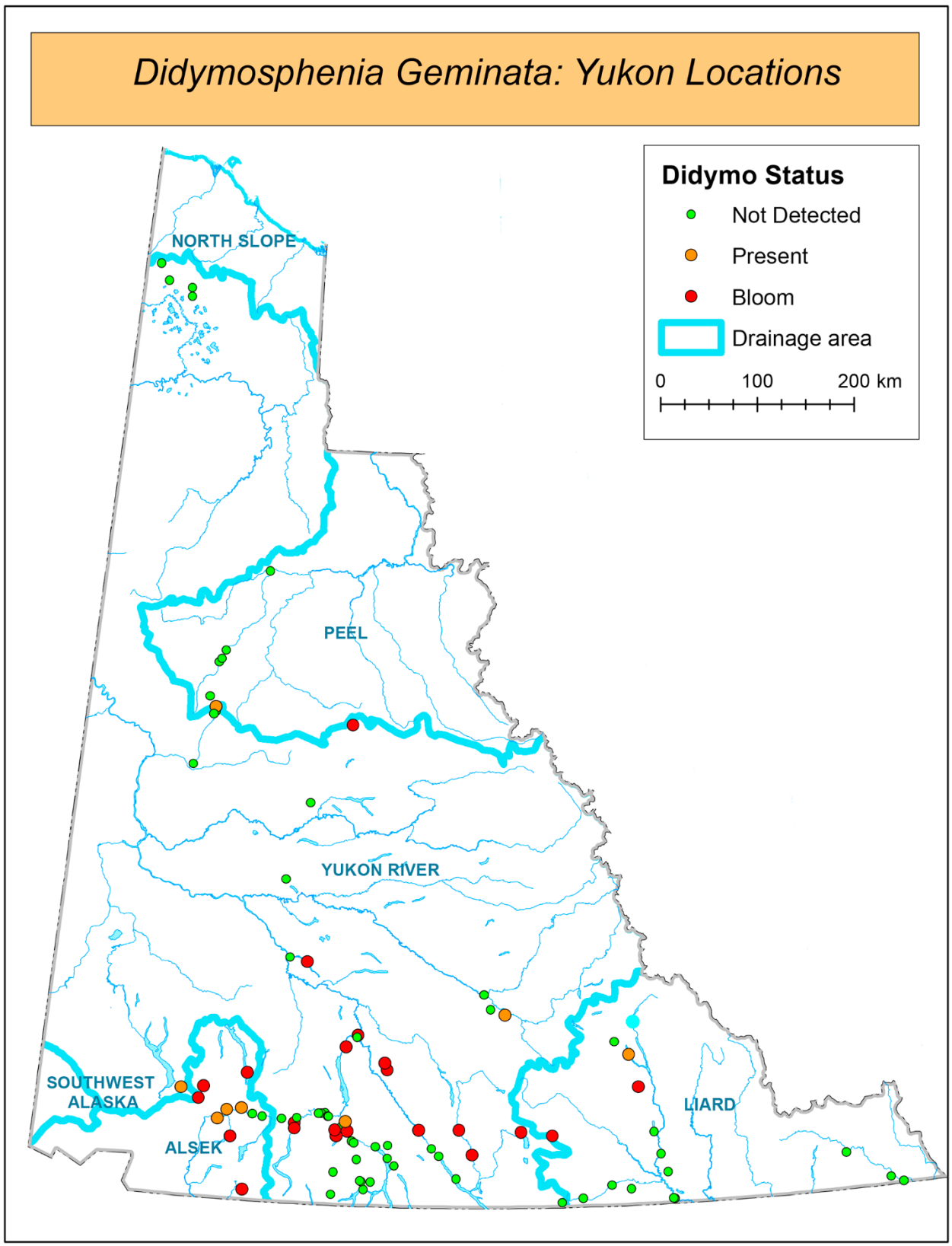


**Figure 1.** Locations of *Didymosphenia geminata* in Yukon from 1992-2014 records (n = 88 sites). Blooms are sites with mats of didymo coverings rocks. Sites without mats of didymo that had didymo identified in algal samples, are identified as “present”.

**Figure 2.** Didymo mat covering rock at Porter Creek.

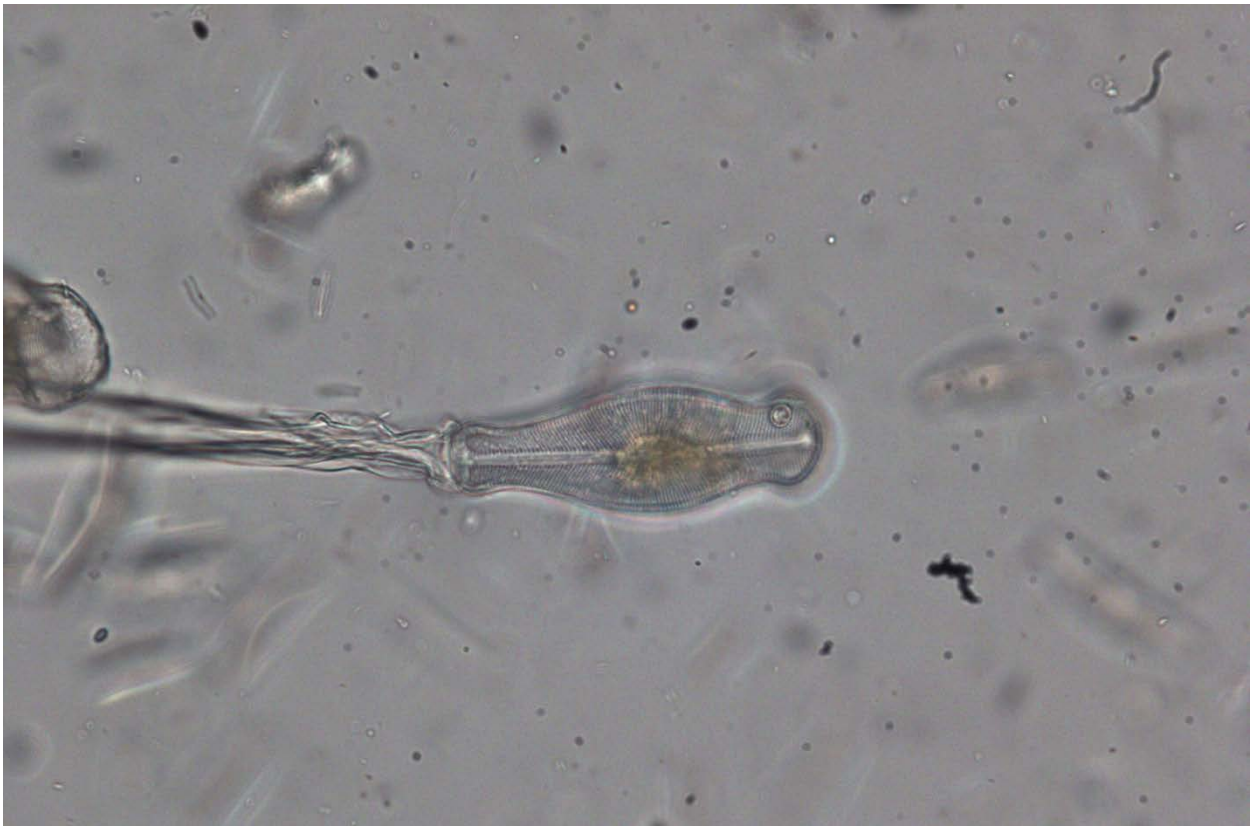

**Figure 3.** *Didymosphenia geminata* cell and attached extracellular stalk from Aishihik River. Magnification 400x.

## Conclusions and Recommendations

We found that didymo was more widespread than anticipated and was detected in all Yukon watersheds that we sampled (Alsek, Liard, Peel, and Yukon River). This survey provides a baseline for presence and absence of didymo in some Yukon rivers. It does not show whether didymo is spreading or answer the question about how long it has been in Yukon and whether it affects the aquatic environment.

Further research will improve our understanding of didymo presence in Yukon. Based on our current knowledge, we have the following recommendations.

We recommend that an analysis of the genetic fingerprint of specific didymo samples be carried out to compare Yukon samples with samples from other parts of North America. This will help us understand where didymo in Yukon came from and whether it is native to Yukon. Understanding whether didymo in Yukon is similar to didymo in other areas may also help us understand the environmental factors that may be causing the species to form mats.

Regular monitoring of didymo in Yukon should consider engaging non-governmental organizations and the public. This would have many benefits, including providing information on the stability (or spread) of didymo distribution in Yukon.

Carrying out studies to understand the impact of didymo on aquatic environments will allow us to quantify risk posed by didymo in Yukon.

Finally, a continued focus on public education about invasive species, particularly on those good practices that will help to prevent the introduction and spread of aquatic organisms. Even if didymo is found to be native to parts of Yukon, we know from this survey that it is not currently found everywhere in the territory. Keeping didymo and all other aquatic species to those areas where they already exist will help maintain the quality, diversity, and integrity of Yukon's aquatic environments.

## References


BARRACLOUGH, C.L. 1992. Periphyton of the Yukon River presence of *Didymosphenia geminata* (Lyngb.) M. Schm. University of Victoria report. Victoria, B.C.

ENVIRONMENT YUKON. In Prep. Development of a framework for management of aquatic invasive species of concern for Yukon: Literature review, risk assessment and recommendations. Yukon Fish and Wildlife Branch Report MR-14-01, Whitehorse, Yukon, Canada.

KILROY, C. 2007. Protocol for microscopic analysis of samples for the detection of *Didymosphenia geminata.* National Institute of Water and Atmospheric Research Ltd., Christchurch, New Zealand.

TAYLOR, B. W. and M. BOTHWELL. 2014. The origin of invasive microorganisms matters for science, policy, and management: the case of *Didymosphenia gemimata*. BioScience 64:531-538.