Vermont EPSCoR

Center for Workforce Development and Diversity (CWDD)

Lindsay Wieland, CWDD Director
Dr. Declan McCabe, Professor

CWDD's Goals:

- **Strengthen STEM Workforce** in Vermont by inspiring the next generation of scientists, and preparing them for a career in science, technology, engineering, & math (STEM) fields

- **Broadening Participation** to increase the number of under-represented minorities, veterans, first generation college students, Pell-eligible students, and students with disabilities entering in and completing degrees in STEM fields

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Integrate Students and Teachers into EPSCoR Research

- **Authentic Research**
  - Educational experience for students
  - Professional development for educators
  - Distributed network of support for EPSCoR researchers

RACC
Research on Adaptation to Climate Change in the Lake Champlain Basin

NEWRNET
North East Water Resources Network

Middle School

Middle School Outreach

Years 1-5 (we have 6 months left!):

- 41 middle school classrooms
- 16 middle school teachers
- 6 Vermont counties (Addison, Chittenden, Franklin, Rutland, Washington, and Windsor)

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High Schools

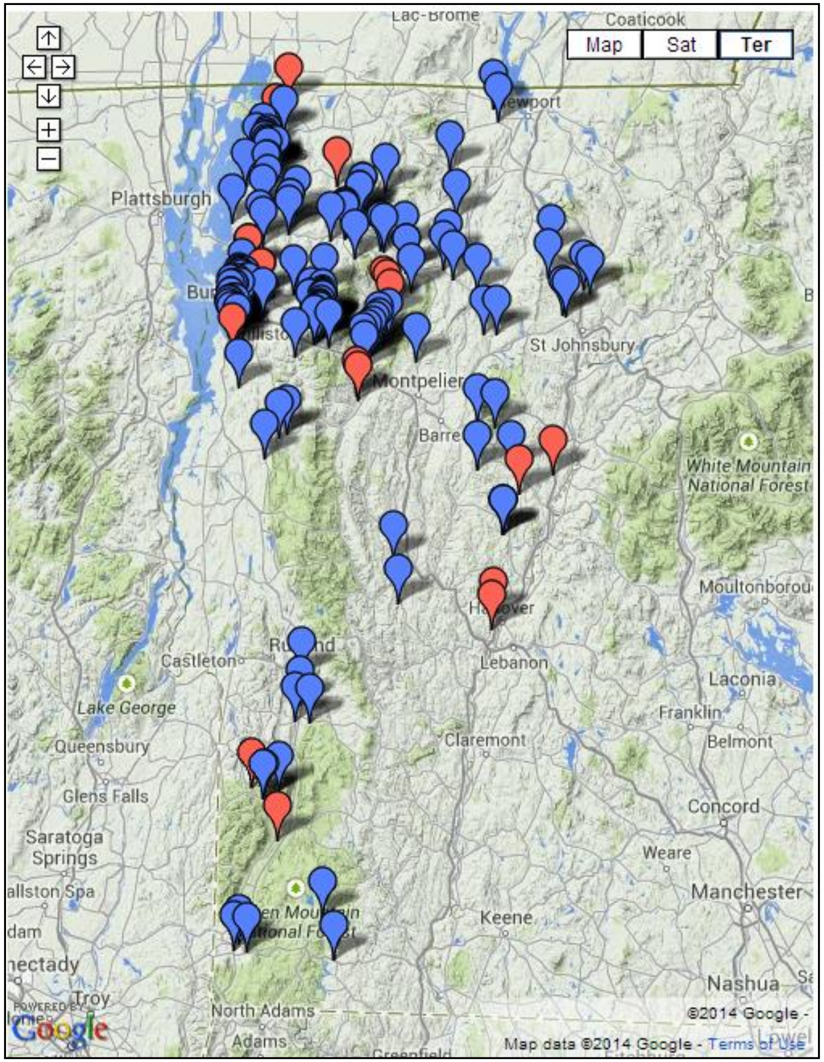
Data Generated from Streams Project Network

Year 5

- 395 grab samples:
  - TSS analysis
  - TP and TN analysis

- Macoinvertebrate community characterization from 11 stream sites, 1 sampling date

- Continuous data from 6 stream stage sensors and 14 temperature sensors



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Database

Lab Data (E. coli,

Click on the variab
definition of that va

Reports

Stream/Site Code *	Available Reports	Date Range
WR_DckBrk_346 WR_DckBrk_754 WR_DckBrk_767 WR_DckBrk_789 WR_DckBrk_908 WR_DogRiv_568 WR_DwvllBrk_649 WR_GoldBrk_952 WR_HntRv_536 WR_JoinBrk_360 WR_JugBrk_1128 WR_LtlRiv_418 WR_LtlRiv_696 WR_LzBrk_809 WR_MdRvr_04288000	○ Site Assessments ○ Habitat Assessments ○ Macroinvertebrate ○ Macroinvertebrate ID ○ Macroinvertebrate ID 2 ○ Water Quality ○ E. coli ○ Total Suspended Solids ○ Phosphorus & Nitrogen ◉ Lab Data (Ecoli, Phosphorus & Nitrogen, TSS) ○ GIS Assessment Data ○ Site Information Data ○ Thalweg	**Start Date:** Jun 1 2008 **End Date:** Feb 18 2015

Report Help

- **Data Variable Definition**
- **Bedrock Subcategories**

Generate Report

For additional reports, pleas
request via our "Contact U

** Multiple selections allowed*

Export to Excel File

Site Code	Location	Type	Date Collected	Replicate	Total Coliform (MPN)	E (
WR_GoldBrk_952	Stowe, VT	Riffle	2011-07-18	1	980.4	1
WR_GoldBrk_952	Stowe, VT	Riffle	2011-07-18	2	1553.1	1
WR_GoldBrk_952	Stowe, VT	Riffle	2011-07-18	3	1732.9	2
WR_GoldBrk_952	Stowe, VT	Riffle	2011-08-01	1	224.7	7
WR_GoldBrk_952	Stowe, VT	Riffle	2011-08-01	2	68.3	4
WR_GoldBrk_952	Stowe, VT	Riffle	2011-08-01	3	172.6	8
WR_GoldBrk_952	Stowe, VT	Riffle	2011-08-16	1	549.3	8
WR_GoldBrk_952	Stowe, VT	Riffle	2011-08-16	2	574.8	9
WR_GoldBrk_952	Stowe, VT	Riffle	2011-08-16	3	829.7	7
WR_GoldBrk_952	Stowe, VT	Riffle	2011-09-11	1	292.4	9
WR_GoldBrk_952	Stowe, VT	Riffle	2011-09-11	2	501.2	6
	Stowe		2011-09			

High Schools

Social Science Research

AGU PUBLICATIONS

Earth's Future

RESEARCH ARTICLE
10.1002/2015EF000315

Key Points:
- Data from solar power arrays are a new resource
- Solar flux data are useful for cloud, power, and climate analyses
- Solar data provide local research information for science education

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Alan K. Betts, akbetts@aol.com

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Integrating solar energy and climate research into science education

Alan K. Betts[1], James Hamilton[2], Sam Ligon[2], and Ann Marie Mahar[2]

[1]Atmospheric Research, Pittsford, Vermont, USA, [2]Rutland High School, Rutland, Vermont, USA

Abstract This paper analyzes multi-year records of solar flux and climate data from two solar power sites in Vermont. We show the inter-annual differences of temperature, wind, panel solar flux, electrical power production, and cloud cover. Power production has a linear relation to a dimensionless measure of the transmission of sunlight through the cloud field. The difference between panel and air temperatures reaches 24°C with high solar flux and low wind speed. High panel temperatures that occur in summer with low wind speeds and clear skies can reduce power production by as much as 13%. The intercomparison of two sites 63 km apart shows that while temperature is highly correlated on daily (R^2=0.98) and hourly (R^2=0.94) timescales, the correlation of panel solar flux drops markedly from daily (R^2=0.86) to hourly (R^2=0.63) timescales. Minimum temperatures change little with cloud cover, but the diurnal temperature range shows a nearly linear increase with falling cloud cover to 16°C under nearly clear skies, similar to results from the Canadian Prairies. The availability of these new solar and climate datasets allows local student groups, a Rutland High School team here, to explore the coupled relationships between climate, clouds, and renewable power production. As our society makes major changes in our energy infrastructure in response to climate change, it is important that we accelerate the technical education of high school students using real-world data.

1. Introduction

Vermont has an ambitious comprehensive energy plan with the goal of meeting 90% of the state's energy needs through renewable resources by 2050 [*Vermont Comprehensive Energy Plan*, 2015]. Part of this is a transition to a distributed renewable energy power system based on solar power and wind farms. In addition, the installed cost of solar power has fallen more than 60% in the past 6 years. As a result, Vermont has seen rapid deployment of solar power projects ranging in scale from small arrays of a few kilowatts (kW) of peak power for individual households, community-shared arrays of a few hundred kilowatts, and much larger megawatt arrays. Since 2011, more than 100 MW of solar photovoltaic (PV) electric generation has been added in the

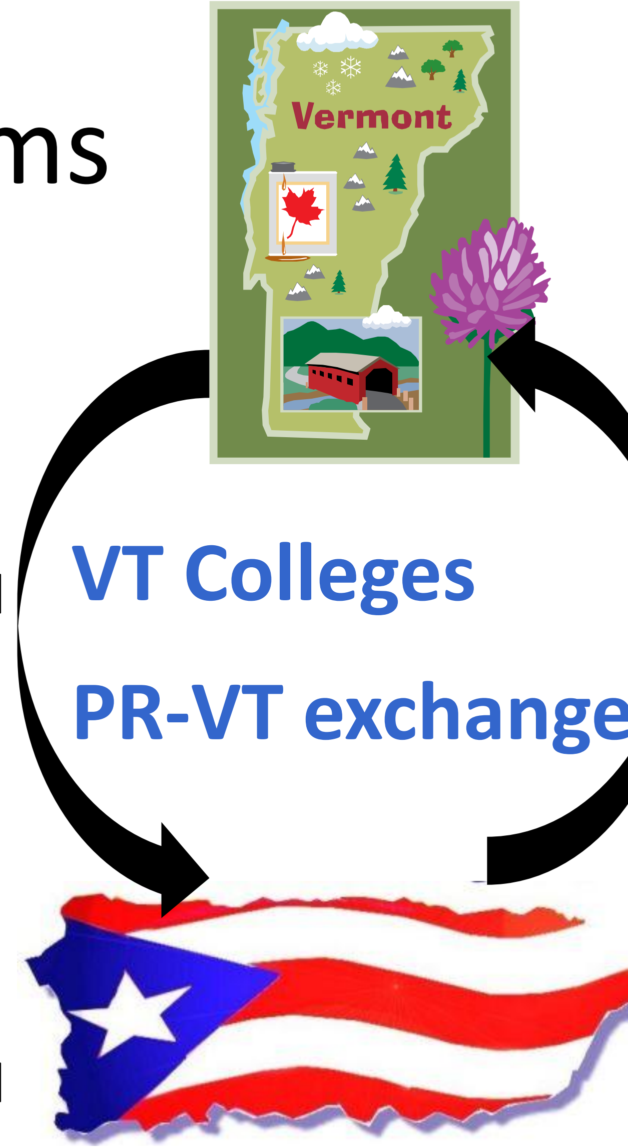
High School Teams

2015-16 High School Teams:

- 18 teams: one teacher and two$^+$ students
- Teachers 50% female; 28% under-represented
- Students: 73% female; 34% under-represented

Years 1-5 (2011-2016):

- 94 teams (Vermont, Puerto Rico, New York, Delaware, Boston)
- Teachers 51% female; 18% under-represented
- Students: 68% female; 22% under-represented



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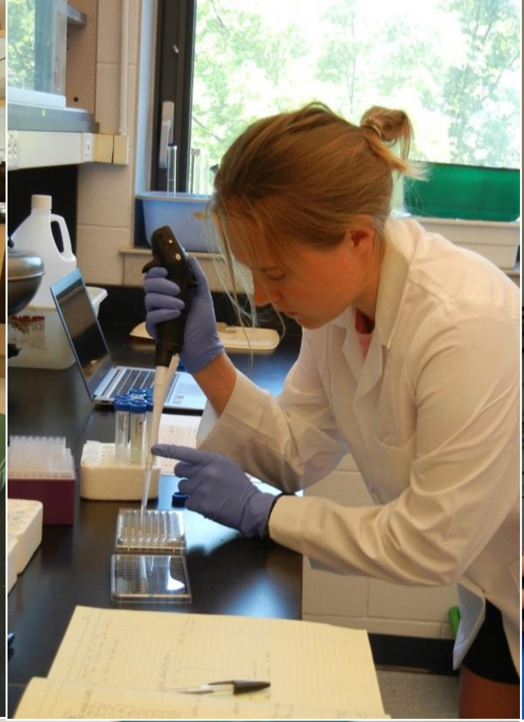
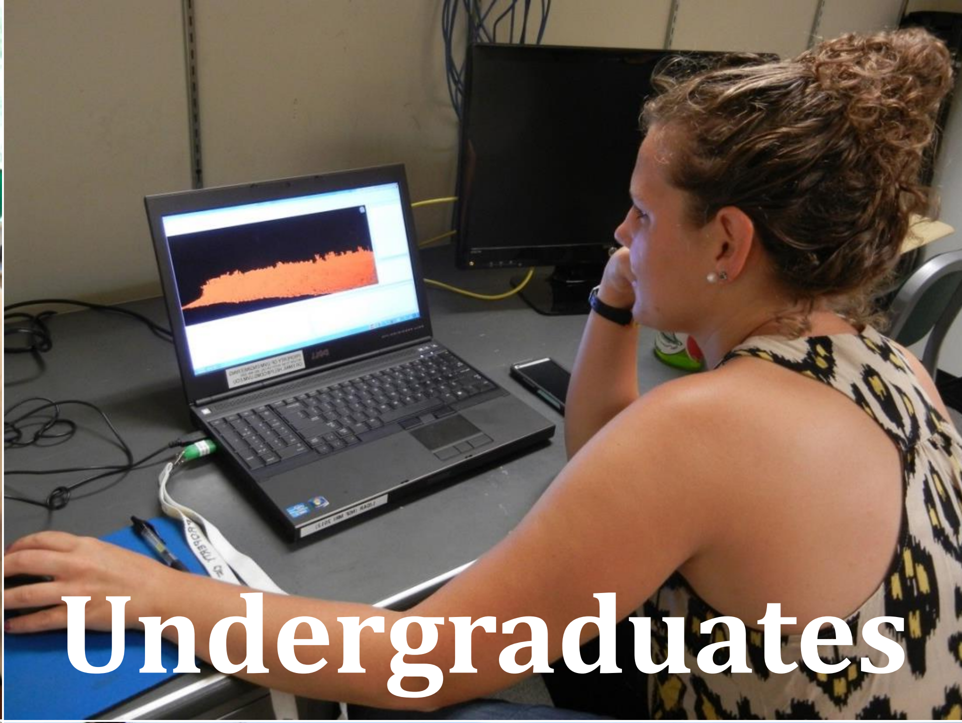
Undergraduates





RACC Interns

Summer 2015 (Year 4)

44 students from 15 institutions

65% female; 33% under-represented

Years 1-4 (2011-2015)

160 students from 25 institutions

66% female; 27% under-represented

8 military-connected/veterans

5 students with disability

27 first-generation college students

13 community college students

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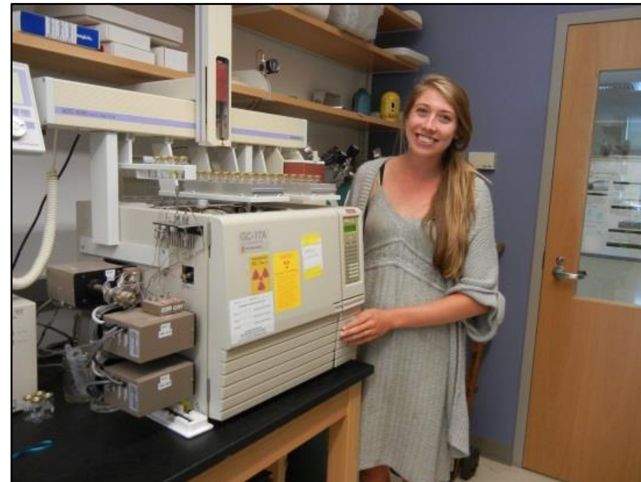
RACC Interns

2016 RACC Research:
17 faculty-led research teams
Grouped by Questions

Q1: 15 interns
Q2: 5 interns
Q3: 8 interns
IAM: 2 interns

30 interns located at:
University of Vermont
Saint Michael's College
Johnson State College



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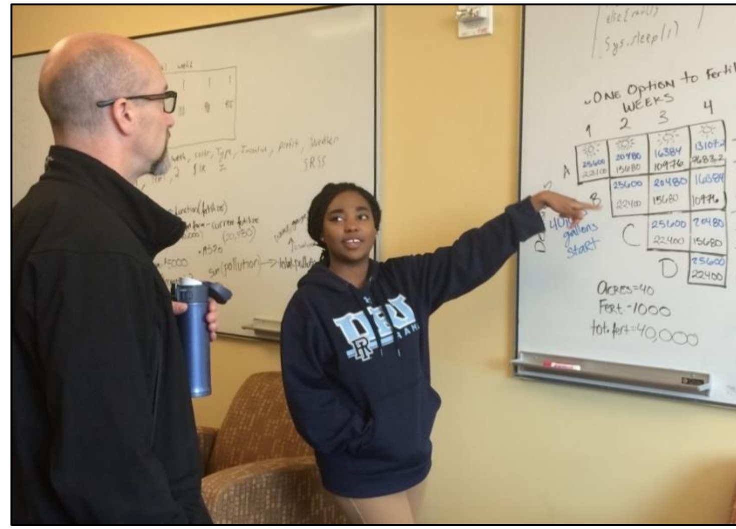
NEWRnet Interns



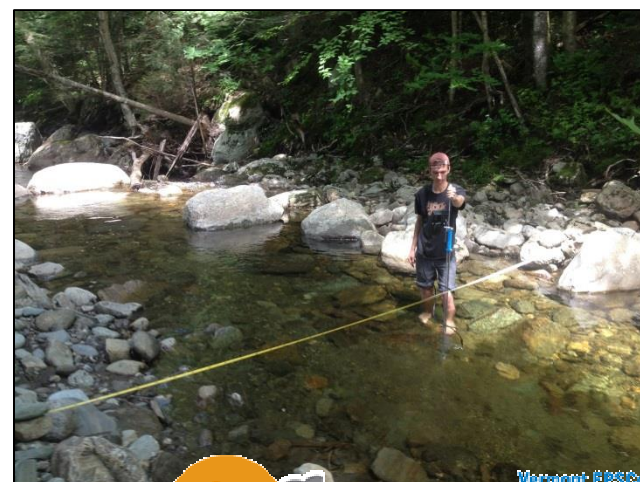
Summer 2015

18 students from 7 institutions

56% female

17% under-represented

4 first-generation college students



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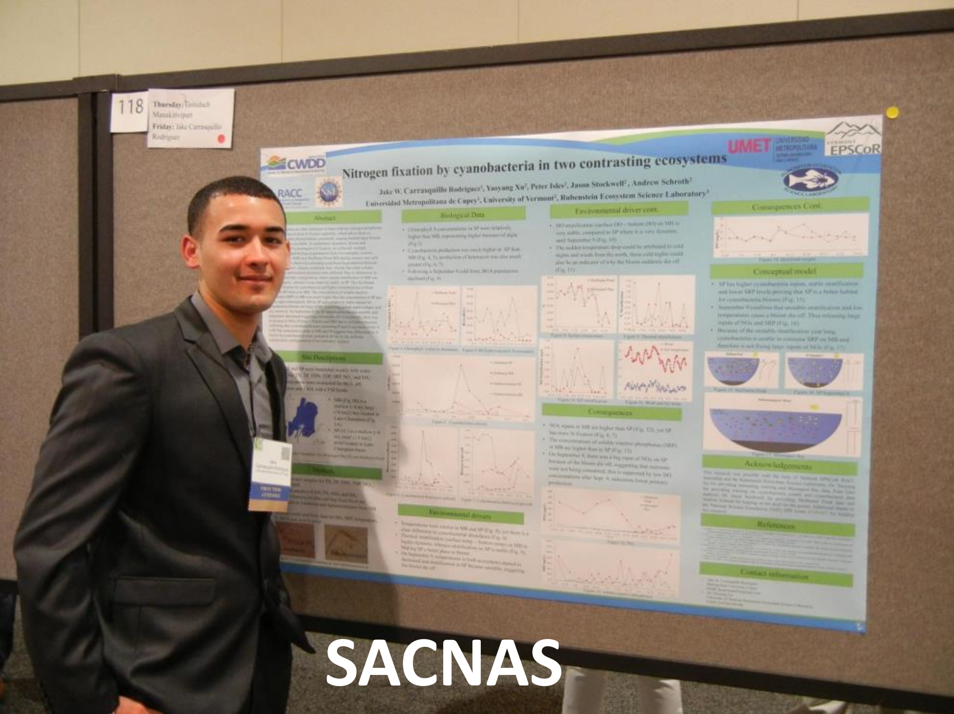
Student Research Symposium

Register by 4:00pm February 25, 2016

uvm.edu/epscor/symposium

RACC Undergraduate Intern Presentations 2015-2016

# VT EPSCoR Undergraduates	Conference Name	Location	Date
2	AGMUS Conference for Minority Students	San Juan, PR	August 2015
3	New England Graduate Student Water Symposium	Amherst, MA	September 2015
1	SACNAS Conference	Washington, D.C.	October 2015
2 2 HS!	American Geophysical Union (AGU)	San Francisco, CA	December 2015
1	American Meteorological Society (AMS)	New Orleans, LA	January 2016
1	Northeastern Geological Society of America (GSA)	Albany, NY	March 2016


118
Nitrogen fixation by cyanobacteria in two contrasting ecosystems
UMET
EPSCoR
CWDD
RACC
SACNAS


Temperature Anomalies and Carbon Dioxide Conc
Melissa Segall
Lyndon State College
Mentor: Dr. Tania Bacchus Johnson State College
Introduction
Methods
AGU & AMS


854
853
Microbial Activity and Phosphate
AGU


para la Naturaleza
UMET
UNIVERSIDAD METROPOLITANA
SISTEMA UNIVERSITARIO ANA G. MÉNDEZ
Nutrients and metals concentration analysis in the Río Piedras River, San Juan, Puerto Rico
Santiago-Iliansberry[1] & Infante-Gabriel[2]
School of Science & Technology
Universidad Metropolitana, Cupey Campus
San Juan, Puerto Rico
AGMUS

STEM Scholarships

$5,000 Scholarships for students enrolled at a Vermont college or university:

- First Generation College Student Scholarships
- Native American Student Scholarship

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
First Generation College Student Scholarships	1	5	5	5	*5*	21
Native American Student Scholarship	2	1	1	2	*1*	7

CWDD impacts

	Year 1	Year 2	Year 3	Year 4	Year 5
MS Teachers		7	9	12	7 (12)
MS Students		81	68	250+	180 (300)
HS Teachers	18	21	20	18	(20)
HS Students	36	44	41	41	(40)
RACC UGs	38	42	44	44	(30)
NEWRnet			14	18	(14)
Scholarships	3	6	6	7	(6)
Total	95	201	202	390	~420

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Water Quality Labs at
Saint Michael's College and
Johnson State College

Saint Michael's College Laboratory – TSS

Year 5: 1,801 TSS samples

Fall 2015:
855 TSS samples (87 NEWRnet; 475 watershed, 293 high school stream)

Spring/Summer 2016:
946 TSS (93 NEWRnet, 751 watershed, 102 high school streams)

Grant Cycle Total: **6,428**

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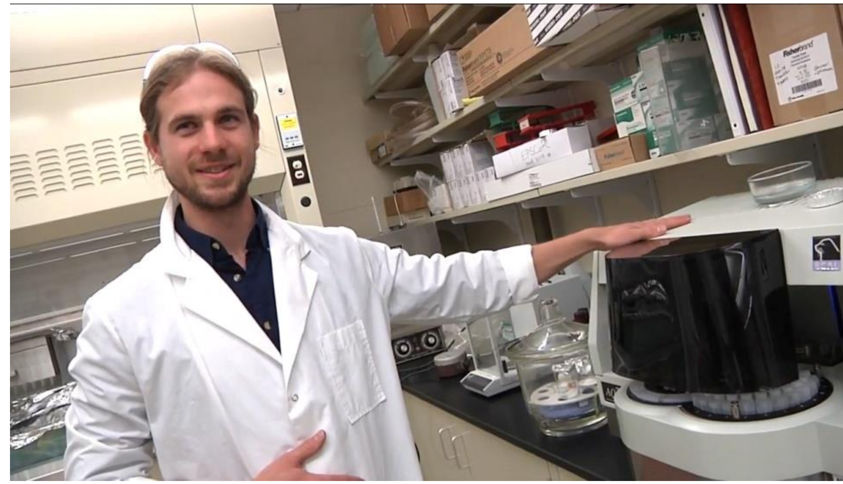
Johnson State College Laboratory – Nutrients

- Phosphorus
  - Total P
  - Total dissolved P
  - Soluble reactive P
- Nitrogen
  - Total N
  - Total dissolved N
  - Ammonia
  - Nitrate



Seal AQ2

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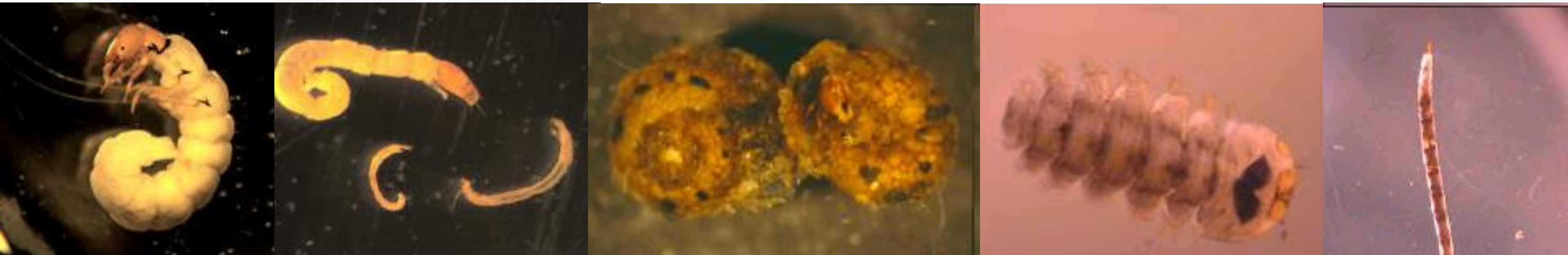
Johnson State College Laboratory – Nutrients

Source	2015 season (April-Oct 2015)	2016 season (April-Oct 2016) *expected*	2011-2016 cumulative
River ISCO/Grabs	1,352	1,000	3,567
Lake ISCO/Grabs	960	TBD	6,272
High school	552	600	1,972
Total	**2,864**	**1,600**	**11,811**
Samples analyzed for various P and N analytes			

SAINT MICHAEL'S COLLEGE FOUNDED 1904

Declan McCabe; Janel Roberge; Lindsay Wieland; Patrick Clemins; Steven Exler; Erin Hayes-Pontius; Lillian Gamache; Elissa Benedetto; Jeremy Gould; My Mai; Lara Nargozian; Colum Smith

Not your parents' field guide: a site-specific macroinvertebrate IPhone app for citizen scientists

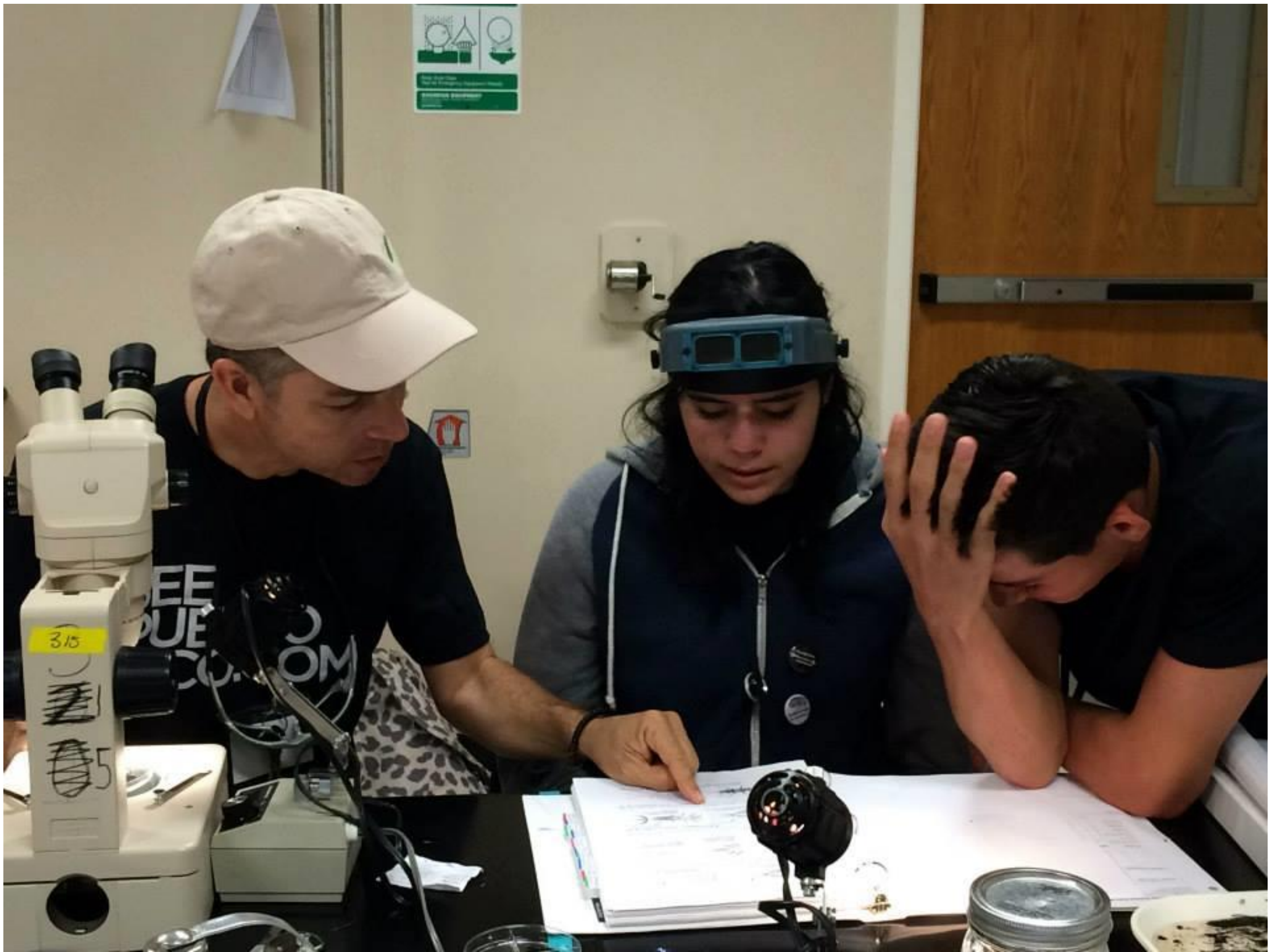


Macroinvertebrates

- A gateway drug for budding scientists

Easy to sample

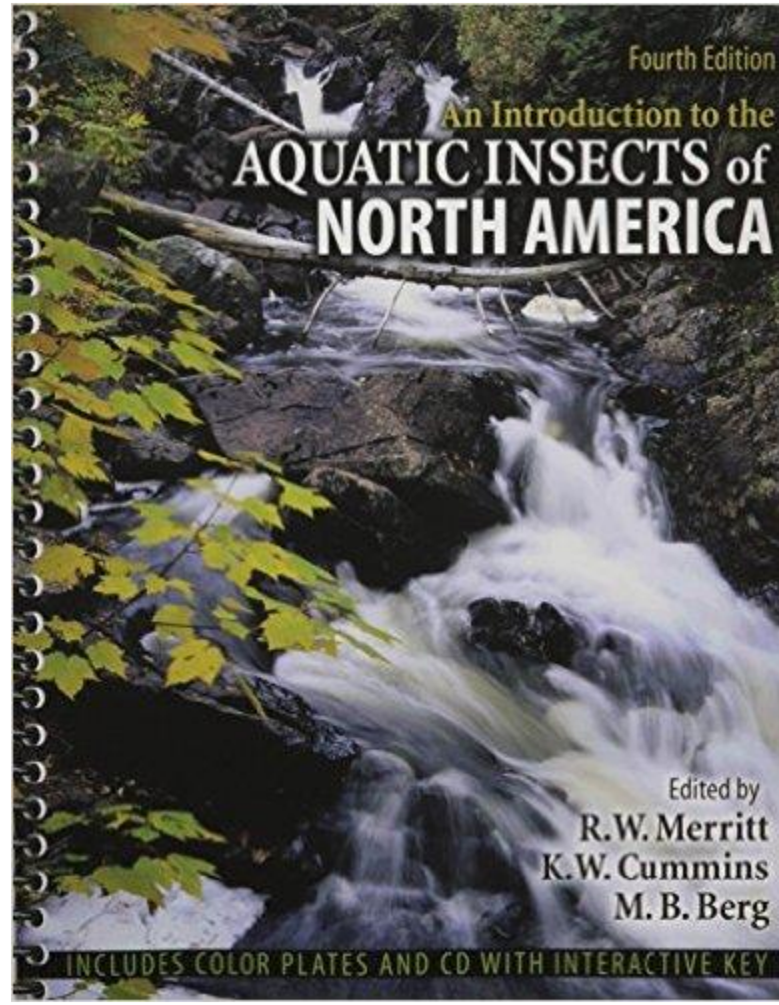
A headache to identify



Professional keys

- All-inclusive, time consuming, dense:
  - “pronotum crenulate”
  - “flabellate antennae”

- Blind alleys:
  - Two hours later…… the bug you sampled in Vermont …. “*occurs only in spring seeps in the Columbia River Gorge*”

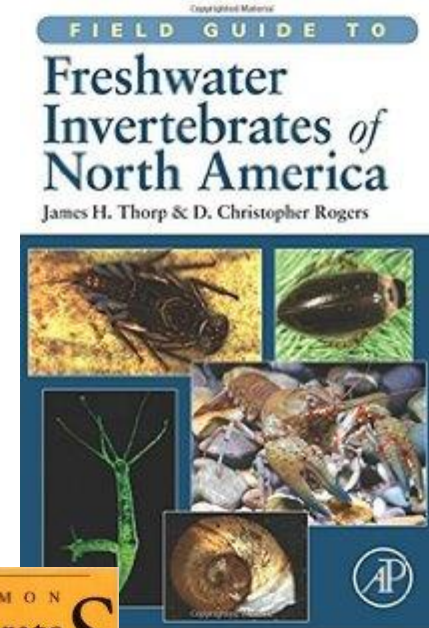


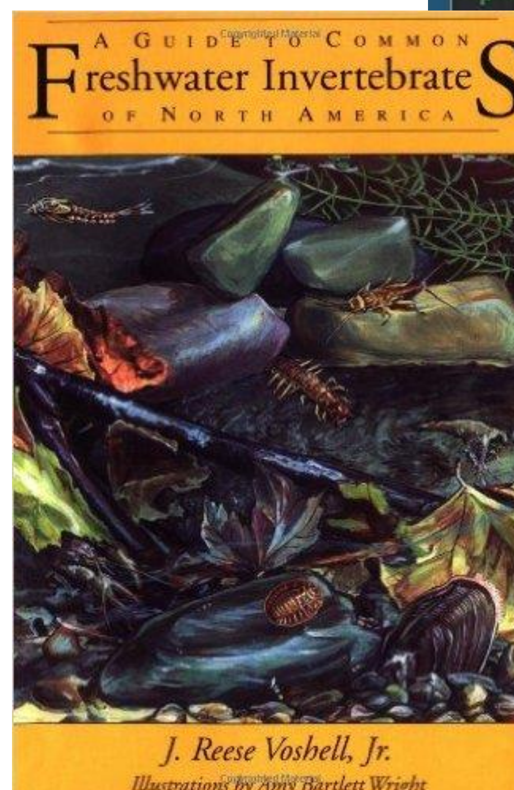
26 chapters; 1158 pages; 5963 references

Field guides?

- Field guides miss Some *really* common invertebrates

- *“Declan, I found a new species….It’s not even in the field guide….”*





Light at the end of the tunnel?

- At typical sites, we repeatedly find the same invertebrates

- You can list the "usual suspects" for each site

…and once you have the list

- You can make photo gallery
- More visits ….better lists

Halls Brook (CTJW_ HllsBrk_713)

These are the most common macroinvertebrates identified from samples from Halls Brook by Snake Road in Newbury, Vermont.

Click on images to zoom in.

ORDER: *Ephemeroptera*
FAMILY: *Baetidae*
GENUS: *Baetis*

This mayfly has three "tails" and a unique head shape. Its gills are oval shaped and insert dorsally. More mature

ORDER: *Diptera*
FAMILY: *Chironomidae*

Midge larvae tend to be the most common macroinvertebrate at our sites. As with other *Diptera*, there are no true jointed legs

ORDER: *Plecoptera*
FAMILY: *Leuctridae*
GENUS: *Leuctra*

This family of stonefly is fairly slender by stonefly standards. The divergent wing pads are a helpful characteristic. *Leuctridae* are similar in

Reusable wiki templates for common macroinvertebrates

Join our WikiEducator discussion group. [dismiss]

Template:Leuctra

Leuctra

This family of stonefly is fairly slender by stonefly standards. The divergent wing pads are a helpful characteristic. Leuctridae are similar in overall shape to the Capniidae; however, Leuctridae often do not have pleural folds. If they are present, they only extend from abdominal segments 1-7. *Leuctra* are recognized by abdominal terga with posterior fringes of short hairs and last few segments with longer hairs.

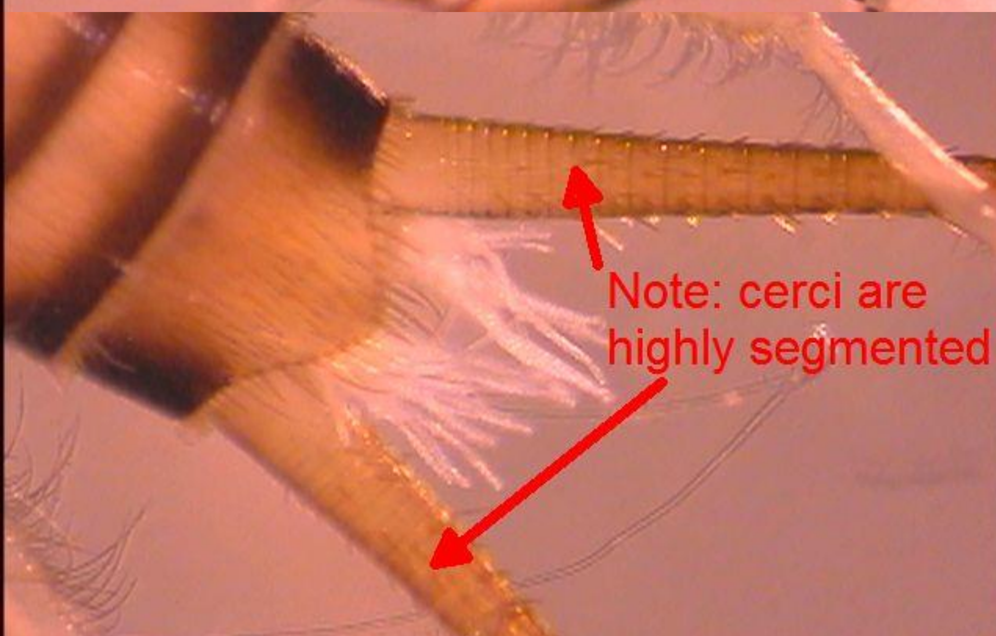
Order
: *Plecoptera*

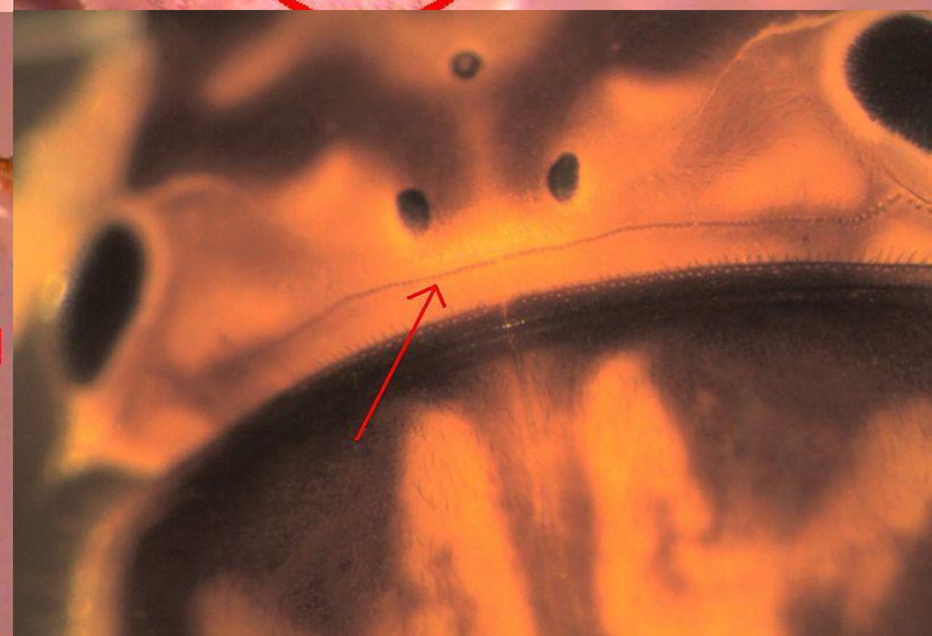
Family
: *Leuctridae*

Genus
: *Leuctra*

Category: Aquatic Invertebrate

Links to photographs





A wiki for each stream

- 81 stream sites: VT; NY; PR
- 4 lake/pond sites

Dicranota

Dicranota can be distinguished by the two tails and their comb feet. There are usually 5 pairs of prolegs on the abdomen with combs on them. In addition, the posterior portion of the abdomen often has a slight swelling.

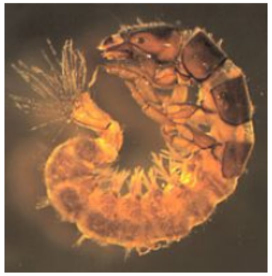
Order
Diptera
Family
Tipulidae
Genus
dicranota

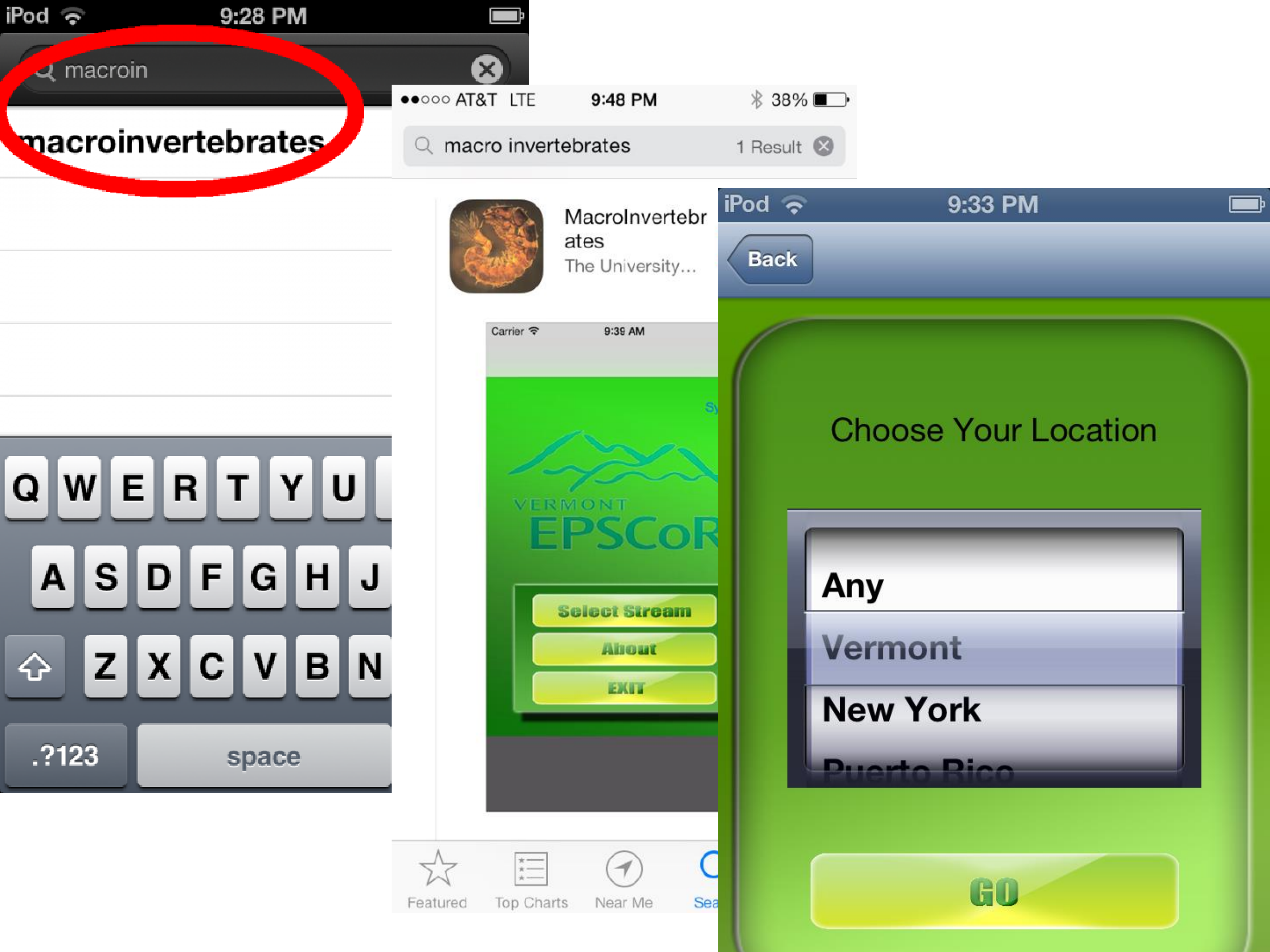
Hydropsychidae

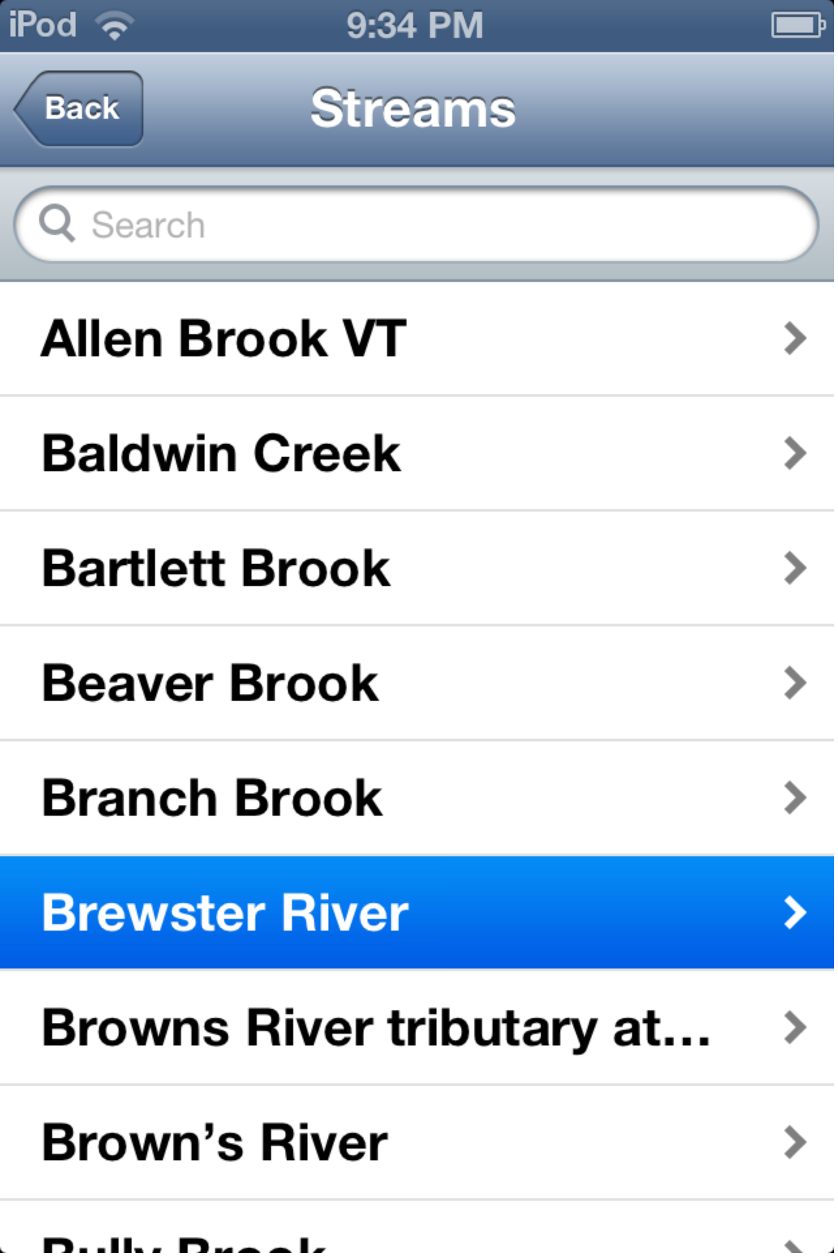
This family of net-spinning caddisflies is very abundant at several sites. They are important filtering collectors and are quite common at urban and agricultural sites where particles of organic material can be important food resources. Genus-level identification is possible for mature specimens and we will include the genera we found at your site if possible. Commonly found genera include *Cheumatopsyche*, *Ceratopsyche*, and *Hydropsyche*. Less commonly, we have found *Arctopsyche* and *Potamyia*.

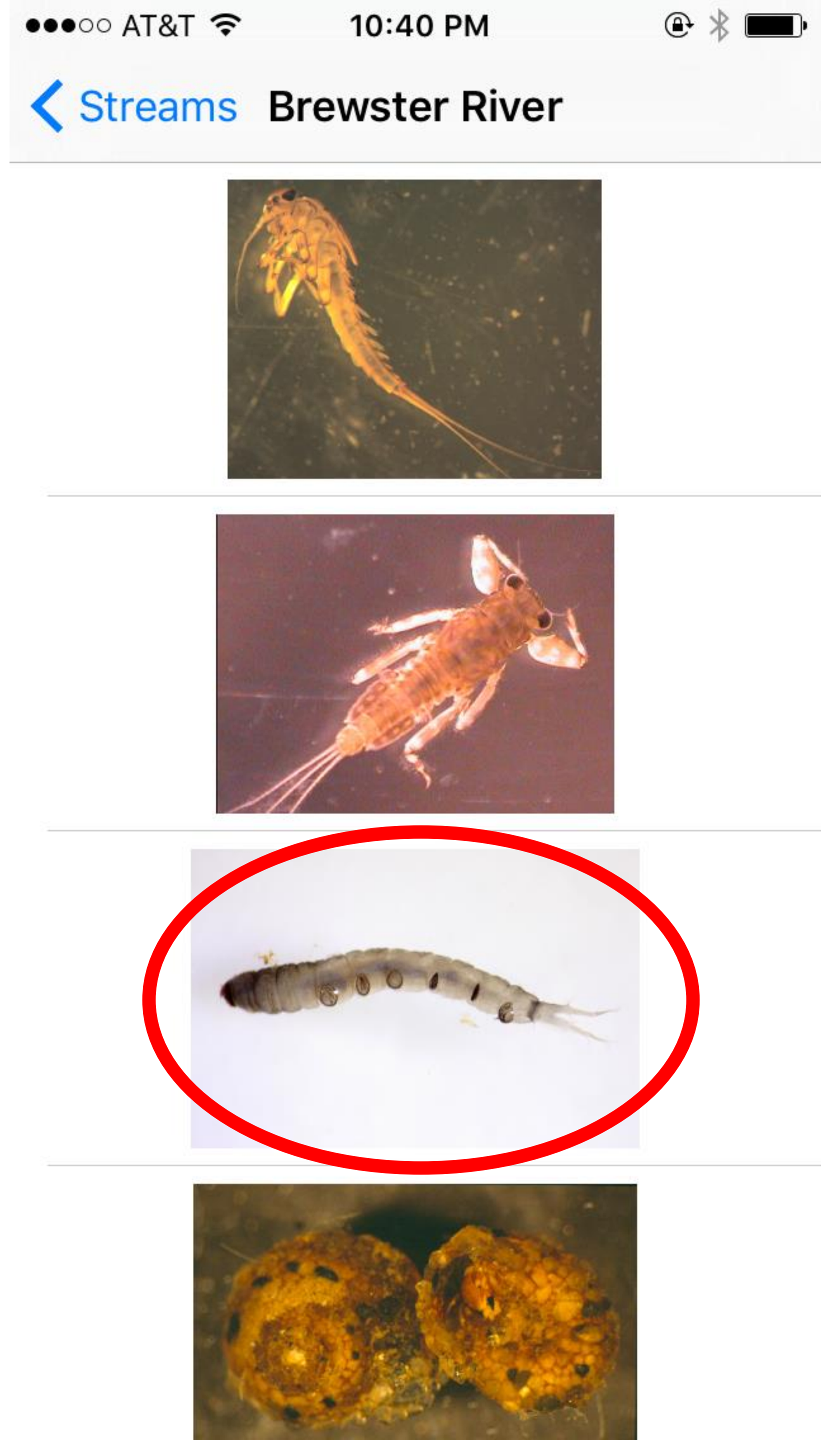
When using the key, some features that are challenging to see are the forked trochantin and the paired sclerites in the folds between segments. Other, more easily seen key features include filamentous gills on the abdominal segments and the sclerotization of the dorsal surfaces of all three thoracic segments. Keep in mind that with smaller or more immature specimens, genus-level ID may not be possible.

Order
Trichoptera
Family
Hydropsychidae




iPod 9:28 PM
macroin
macroinvertebrates
Q W E R T Y U
A S D F G H J
Z X C V B N
.?123
space
●●○○○ AT&T LTE 9:48 PM 38%
macro invertebrates
1 Result
MacroInvertebrates
The University...
Carrier 9:39 AM
VERMONT
EPSCoR
Select Stream
About
EXIT
Featured
Top Charts
Near Me
iPod 9:33 PM
Back
Choose Your Location
Any
Vermont
New York
Puerto Rico
GO


iPod 9:34 PM
Back
Streams
Search
Allen Brook VT
Baldwin Creek
Bartlett Brook
Beaver Brook
Branch Brook
Brewster River
Browns River tributary at...
Brown's River


AT&T 10:40 PM
Streams
Brewster River

- Template content from wiki:
- 140 templates
- Covers 99% of sampled invertebrates


Site Code:
Number Squares Picked:

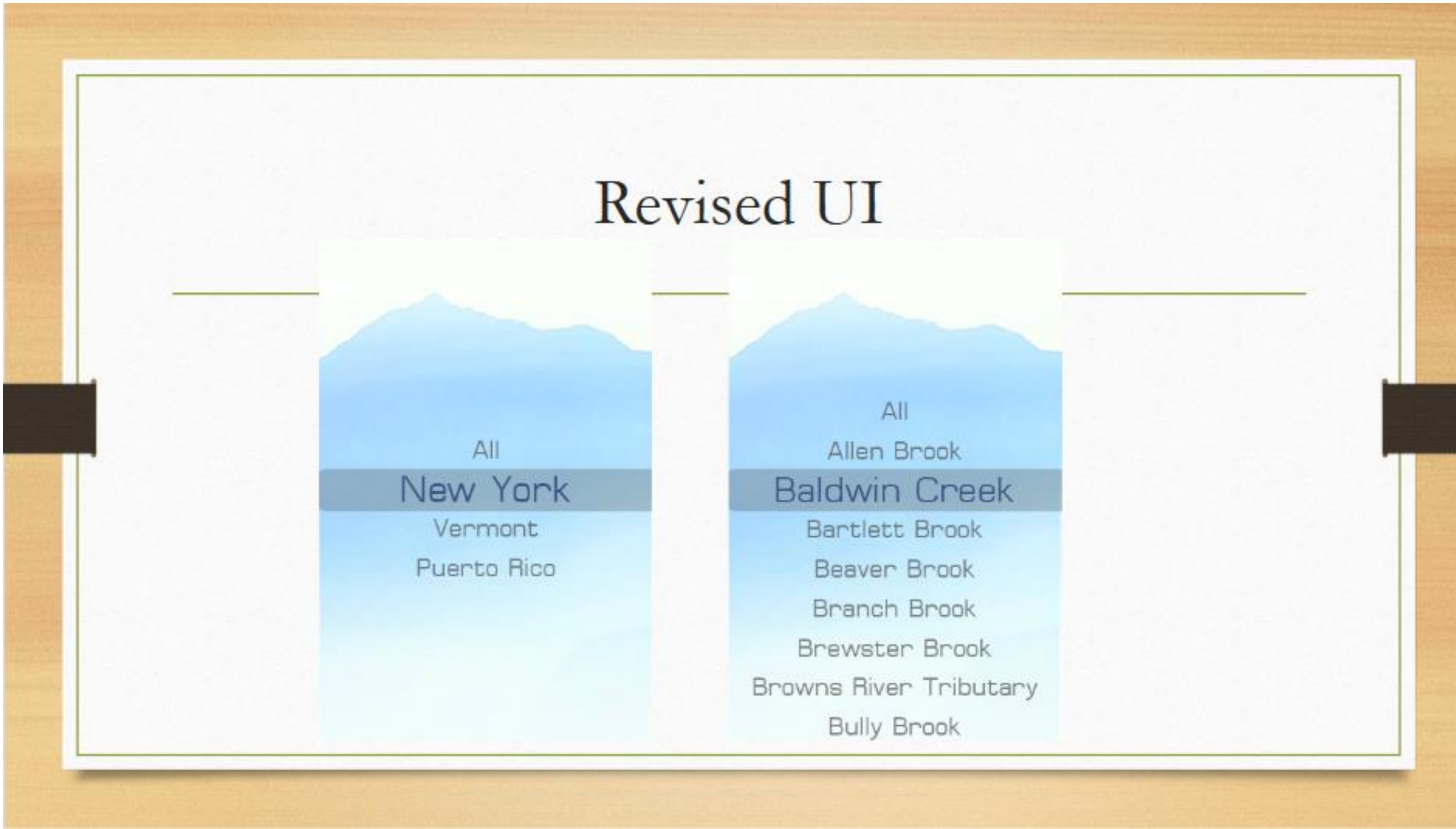

FORNWALT
RACC

Coming soon

- Common names
- Tied fly names
- App-specific and wiki-specific content
- Efficient synchronization
- New look

Slide from Bijay Koirala

Slide from Bijay Koirala



Conclusions

- Training entomologists or doing research?

Use traditional keys

- Working with citizen scientists?
- Need data for teaching purposes?

IPad app is an efficient alternative

Questions?

Thanks!