

Rock snot and river congestion: What are the causes and consequences of blooms of *Didymosphenia geminata*

David C. Richardson,
Ph.D.

Cary Institute of Ecosystem Studies
SUNY New Paltz, Biology Dept.

Timothy J. Hoellein,
Ph.D.

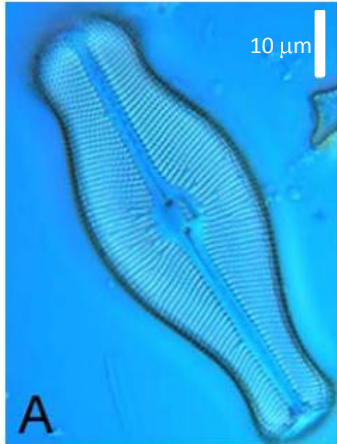
Baruch College, Dept. of Natural Sciences



Outline

- What is *Didymosphenia geminata* (Didymo)?
- Where is Didymo?
- What are the consequences of blooms?
- What causes blooms of Didymo?
- What are management options?
- Future work on Didymo

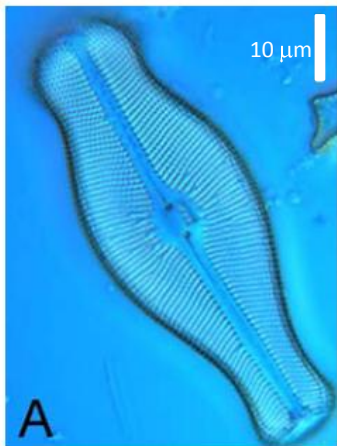
Didymosphenia geminata



Stream and river benthic diatom
aka Didymo

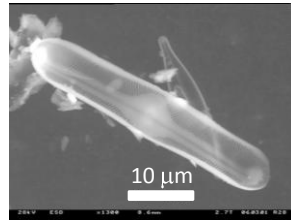
Spaulding et al. 2007

Didymosphenia geminata



Larger than most other diatoms

Spaulding et al. 2007



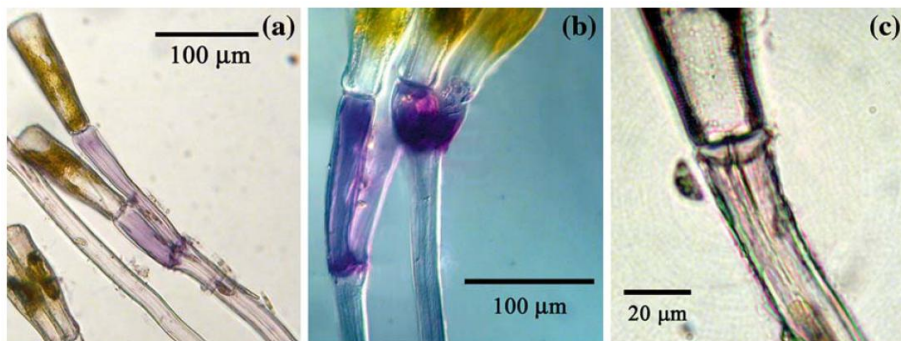
Richardson et al. 2009

Grows on stalks

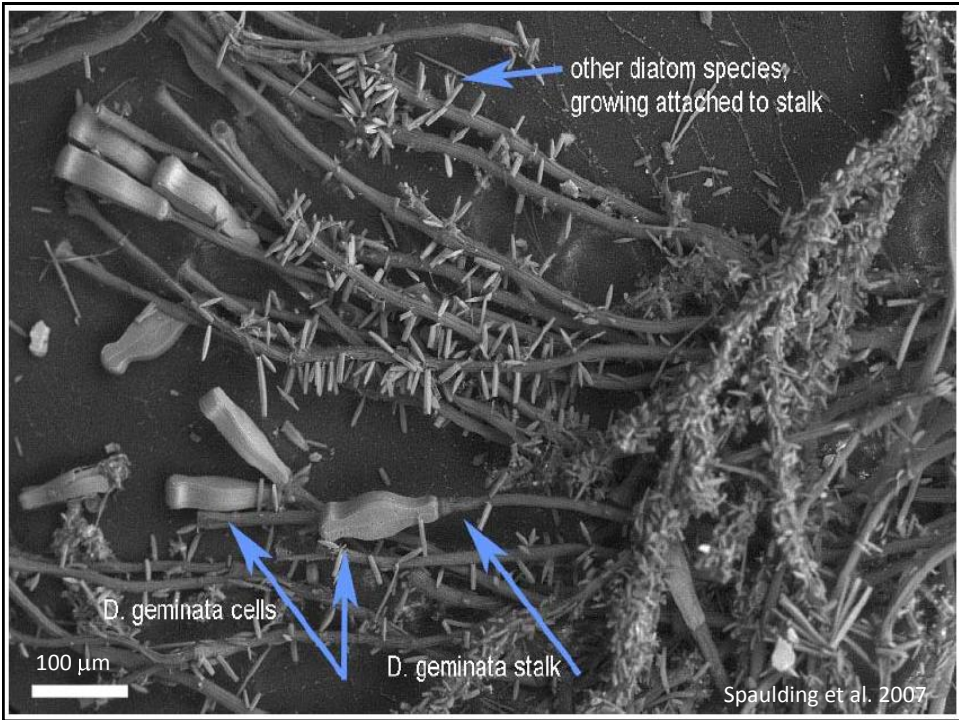


www.rwaa.us/photos/Battenkill_06_diatom.jpg

Stalks



- Organic phosphorus hydrolyzed in stalk
- Inorganic P travels to cells through stalk
(Ellwood and Whitten 2007)



Rock spot!



Amy Smagula, NYDES



Consequences of Didymo blooms

In New Zealand

- Commercial eel fisheries ↓
- Biofouling of municipal, industrial and agricultural water intakes
- Decrease drinking water quality
- loss of local recreation values

(Biosecurity New Zealand)

Consequences of Didymo blooms

- Increase algal biomass
- Capture sediment and other debris
- Macroinvertebrates in NZ (Kilroy et al. 2009)
 - Higher densities of oligochaetes (aquatic worms), chironomids (fly larvae)
 - Characteristic of lower water quality
 - No change in overall diversity

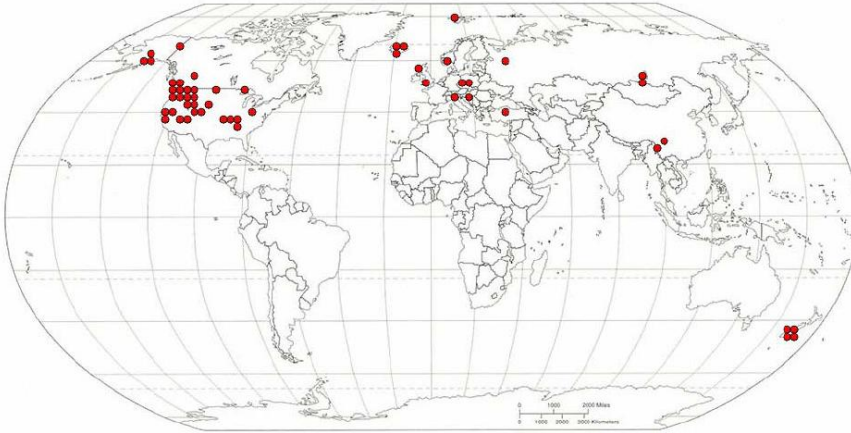
Consequences of Didymo blooms

- Not much known about the ecosystem level impacts
- Could negatively impact fish
 - loss of benthic habitat

Where is Didymo?

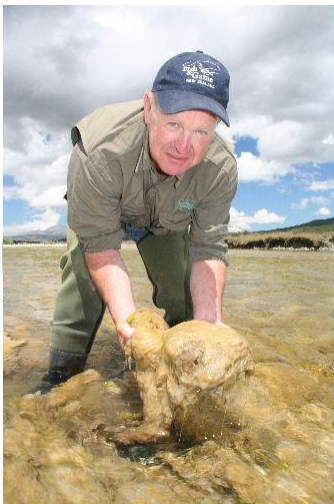
- Native to North America, Europe
 - Record in Vancouver in 1890s
 - U.K. for over 150 years
- As recent as 1975, only one state (Va) was reported as Didymo distribution
- Within the past 20 years, spread all over the world

Global Distribution



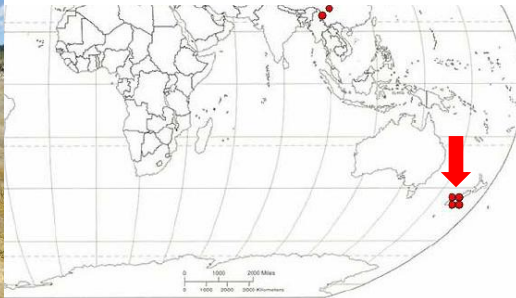
Spaulding et al. 2007

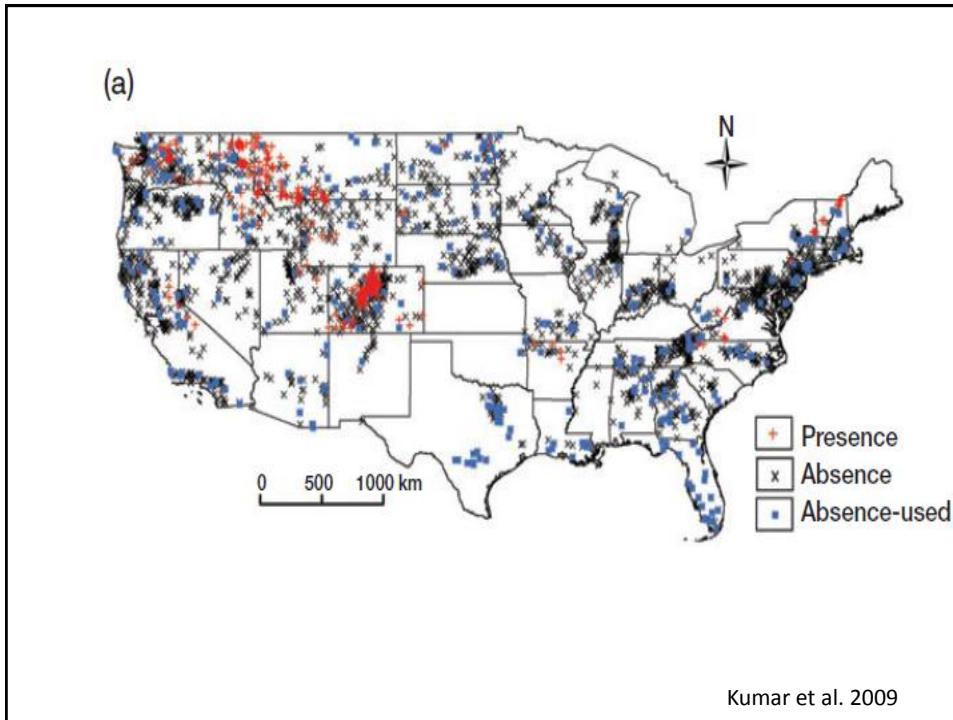
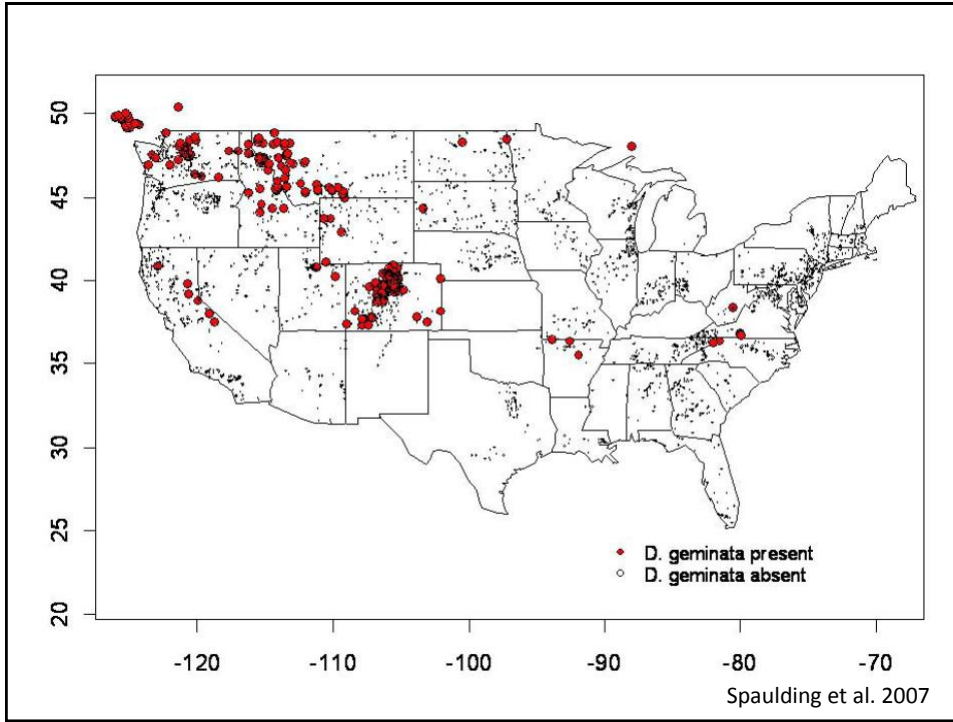
Global Distribution



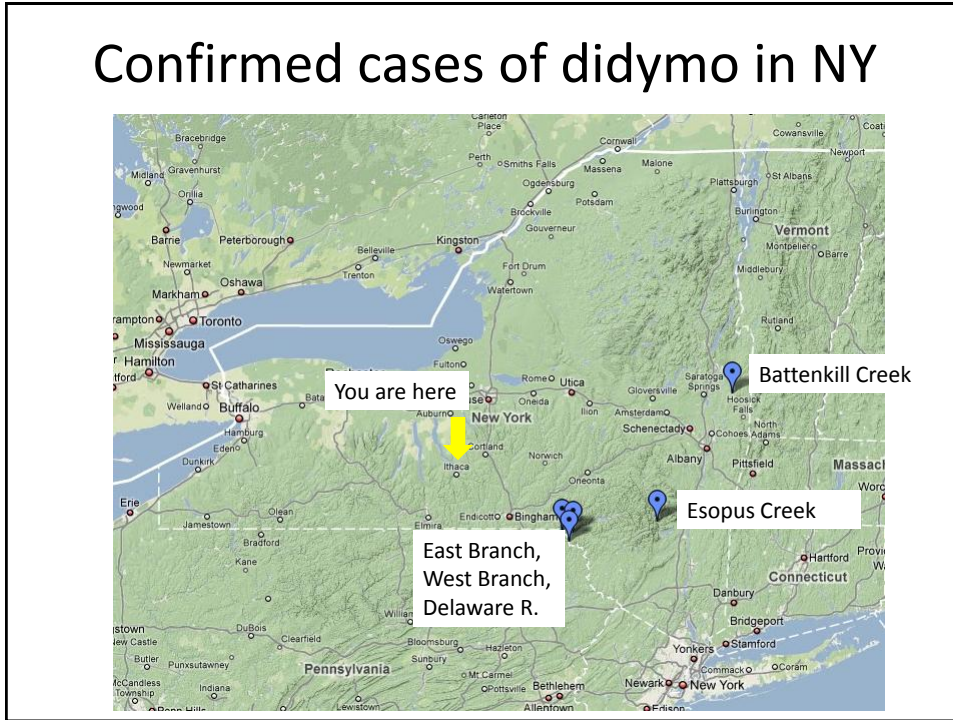
Sporting Life, New Zealand

- Record starts in 2004
- New Zealand spending between \$58 million and \$285 million over the eight years 2004/05 to 2011/12

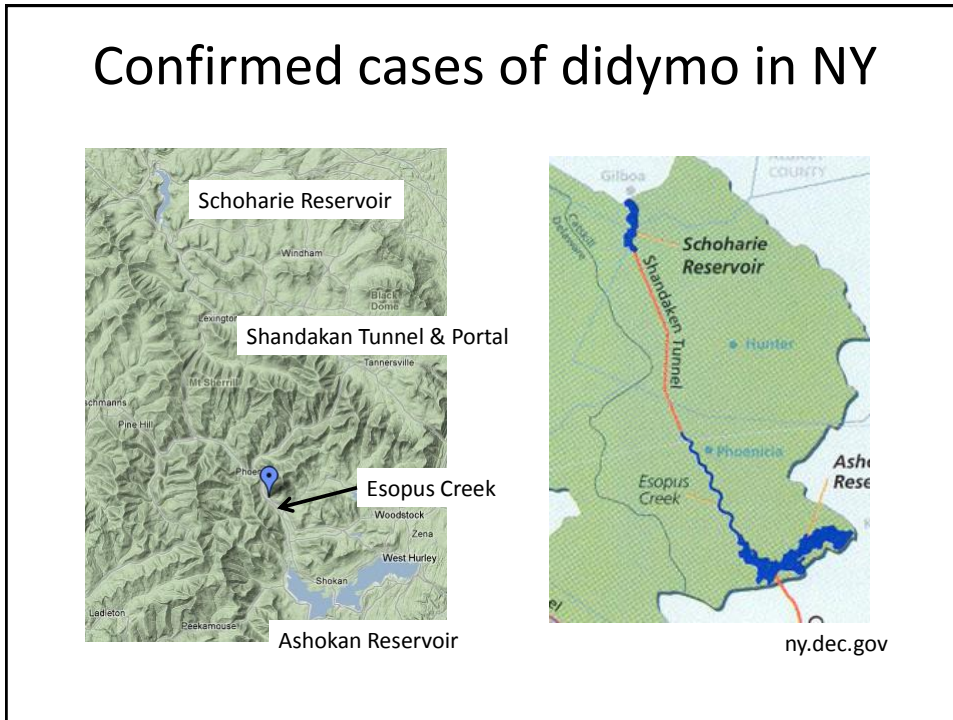




Confirmed cases of didymo in NY



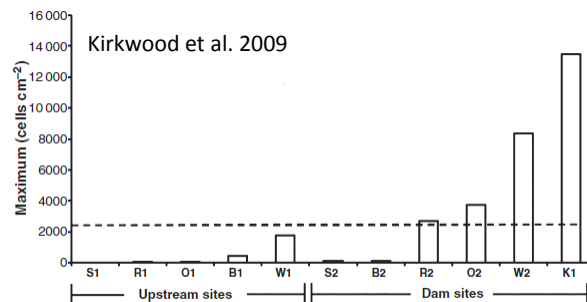
Confirmed cases of didymo in NY



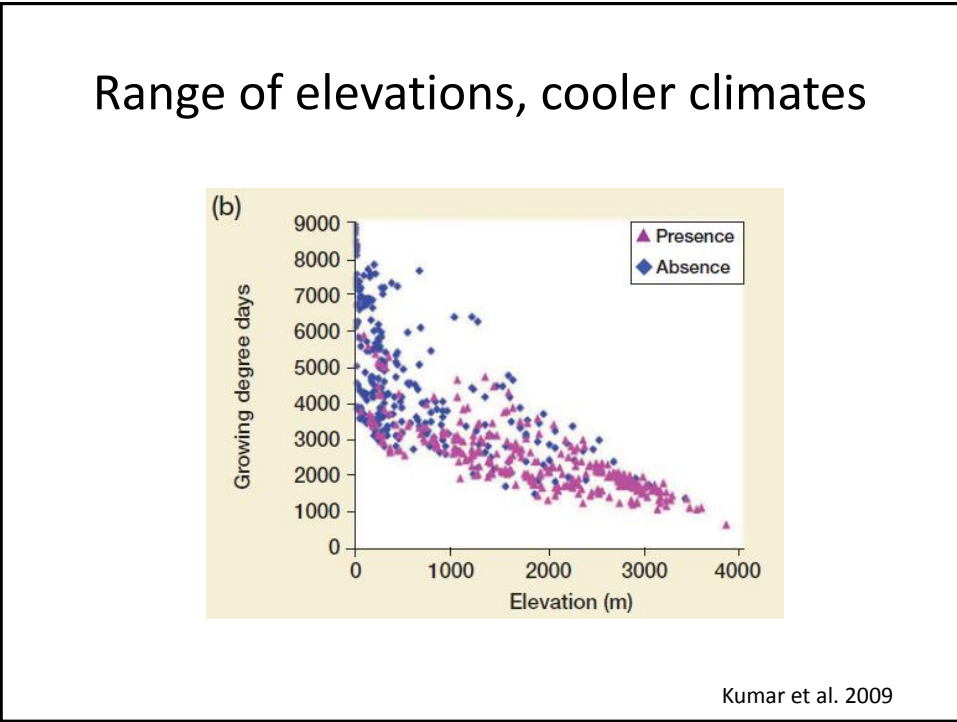
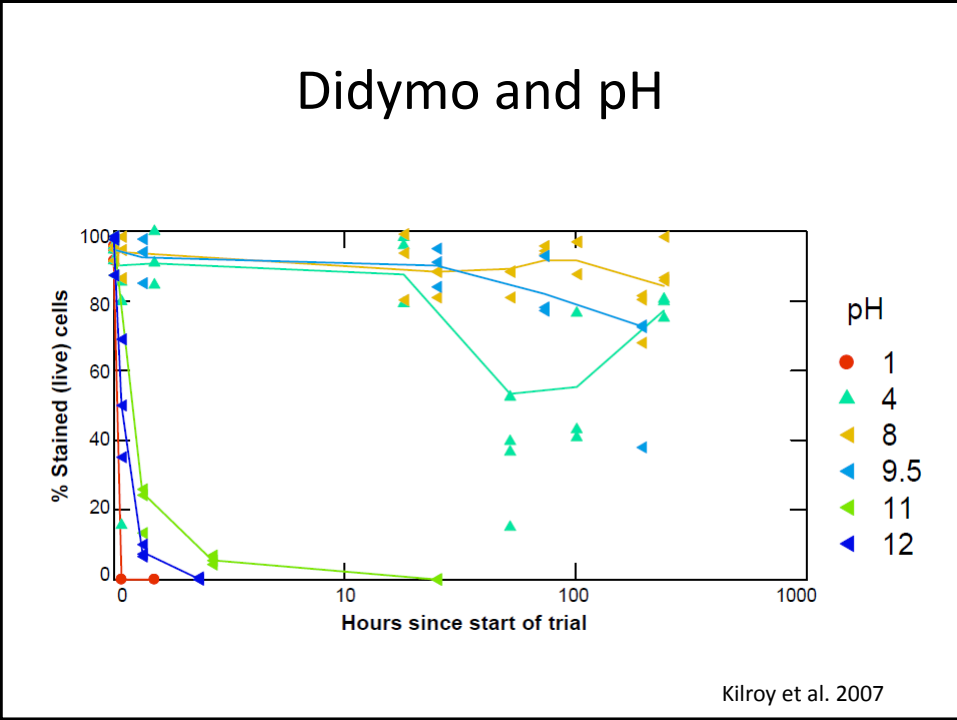
What causes Didymo blooms?

- Hydrology
- Water chemistry
- Climate, land-use
- Other?

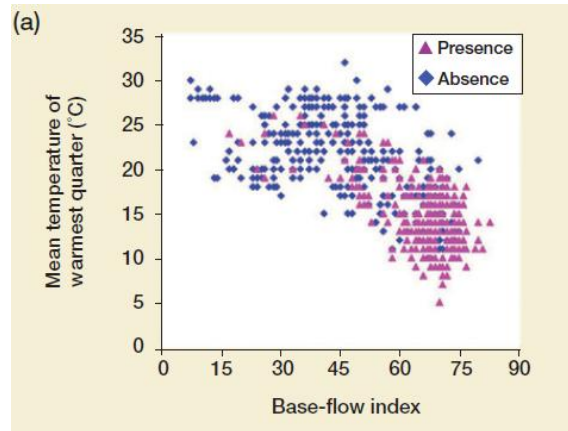
Geographical locations



- Most invasion sites in the NE United States (NY, MD, NH) are downstream of reservoirs
- Could be hydrology (low mean discharge, low variation in discharge, shallow streambed gradients – Miller et al. 2009)
- Could be temperature
- Could be chemistry (pH? Sulfate? Phosphorus? Nitrogen?)



Cooler temperatures, lower variation in flow

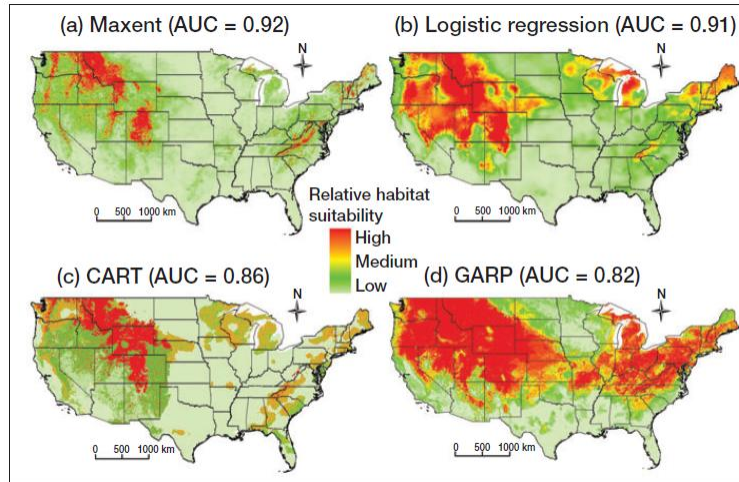


Kumar et al. 2009

Other?

- Genetic mutation of the cell?
 - Drs. Tim King (USGS) and Don Hamilton (NPS)

Predicted ranges of suitable habitat



Kumar et al. 2009

Management options

- Transported easily in felt-soled waders

Gunpowder Falls, MD



<http://www.onearth.org/blog/whats-happening-on-earth/what-to-do-about-didymo-help-protect-against-%E2%80%9Crock-snot%E2%80%9D>

Decotaminating Didymo

- Soak and scrub ~1 minute in a 5% solution of:
 - salt
 - household antiseptics (chlorhexidine or chloroxlylenol based)
 - detergent
 - NO EFFECT for borox, other green cleaners
 - Ethanol (higher concentrations)
- Soak and scrub ~1 minute in a 2% solution of household bleach
- Hot water for ~2 min, to a final temperature of at least 60 °C.
- For swimmers
 - allow hair to dry completely
 - shampoo > 1 minute and rinse with warm/hot water
- For large items
 - desiccate completely by drying for an extended period of time
 - >48 hours *after all parts of the item* appear to be dry

Kilroy et al. 2006

Post signs at fishing entry points

DON'T SPREAD DIDYMO
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CHECK: Before leaving a river's edge, look for clumps of algae and sediment, and remove them. Leave them at the site.

CLEAN: Soak and scrub all gear for at least one minute in a 2% (by volume) solution of household bleach, or a 5% (by volume) solution of salt, or dishwashing detergent. Note that all surfaces must be contacted by the cleaning solution. Water-absorbant equipment (lifejackets, waders) should be soaked to insure they do not remain a risk.

DRY: If cleaning is not practical, after the item is dry to the touch, leave it to dry for at least 48 hours before using in another freshwater system.

Spaulding et al. 2007

Take homes

- Need to know more about the “why” of spread and nuisance blooms
- Need to know about the potential ecosystem and economic effects of Didymo blooms as it spreads to the NE US
- Can take some initial management steps
 - Post signs, cleaning stations, educate fisherman, especially in invaded streams and rivers