

Volunteer based Observations to understand the Growth, Persistence and Removal of Rock Snot Blooms

Citizen Science: Involving volunteers in Rock Snot bloom monitoring for scientific purposes

DIDYMO IN EASTERN CANADA

Since 2006, the Restigouche River watershed is affected by the presence of *Didymosphenia geminata*, commonly called "didymo" or "Rock snot". This invasive alga is suspected to alter the environment and aesthetic value of the affected rivers. One of the main local concerns of this invasive species is that regional economy mainly relies on Atlantic salmon fisheries and that didymo could act as an additional stressor to this anadromous population.



Figure 1
Didymo mat covering large cobble

WHAT IS DIDYMO?

- Stalked diatom
- Frequently associated with clear, cold, pristine rivers
- Cells produce a fibrous stalk (fig. 1 & 2). Excessive stalk production are commonly called "blooms"
- Brownish-yellow to white fibrous mat on riverbed

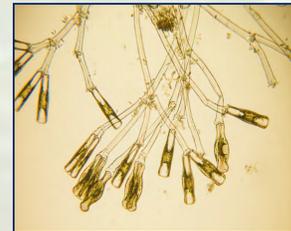


Figure 2
Didymo cells and stalks

WHY CREATE A VOLUNTEER NETWORK?

Throughout the years, didymo presence has varied in intensity as well as occurrence making study site selection for achieving research objectives quite complex. Therefore, since 2009, a volunteer network engages citizens to ensure a weekly monitoring of the didymo proliferations on multiple sites along different rivers. We aimed concerned parties by engaging multiple organizations related to Atlantic salmon fisheries motivated to understand the nuisance blooms present in THEIR rivers and how it affects THEIR local economy.

DIDYMO VOLUNTEER NETWORK

Objectives

- Develop a volunteer network for effective monitoring of didymo presence, absence and extensiveness across various scales
- Produce a dataset that will help determine which variables can favor didymo colonization, growth, persistence and removal
- Involve the local community
- Raise awareness

Monitoring

To standardize the collected data from one observer to another and ensure quality control:

- Volunteer Booklet in which didymo presence can be classified into different categories (fig. 3)
- Training (fig. 4)
- Field visit to ensure proper monitoring
- Communicate frequently

Collected data (fig. 5):

- Location
- Type of cover (stage of development)
- Thickness
- Percent cover

RESULTS

Current Network : 2010-2012

More than 1000 observations collated by :

- 70 volunteers from 22 organizations on 23 rivers

Data obtained :

- Ensured an efficient monitoring of didymo
- Optimized sampling site location
- Valuable information for building a conceptual model on the growth, persistence and removal of didymo blooms

Standard Crop Index (Kilroy & Bothwell, 2012)

$$SCI = thickness \times \% cover$$

Upcoming work

Database offers wide range of analysis for comparison across landscapes. International datasets can also be compared via this standardized method.

VOLUNTEER NETWORK BOOKLET

Easy to Use

- Bilingual
- Step by step data collection protocol
- Photo guide with various didymo cover to help determine % cover
- Contact info for questions
- Waterproof data collection charts

Training

- Information session
- Data training protocol
- "In the field" assessment
- How to identify didymo and quantify its presence

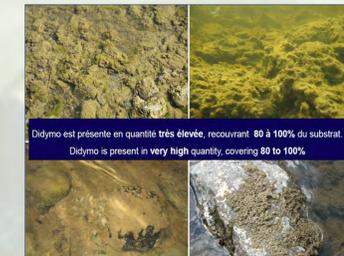


Figure 3
Photo guide to help determine the extensiveness of didymo



Figure 4
Didymo Training session with a group of volunteers

CITIZEN SCIENCE: USEFULNESS OF PPSR METHODS

This effort of Public Participation in Scientific Research (PPSR) enables :

- Community involvement in protecting natural resources, essential to their local economy
- Robust datasets collected by the volunteer network throughout multiple watersheds. Covering this extensive territory would not be possible by scientists or field staff alone.
- Public participation is key in achieving conservation outcomes in this case. By involving them, we achieve a higher success of awareness-building.

DATE:	LIEU/LOCATION:	GPS:
TYPE DE PROLIFÉRATION / TYPE OF COVER:		TAPIS / MAT <input type="checkbox"/> SPHÈRES / TUFTS <input type="checkbox"/>
OBSERVATIONS:		POURCENTAGE DE RECOUVREMENT / PERCENT COVER
ÉPAISSEUR / THICKNESS:	AUCUN NONE 0%	TRÈS FAIBLE VERY LOW 0% - 20%
	FAIBLE LOW 20% - 40%	MOYEN MEDIUM 40% - 60%
	ÉLEVÉ HIGH 60% - 80%	TRÈS ÉLEVÉ VERY HIGH 80% - 100%
NOM / NAME:		

Figure 5. Data Collection Chart

Testing the DIDYMO CONCEPTUAL MODEL

In recent years, didymo has expanded its distribution worldwide. This may be due to an increasing tolerance to environmental variables. A conceptual model (fig. 6) had been developed to link possible controlling variables and understand factors playing a role in didymo establishment, growth, persistence and removal as well as defining the habitat window (fig. 7).

The investigation of didymo spatial patterns in Québec, with the volunteer network, contributes to the conceptual model by:

- Consolidating **current knowledge**
- Presenting **testable hypotheses** to shape the design and implementation of future studies
- Guiding the **collection of appropriate data**
- Providing a basis for **developing models** to be used to improve our understanding and facilitate prediction and management of future blooms

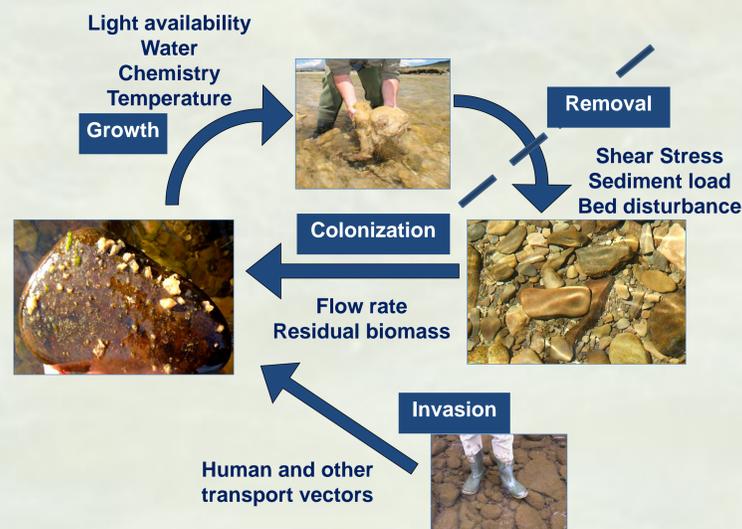


Figure 6. Schematic of proposed conceptual model presenting colonization, growth and removal of didymo blooms (Cullis *et al.*, 2012)

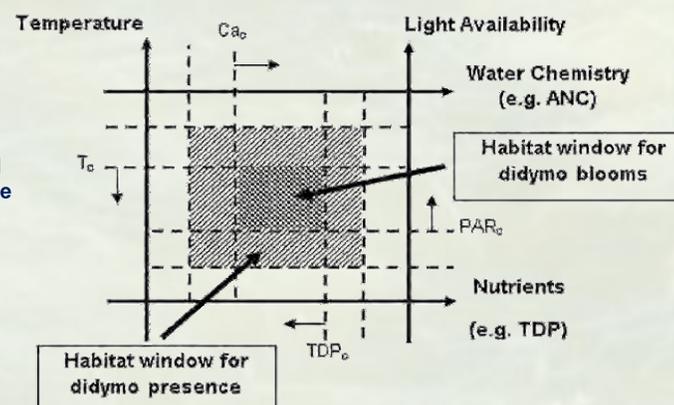


Figure 7. Example of a proposed habitat window describing the potential for *D. geminata* to be present in a stream as well as the potential for nuisance blooms to form, as defined by a set of as yet unconfirmed and unknown potential critical requirements for temperature (T_c), light availability (PAR_c), water chemistry represented by acid neutralizing capacity (ANCC), and nutrient concentrations (TDP_c). (Cullis *et al.*, 2012)

REFERENCES

- Cullis, J. D. S., C.-A. Gillis, M. L. Bothwell, C. Kilroy, A. Packman, and M. Hassan (2012), A conceptual model for the blooming behavior and persistence of the benthic mat-forming diatom *Didymosphenia geminata* in oligotrophic streams, *J. Geophys. Res.*, 117, G00N03, doi:10.1029/2011JG001891.
- Gillis, C.A. & A. Provencher St-Pierre, 2010. Volunteer Guide – Didymo Algae, Guide de poche bilingue à l'intention du Réseau de Capteurs Citoyens dans le cadre du projet de recherche: Évaluation de l'impact de la présence de l'algue *Didymosphenia geminata* sur le saumon atlantique juvénile dans le bassin versant de la rivière Restigouche, 30 p.
- Gillis, C.A. et M. Chalifour, 2010. Changes in the macrobenthic community structure following the introduction of the invasive algae *Didymosphenia geminata* in the Matapédia River (Québec, Canada), *Hydrobiologia*, vol. 647 (1); 63-70.

ACKNOWLEDGEMENTS

To all the volunteers, from Mitis to Malbaie, to Edmundston. Quality data was collected in partnerships with many stakeholders weary of Atlantic salmon conservation and local economy. Financial support was provided by M. Gaston Lepage through his donation to the Fondation de l'Université du Québec (FUQ), the Atlantic Salmon Conservation Foundation (ASCF) as well as the New-Brunswick Wildlife Trust Fund (NBWTF).