

Didymosphenia geminata in Tennessee and North Carolina

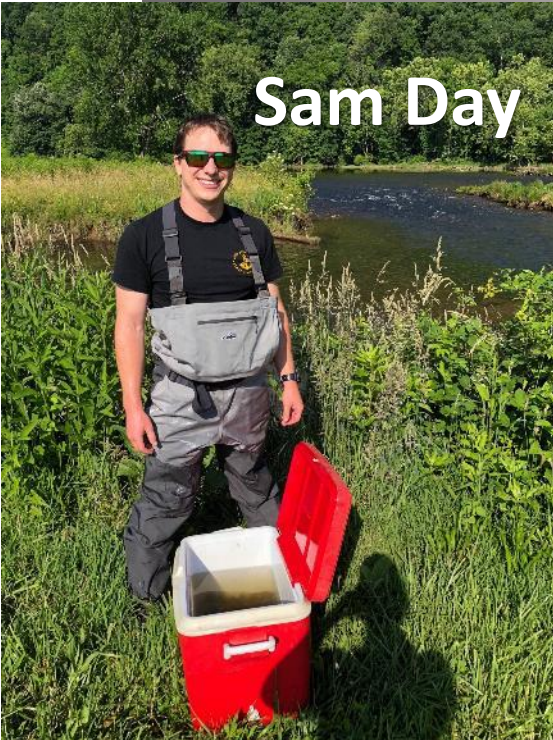
Justin Murdock **Tennessee Tech University**

Great Lakes Panel on Aquatic Nuisance
Species
June 14, 2021

Natalie Knorp



Sam Day



Lucas Hix



Andrea Engle-Bowman

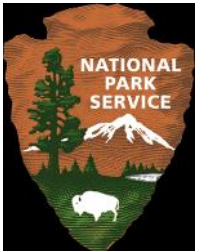


Spencer Womble



Acknowledgements

- National Park Service
- US Fish & Wildlife Service
- Trout Unlimited
- Gulf Coast Marine Fisheries Association
- Tennessee Wildlife Resources Agency
- North Carolina Wildlife Resources Commission
- Duke Energy
- Tennessee Valley Authority
- Tennessee Tech Water Center
- Tennessee Tech USGS Fisheries Cooperative Unit
- US Forest Service
- Matt Kulp, Jake Rash, Jim Habrera, Tyler Baker
- Many undergraduate and graduate students



- **Regional Distribution**
- **Research focus**
 - Causes of cell establishment and mat formation
 - Mat effects on stream food webs
- **Management**

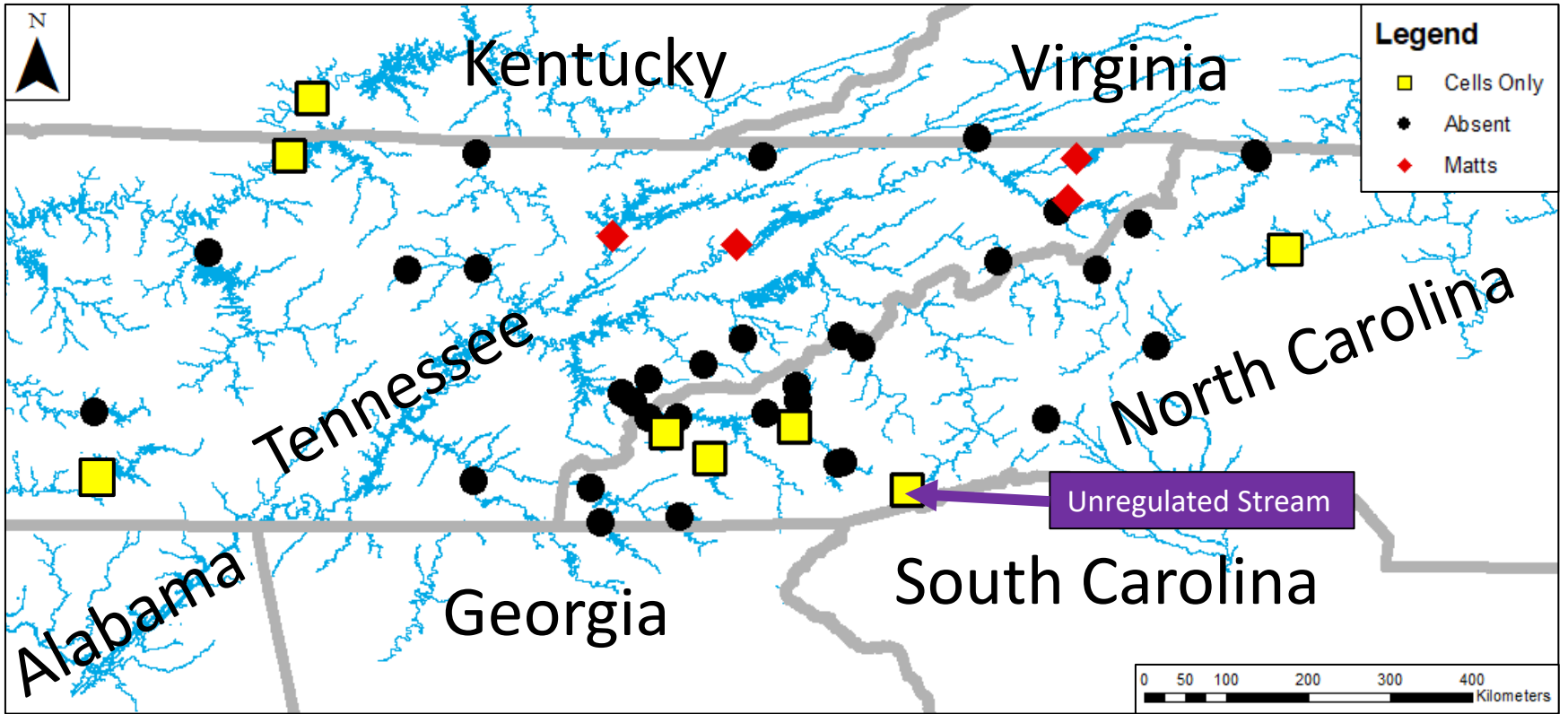


Clinch River, TN

Distribution



South Holston River, TN



Rivers sampled 2015-2019



DIDYMO DISTRIBUTION IN THE SOUTHEASTERN U.S.

Didymosphenia geminata (Didymo) is a single-cell alga (a diatom) that can form thick blooms in streams and completely cover stream bottoms. The cells attach to rocks by long stalks, which can smother stream bottoms and remain after algal cells have died, often littering stream banks and reducing recreation and aesthetic appeal. The magnitude of Didymo's impact on stream health is not clear. Our research has shown that dense mats can alter the macroinvertebrate (bottom-dwelling insects) species composition by changing food availability. Since macroinvertebrates are a major food source for trout in Southern Appalachian Mountain streams, there is concern that Didymo may reduce the quality of fish populations and therefore harm trout fisheries as well as non-sport and native fish species.

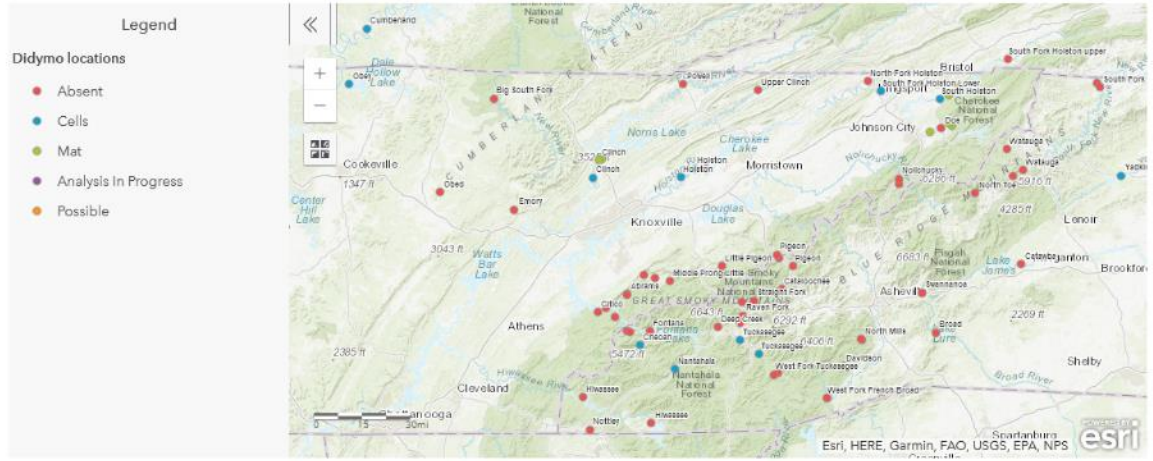
Didymo was first identified east of the Mississippi River in Tennessee in 2004. To date, it has only been found in streams below dam tailwaters in Tennessee, but a single cell was found in a free flowing section of the North Fork French Broad River in North Carolina in 2018. To date, no mats have been observed in North Carolina, but more surveys are needed to better understand the current distribution of didymo in the region to better predict where mats may occur in the future.



This project is supported by investments from Tennessee Tech's Center for the Management, Utilization, and Protection of Water Resources, Trout Unlimited, North Carolina Wildlife Resources Agency, and Duke Energy.

Map of Didymo Distribution in Tennessee and North Carolina

Markers denote locations of samples submitted by community volunteers and sampling by Tennessee Tech.



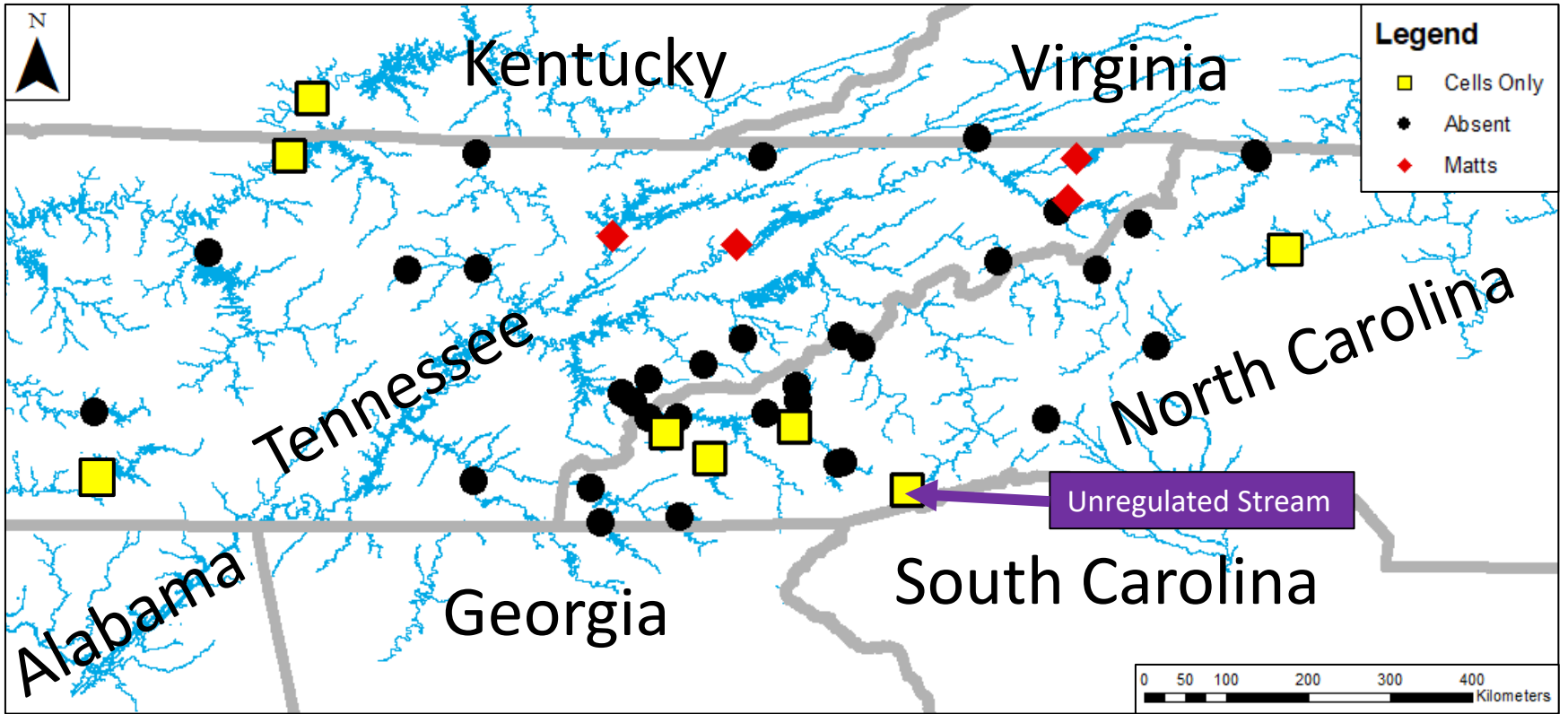
SUBMITTED SAMPLES

Site	Sample Result	Collected By	Collection Date
Watauga River, NC	Absent	Jacob Rash	8/8/2019
Watauga River, NC	Absent	Jacob Rash	8/8/2019

<https://sites.google.com/view/didymocommunityscience/home>

Cells vs. Mats

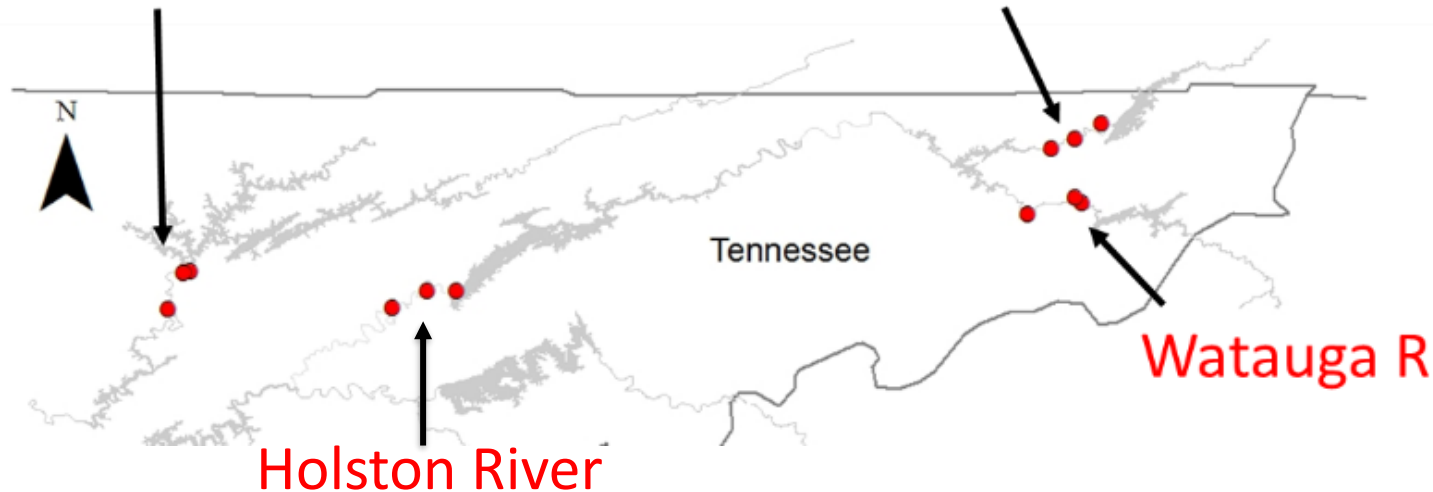




Rivers sampled 2015-2019

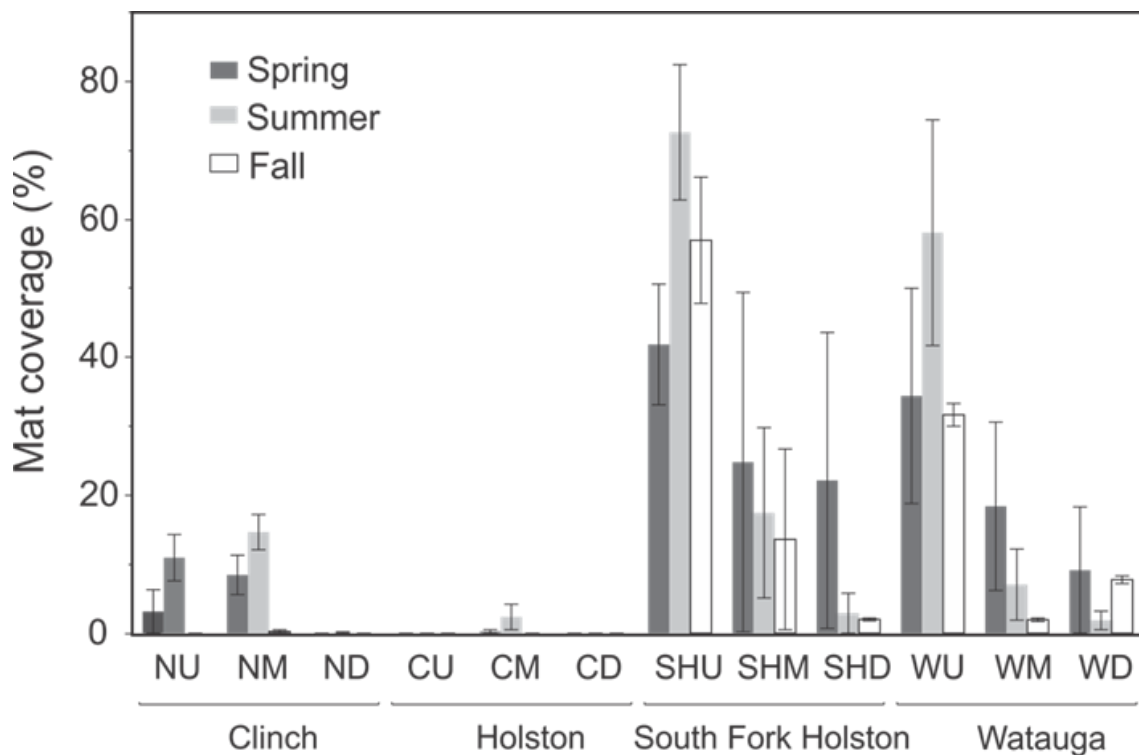
Clinch River

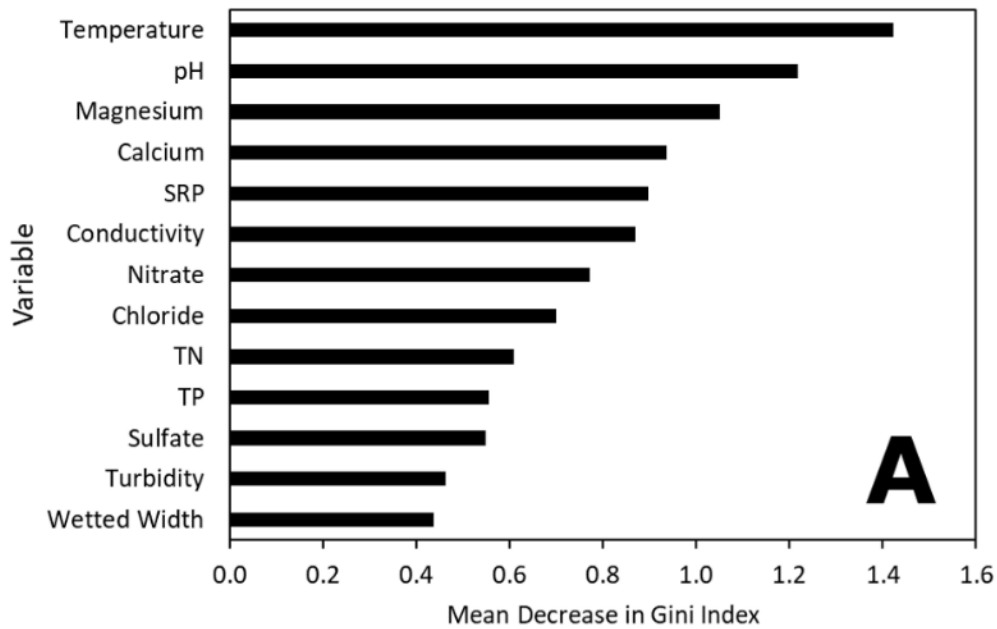
South Holston River



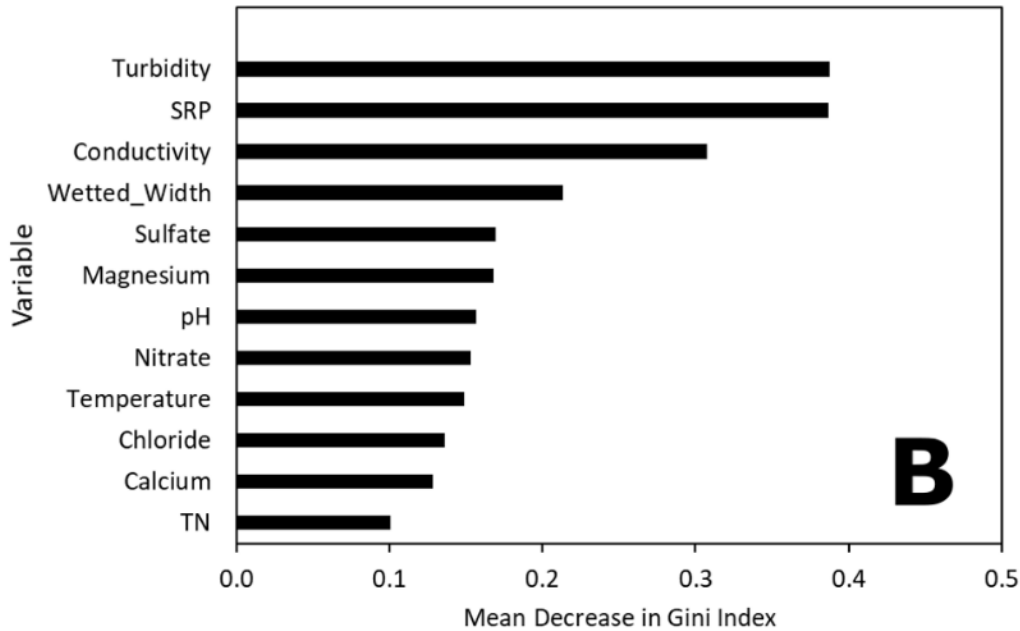
Holston River

Watauga River



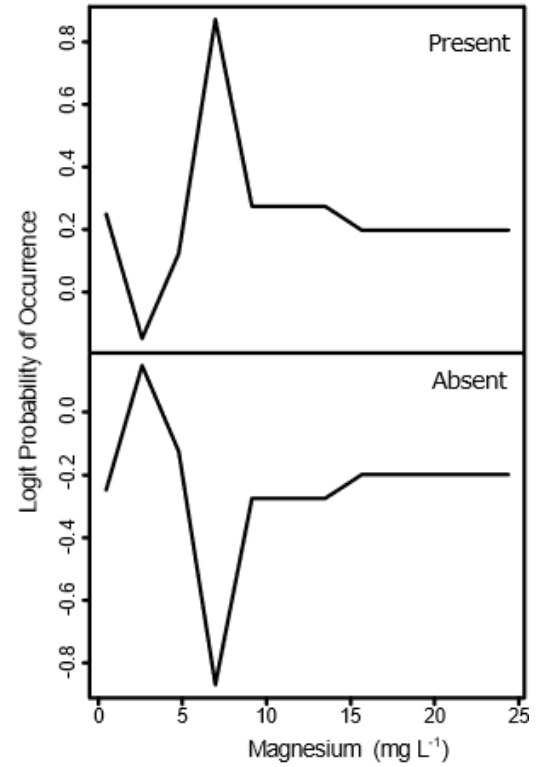
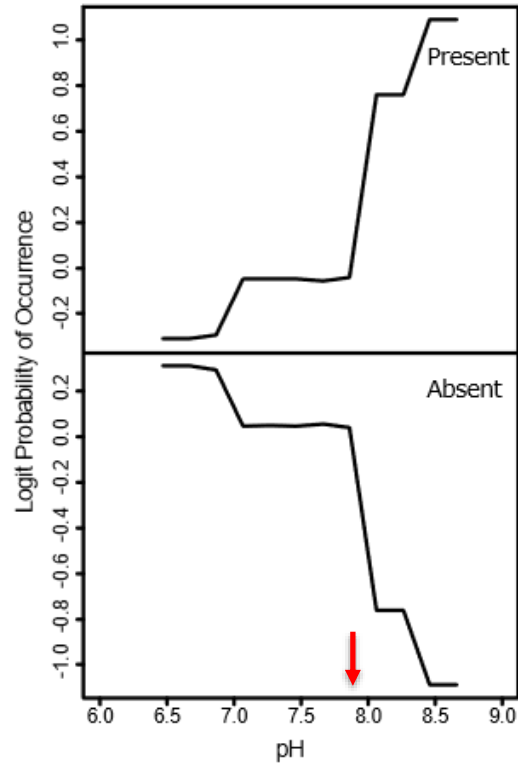
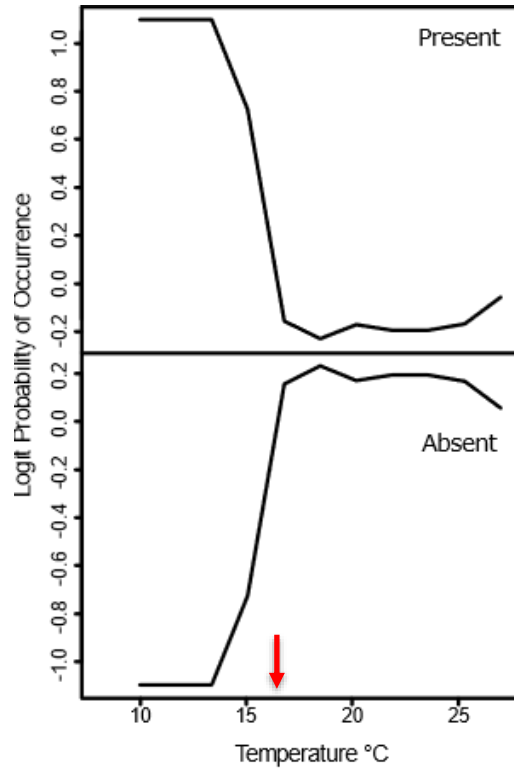


Cell presence

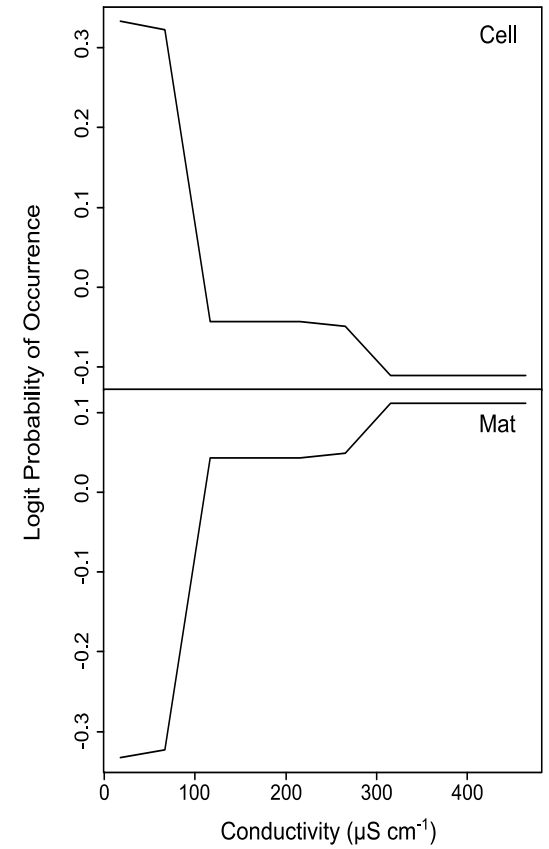
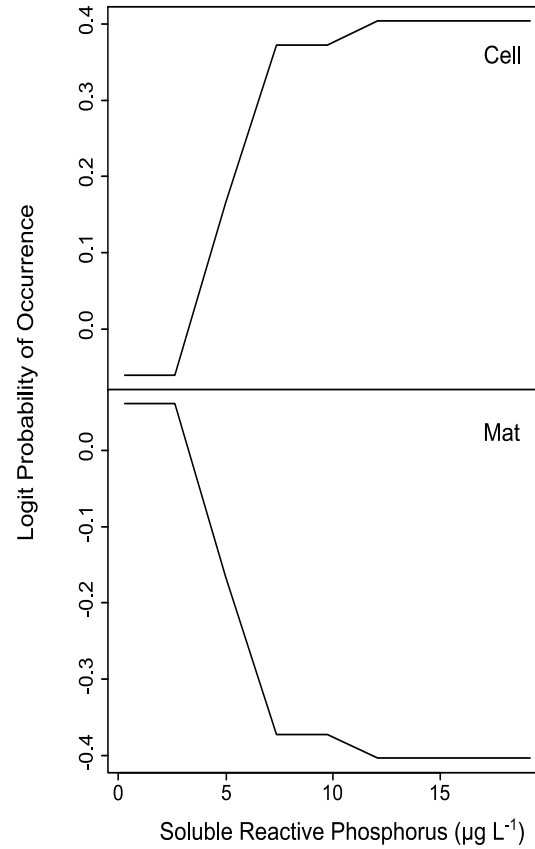
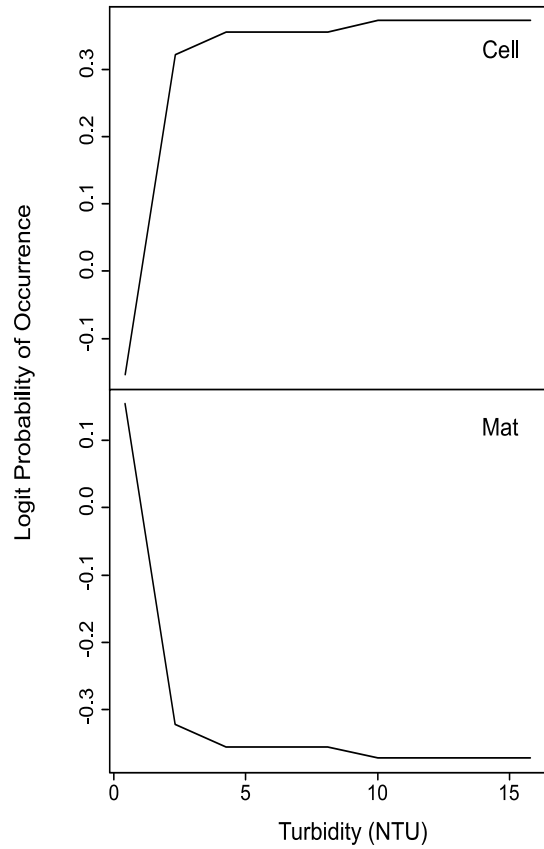


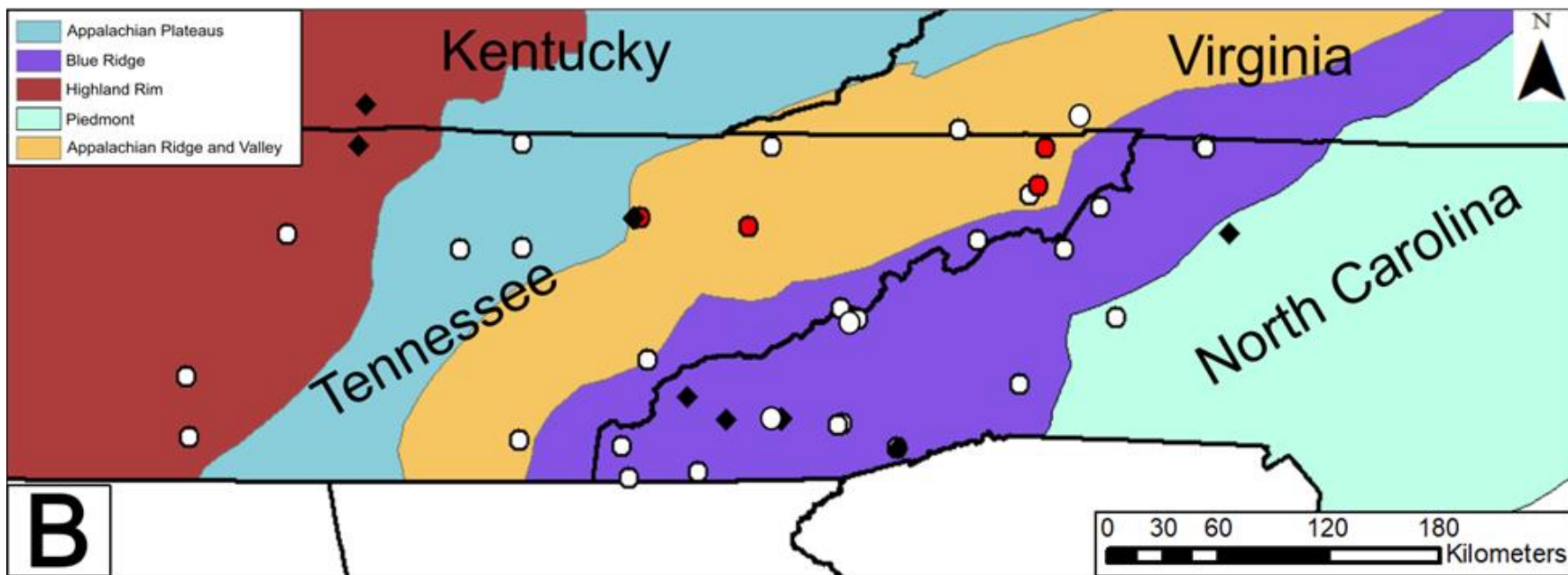
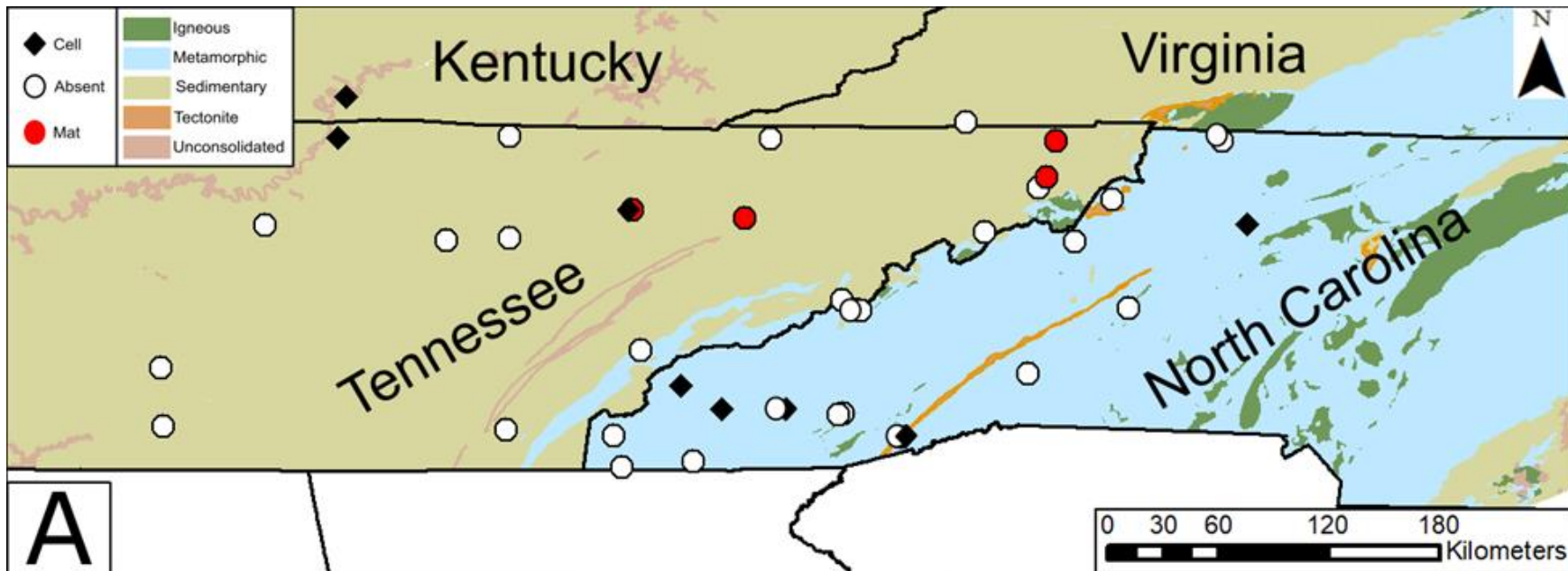
Mat presence

Cell presence



Mat presence





Ecosystem Impacts

A photograph showing a dead animal, possibly a mammal, lying on a bed of green and brown vegetation. The animal's body is covered with numerous dark, elongated leeches, which are clustered primarily on its back and sides. The scene is set in a natural, outdoor environment with various plants and debris visible.

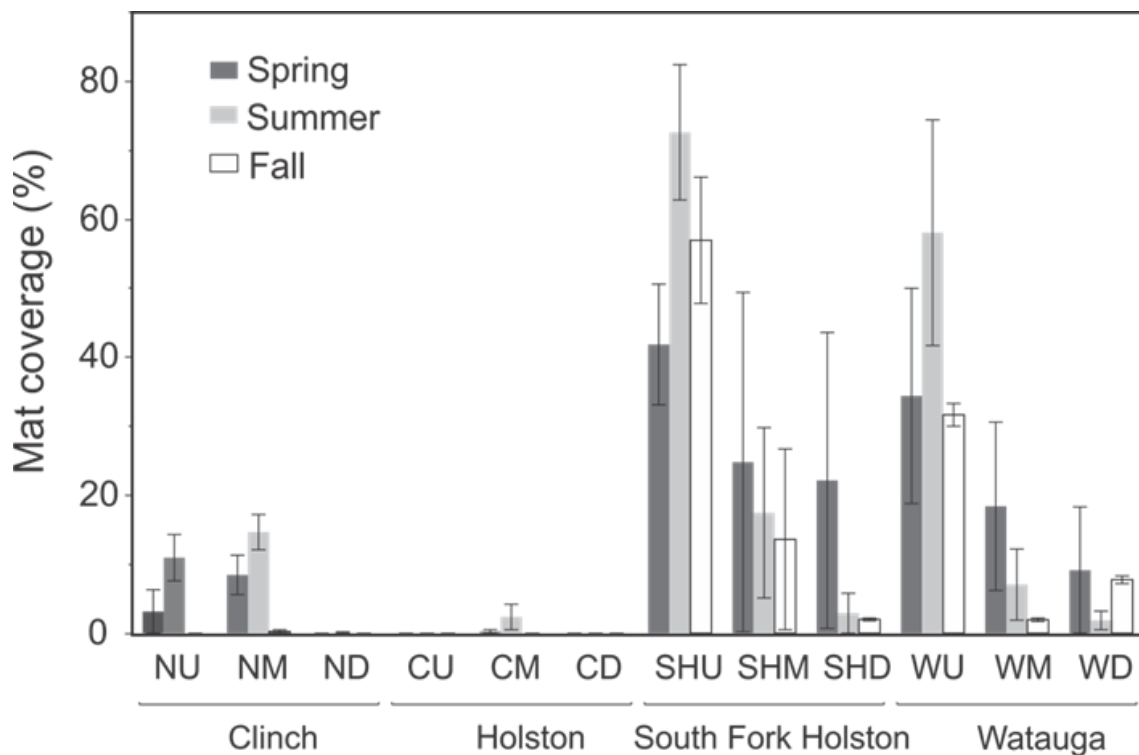
We have not observed large shifts in macroinvertebrates or fishes

Clinch River

South Holston River

Holston River

Watauga River





Does Didymo alter food web structure and/or food resource use of macroinvertebrates and fishes? (stable isotopes and lipids)

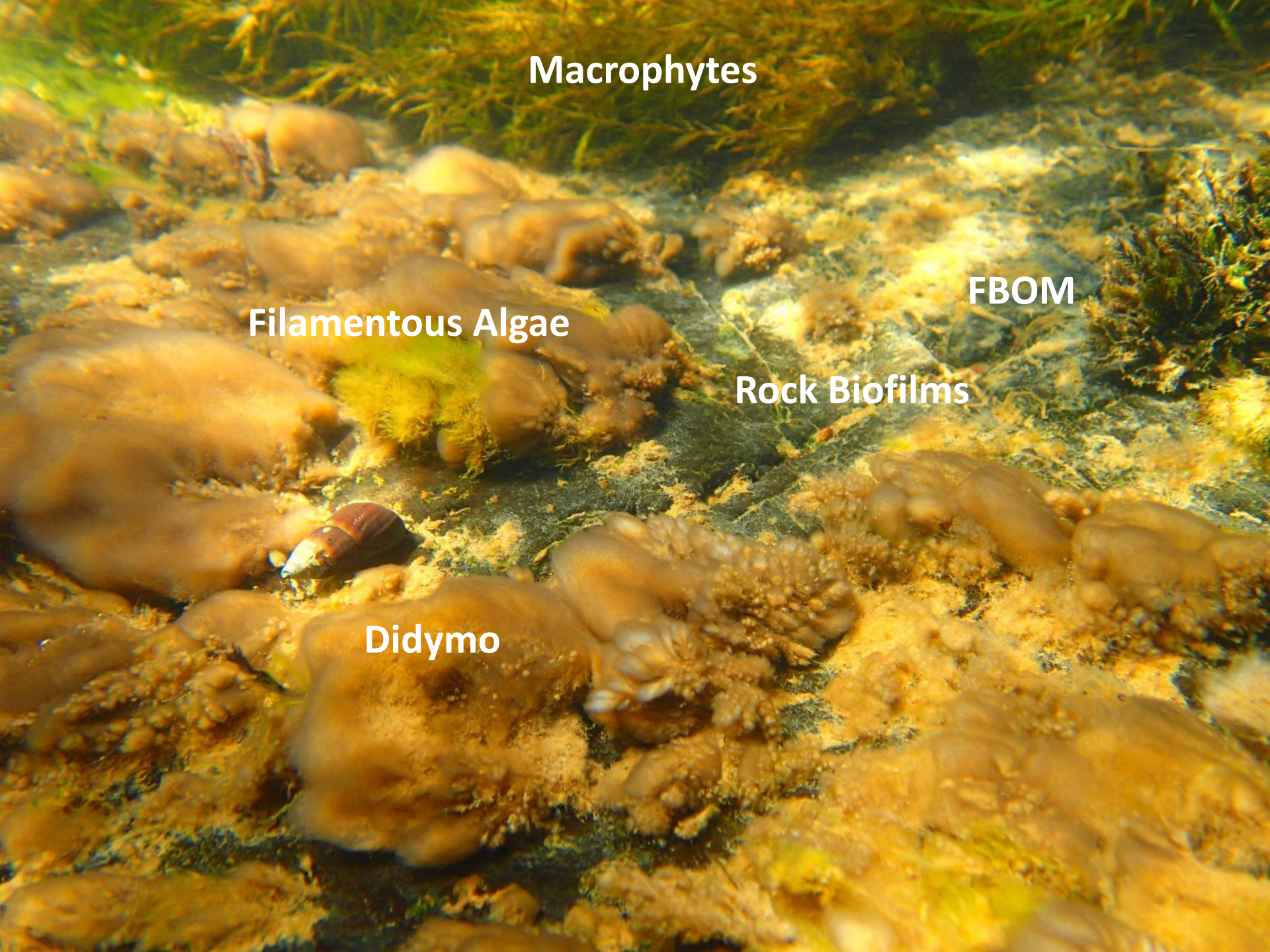
Macrophytes

Filamentous Algae

FBOM

Rock Biofilms

Didymo



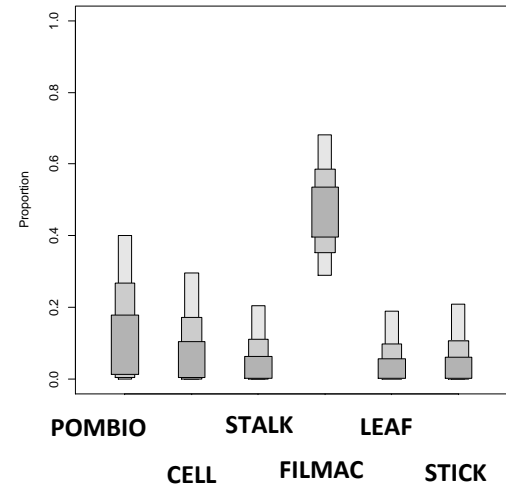
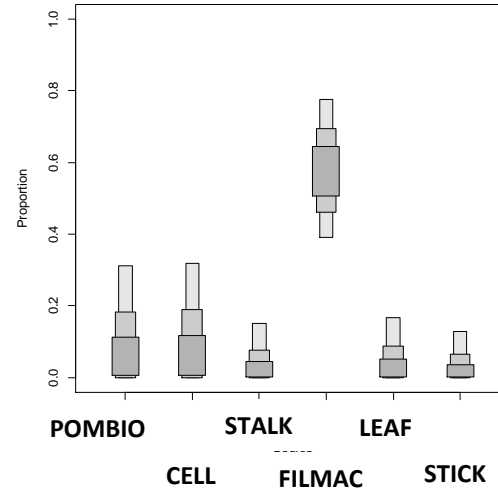
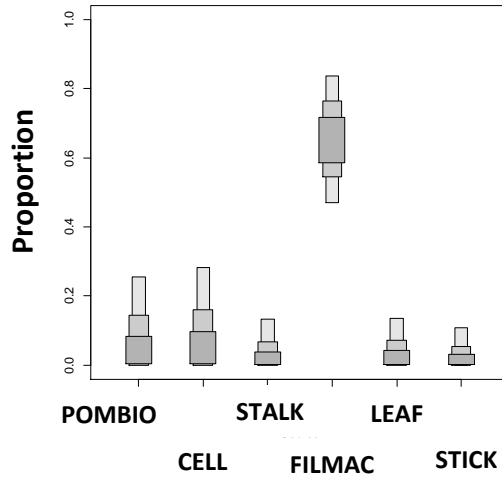
Macroinvertebrate Stable isotope mixing models

Ephemeraella

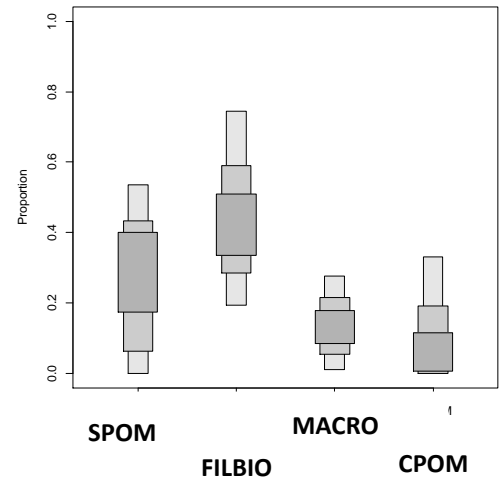
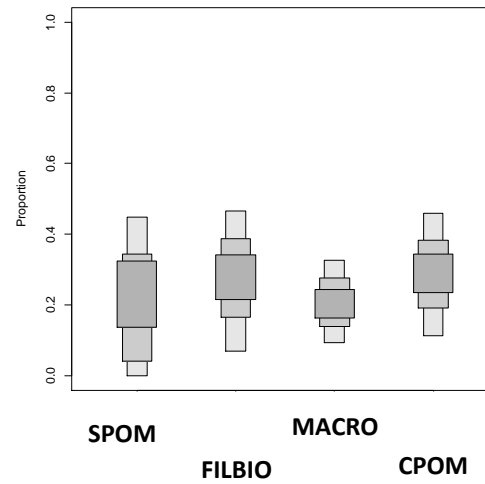
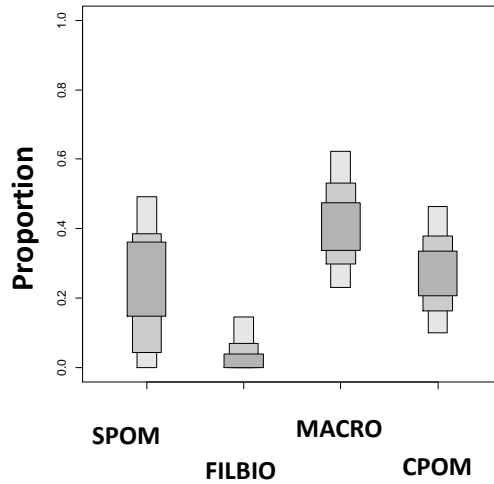
Chironomid

Oligocheate

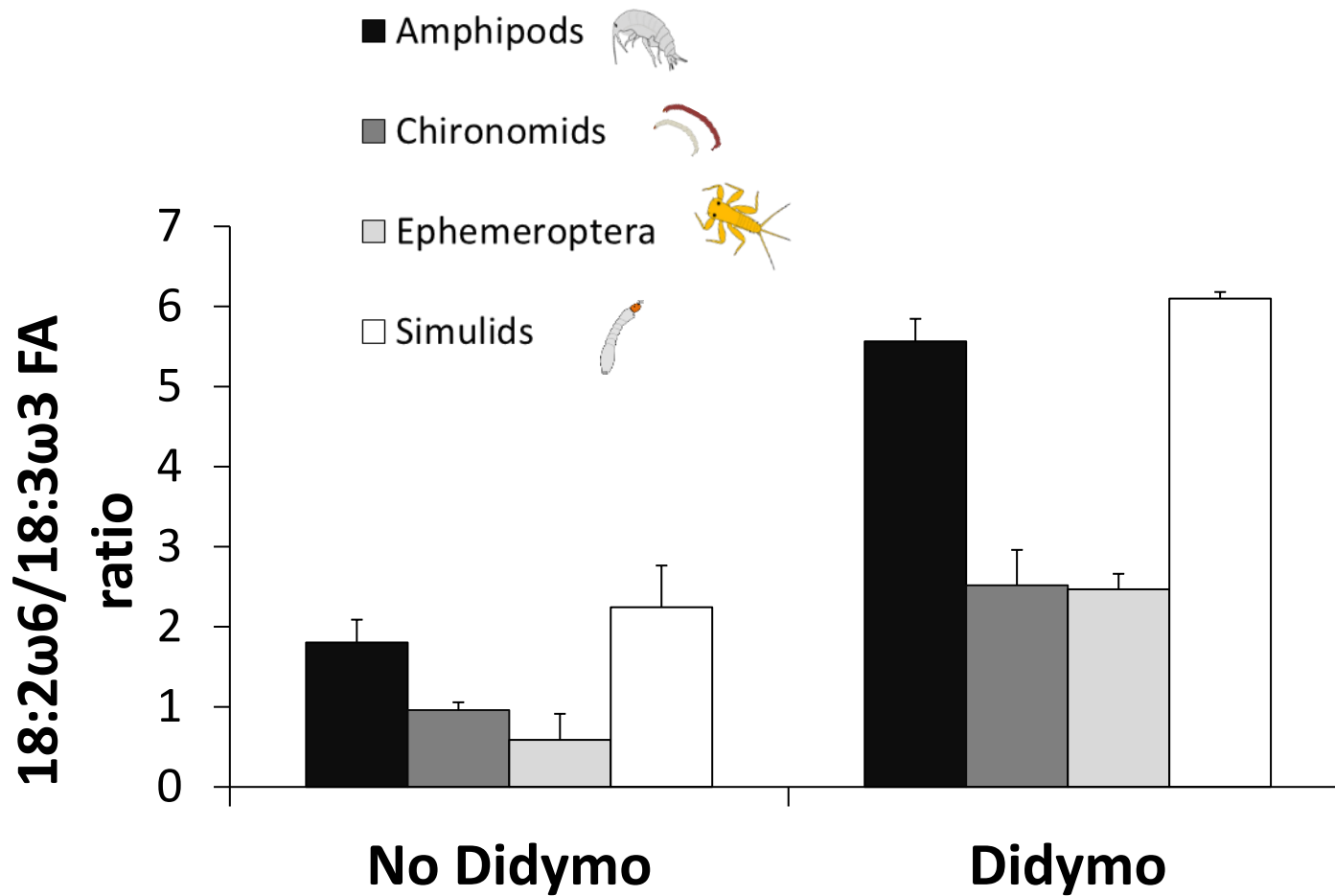
High
Didymo



Low/No
Didymo

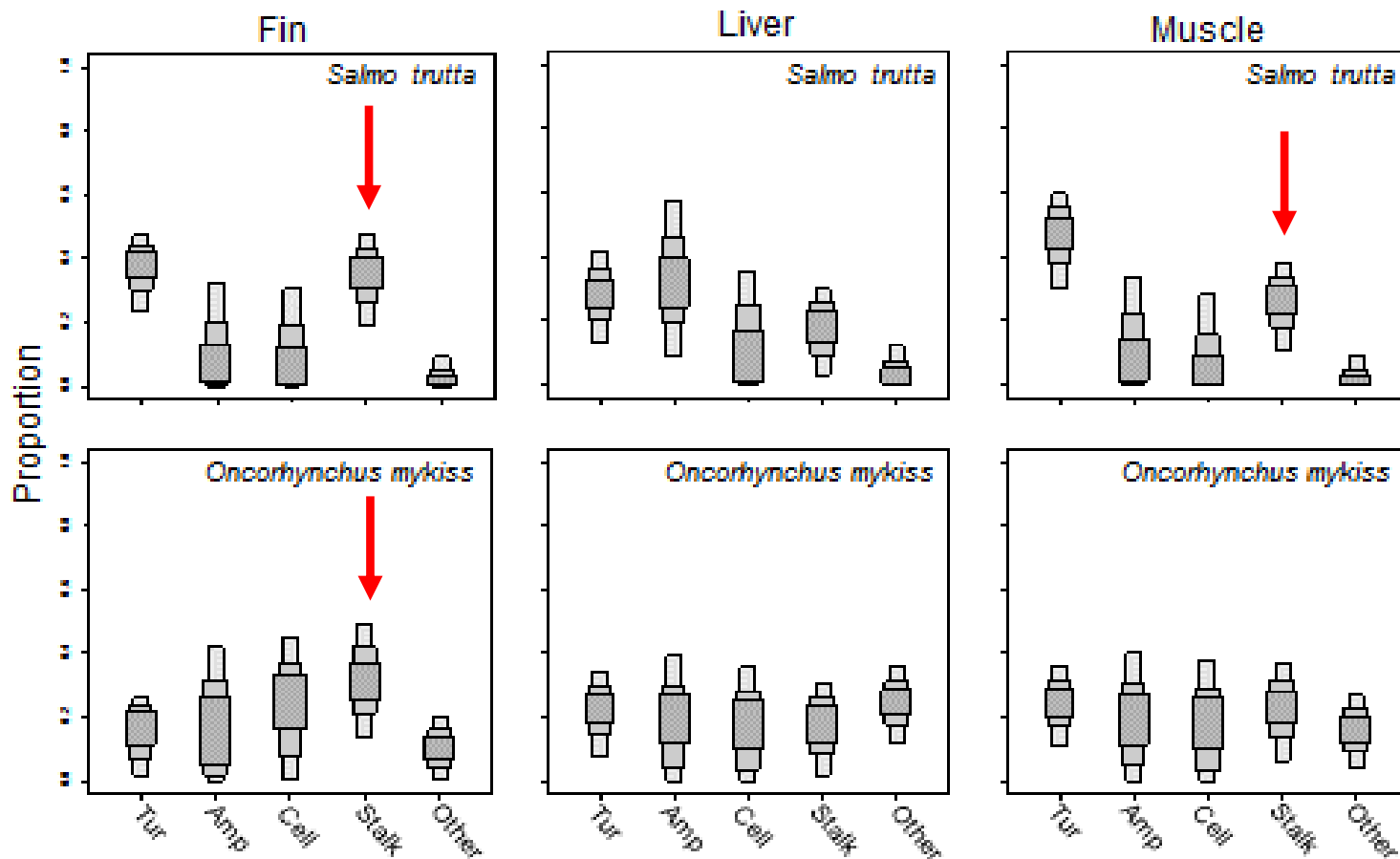


Simulids, Amphipods, and Planarians showed the same trends

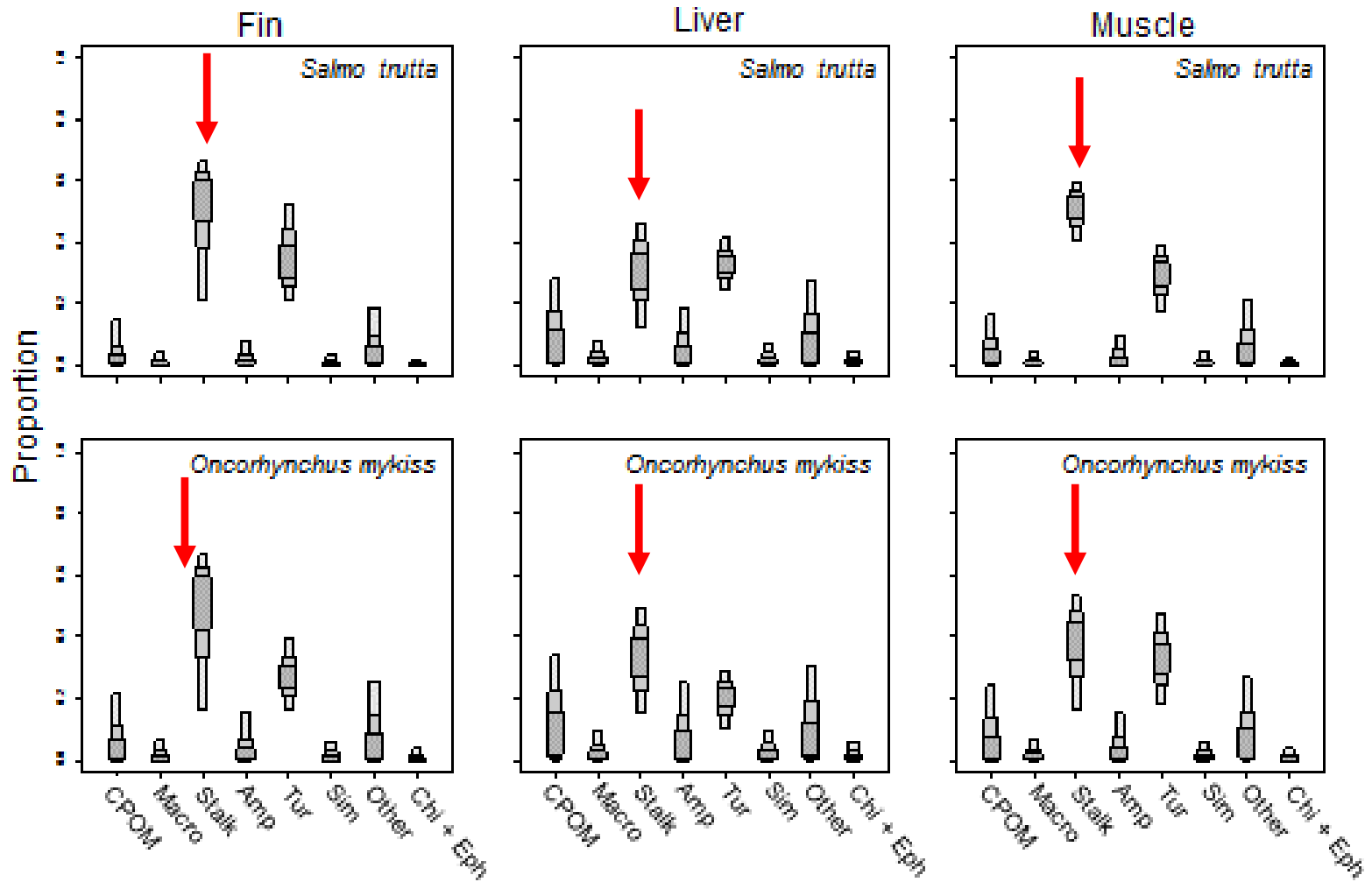


Increase in the 18:2ω6/18:3ω3 ratio in the presence of Didymo suggests a shift food source from biofilms to vascular plants, like macrophytes.

Fish – Isotopes (High Didymo)



Fish – Isotopes (Low Didymo)



Ecosystem Effects

Macroinvertebrates

- Food resources switching with mat coverage >50%. Eating resources that did not get covered. - Biofilms to macrophytes.
- Did not assimilate Didymo cells or stalks.
- Effects less severe in “Patches” than “Blankets”.

Trout

- Stalks increase chironomid midge and oligochaete worm abundance, but the strongest isotopic signatures came from turbellarians and amphipods, which are typically found outside of mats.
- Still missing part of the trout food web.
(Terrestrial)

Native in Appalachians?

Literature Reports:

- Report of 1 Didymo cell in the Holston River, VA (Patrick and Reimer, 1975).

Current Research

In Tennessee

- Guts; 30 preserved brown trout and many macroinvertebrate samples from 1988 collected in the South Holston River by TWRA. (Mats 1st reported in 2004)
 - We have found no didymo in trout guts. Still processing macroinvertebrate guts.

Management Actions

CLEAN YOUR GEAR

STOP **STOP AQUATIC HITCHHIKERS!™** **STOP**

Prevent the transport of aquatic invasive species.
Clean all recreational equipment.
www.ProtectYourWaters.net

Check for and remove any visible plants, mud, and aquatic life from all equipment before transporting.

Dispose of unwanted bait in the trash, not on land or in the water.

Drain water from all equipment before transporting elsewhere.

Clean gear with hot water (140°F), disinfect with 10% bleach solution (13 oz./gallon) water or soak in 5% salt (2 cups/3 gals) for 30 minutes followed by tap water rinse.

Dry everything for at least five days.

Never release plants, fish or animals into a body of water unless they came out of that body of water.

Check these areas:
Clothing, Fishing rod, reel and line, Fishing vests, Nets and traps, Shoes or boots, Paddle, Boat, Gear.



STOP AQUATIC HITCHHIKERS



Stop the spread of invasive aquatic species

Take these 4 steps after each trip on the water

CLEAN: equipment of aquatic plants and animals

DRAIN: water from boats, live wells, and equipment

DRY: allow equipment to thoroughly dry

NEVER MOVE: fish, plants or other organisms from one body of water to another

Cold water hitchhikers to be on the lookout for:



Hydrilla



Didymo



Whirling Disease



Gill Lice

For more information about aquatic hitchhikers visit:

www.protectyourwaters.net

