Post-Transport Migration and Habitat Use by Atlantic Salmon

Frechette, D.[1], Bergeron, N.[1] & Dionne, M.[2]

(1) Institut National de la Recherche Scientifique (INRS), QC, Canada; (2) Ministère des Forêts, de la Faune et des Parcs, QC, Canada

Emergence of *D. geminata* as an Ecologically Disruptive Diatom

Gillis, C-A. & Bergeron, N.

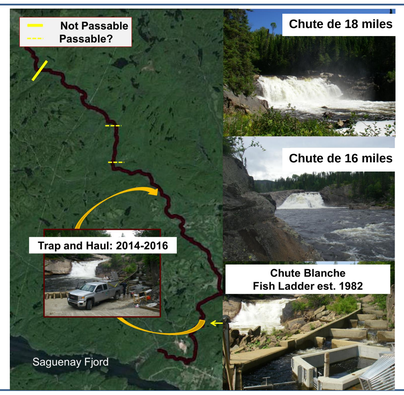
Institut National de la Recherche Scientifique (INRS), QC, Canada;

CONTEXT AND RATIONALE

Assisted migration (A.M.) is used to enable fish to bypass barriers to migration (e.g. hydroelectric dams, natural falls) via fishways or translocation. There is increasing interest in using A.M. of adult Atlantic salmon as an alternative to hatcheries for population enhancement in Québec. Population enhancement via assisted migration is based on the hypothesis that increasing available habitat will decrease spawner density, thereby reducing density dependent effects on offspring growth and survival

Understanding how adults use habitat after transocationis essential in assessing translocation as an enhancement strategy because the distribution of breeding adults directly affects juvenile densities.

The objective of this study is to assess habitat use and migratory behavior of adult Atlantic salmon following transport in a translocation program in the Nord-Est Sainte-Marguerite River (Quebec)

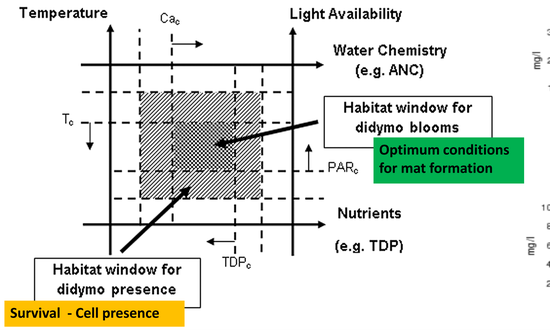


WHAT IS DIDYMO?

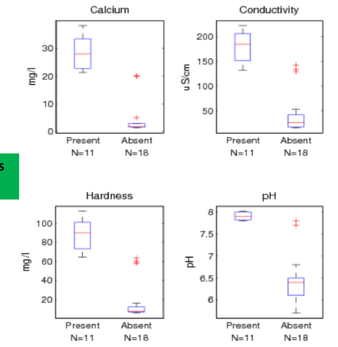
D. geminata is a stalk-forming diatom that, under oligotrophic conditions, produces thick and extensive mats in rivers and streams. Previously, considered a rare taxa, this alga is now common and prevalent in Atlantic salmon rivers of Gaspesie.

Didymo cell and stalks | Didymo benthic mats

HABITAT WINDOW



HABITAT SUITABILITY

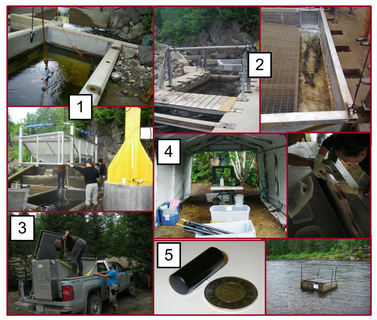


METHODS

Salmon entering the fish ladder at Chute Blanche were: (1) diverted into a retention cage for holding until transport or (2)captured by net from the entrance cage and immediately transferred to the transport truck (3).

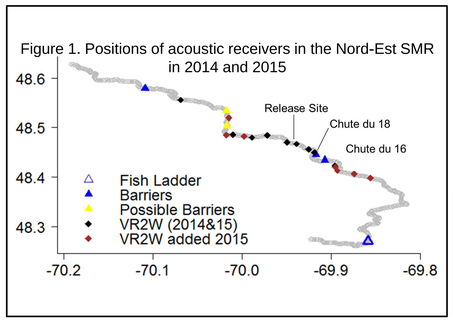
Upon arrival at the release site (4), an acoustic tag (Vemco V13; 5) was surgically implanted (6) and fish were allowed to recover in river (7).

- 2014: 12 adults (2F, 10M) were transported (total run size: 148)
- 2015: 25 adults (12F, 13M) were transported (total run size: 92)



A combination of active (8) and passive acoustic telemetry (9) is then used to track movements of tagged fish following release. Spawning site location is identified using visual surveys and telemetry data.

Figure 1. Positions of acoustic receivers in the Nord-Est SMR in 2014 and 2015



RESULTS

- In general, males moved substantially more than females (Fig. 2)
- But there was considerable variation among individuals (Fig. 3)
- Spawning activity occurred in the same stretch of river during 2014 and 2015

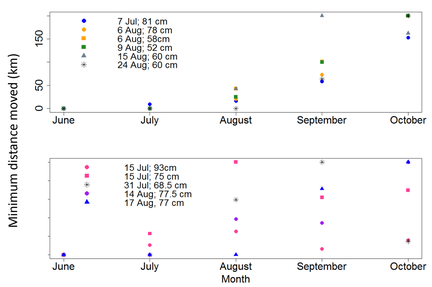


Figure 2. Minimum distance moved per month (km) by females (top panel) and males (bottom panel) that remained in the study area until spawning (2015). Note the different y-axes.

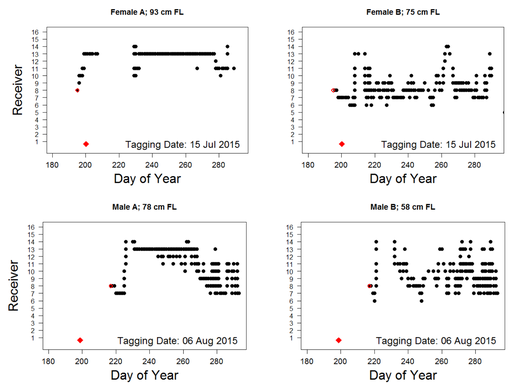


Figure 3. Movement patterns of representative females (top panels) tagged on 15 July and males (bottom panels) tagged on 6 Aug.

FUTURE WORK

- Complete a third and final year of transport and telemetry in 2016
- Analyze movement data with respect to river temperature, discharge, time of day, fish size and sex.
- Compare spawning site distribution among years
- Evalute effects of spawning site distribution on growth of offspring.

REFERENCES

Anderson et al. 2014. *No Am J. of Fish Management* 34:72–93, 2014

Kostow. 2009. Rev Fish Biol Fisheries 19:9–31

Pess et al. 2011. Transactions of the American Fisheries Society 140:883–897

ACKNOWLEDGEMENTS

Funding

FQSA Programme de mise en valeur des habitats de la Côte-Nord

NSERC

FRQNT Programme de bourses d'excellence pour étudiants étrangers

Field Support

Ministère des Forêts, de la Faune et des Parcs: Marc Valentine, Serge Gravel, and Vanessa Cauchon

CIRSA: André Boivin, Francois Caron, Julian Dodson

Zec-Sainte-Marguerite: Valerie Maltais

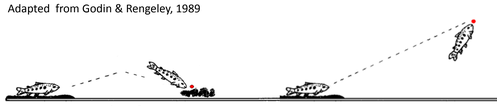
Club de Riviere Sainte-Marguerite

Labo Bergeron: Jean-Baptist Toterotot, Jeremie Isabel, Joannie Carrier

D. geminata's effect on trophic dynamics

The impact of *D. geminata* nuisance growths may therefore be variable across landscapes and seasons

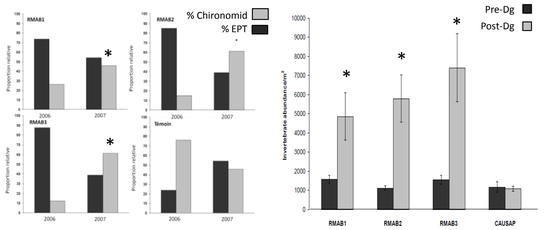
- Successional stage
- Extent of cover
- Mat thickness
- Duration (persistence)



Primary producer | Secondary producer | Consumer

D. geminata's effect on secondary producers

Macro-invertebrate community sampling effort in pre-didymo and post-didymo-affected sites

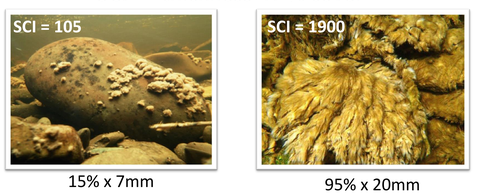


Didymo presence alters BMI community structure

Didymo presence increases overvall BMI densities – *Smaller taxa*

Mat Severity: Standing Crop Index (SCI)

SCI = *thickness* X *% cover*



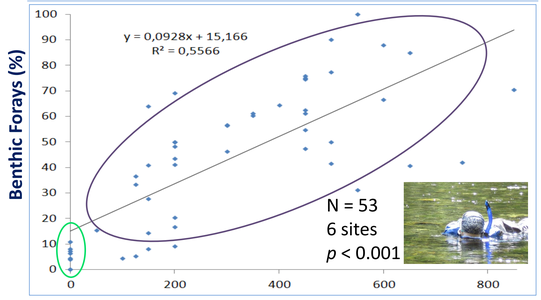
15% x 7mm | 95% x 20mm

Potential effects on foraging behaviour

Since the macrobenthic community composition is altered, foraging behavior will most likely shift from drift to benthic

D. geminata's effect on foraging behavior

Proportion of benthic forays as a function of didymo cover



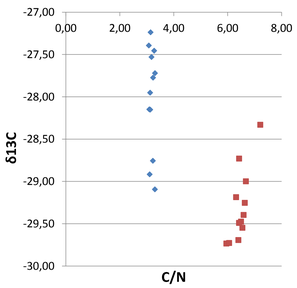
In **didymo-free** sites, drift feeding is the dominant behaviour

↑ Proportions of benthic forays with ↑ **didymo cover**

Foraging behavior altered with **didymo presence**

Disruptive Isotopic shifts and lipid contents

C:N ratios as a proxy for lipid content in relation to didymo presence-absence



In **presence of didymo mats**, $\delta^{13}C$ values of parr muscle tend to be less negative (p <0.001) indicating a greater reliance on smaller prey items such as chironmids, than fish sampled in **didymo-free sites**.

In **presence of didymo mats**, C/N values of parr muscle are significantly low (p <0.001) indicating that lipid contents and diets are depleted compared to fish sampled in **didymo-free sites**

Site fidelity of parr and associated growth

Relocation of PIT-tagged fish using portable antenna

- JAS site fidelity is sustained with increasing Standing Crop Index values (0 → 850)
- JAS daily weight gain is significantly **lower** in **didymo-affected** sites than **didymo-free sites** (p < 0.001)