New England B-WET Regional Meeting

Theodora Pinou, Western Connecticut State University

October 29-30, 2019

Gulf of Maine Research Institute, Portland Maine

FINDING OUR WAY

WESTERN CONNECTICUT STATE UNIVERSITY

By increasing motivation to engage in STEM learning among pre-teens *The Finding Our Way STEM program* may contribute to developing a culturally diverse workforce that is STEM skilled and literate .

This supports the national and state goal of: Workforce Development

BUT HOW TO DO IT BEST?
Fair Access and Opportunity?

By encouraging and fostering families to learn together, environmental and technological literacy can be increased, and create a community of informed citizens that begins life-long learning skills within the home.

This supports the national and state goal of: Improving STEM Literacy

So How Did We Do After 3 Years (2009 - 2012)?

- Increasing Student Motivation In STEM

If students are motivated then they will overcome frustration to learning what they find challenging.

"Overcoming cognitive dissonance"

(Pinou's research interest)

Measuring Motivation Using the Science Motivation Questionnaire (SMQ) (Glynn and Koballa, 2006)

30 questions total divided into 6 subsets, 5 questions per subset

1. Intrinsically Motivated Science Learning – motivation to do something for its own sake (Glynn and Koballa, 2006)

2. Extrinsically Motivated Science Learning – motivation to do something as a means to the end (Glynn and Koballa, 2006)

3. Personal Relevance of Learning Science – does this matter to me? (Membiela, 1999)

4. Self-Determination to Learn Science – the ability to have choices and some degree of control over what we do and how we do it (Glynn and Koballa, 2006)

5. Self-Efficacy for Learning Science – the belief that one has about their own capabilities (Nugent et al., 2010)

6. Anxiety About Science Assessment (reverse scored) – nervousness, worrying or extreme concern (Birenbaum, 2007)

Likert-scale
0 - Never, 1 - Rarely, 2 – Sometimes, 3 - Usually, 4 - Always

SMQ example: Understanding the science gives me a sense of accomplishment.

So How Did We Do After 3 Years?

- Increasing Student Motivation In STEM

(Glynn & Koballa, 2005)

Table 1: Overall Program Statistics (Years 2010-2012)

Gender	Significant Subset(s)	T-test (p-value)	Wilcoxon (p- value)	n	Reliability (Cronbach's Alpha)
Female	1. Self-Determination	0.040	0.060	32	0.521
Male	n/a	n/a	n/a	23	n/a
Male & Female	1. Personal Relevance 2. Self - Efficacy	0.026 0.044	o.028 0.023	55 55	0.777 0.718

Conclusions: Activities that promote confidence to succeed and personal relevance increase motivation for all students.

[Pinou & Ridlon, 2012]

Where Did We go From Here?

How to best to build an environmental steward?

- We wanted to increase number of students served.
- We wanted to continue to track students through high school. Today we know that 100% of our participants are enrolled in college.
- We would like to increase parental participation.
- We would like to consider increasing the number of teachers served beyond summer program.

Family Programming?

Integrate in Classroom?

LOCATION, LOCATION, LOCATION

MWEEs, Stewardship, and outdoor education as pedagogical Instruments for STEM motivation!

Hudson to Housatonic Watersheds, Local History of Manufacturing and Ecological Consequences!

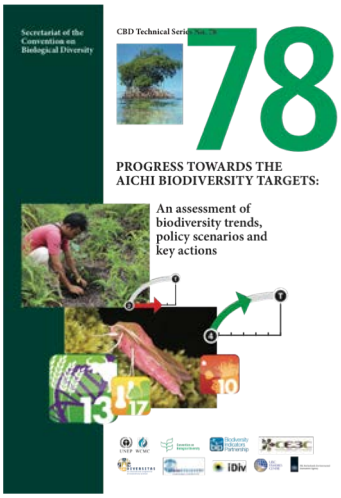
LOCATION, LOCATION, LOCATION

DANBURY HISTORY: Working with University Archives

- The Harpers Weekly from 1869 describing devastating flood when Kohanza Dam broke: http://archives.library.wcsu.edu/omeka/items/show/4194
- The 1850 Hat Industry: https://connecticuthistory.org/ending-the-danbury-shakes-a-story-of-workers-rights-and-corporate-responsibility/
- 1949 Water Issues: http://archives.library.wcsu.edu/omeka/items/show/6029

LOCAL CONTEXT FOR LEARNING

ISSUE DEFINITION



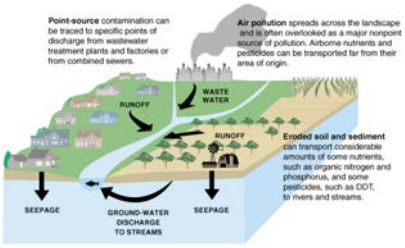
WHO IS RESPONSIBLE FOR OCEAN GARBAGE?

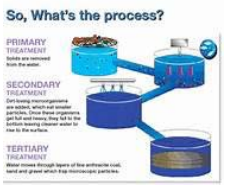
- https://www.usatoday.com/story/tech/science/2018/03/22/great-pacific-garbage-patch-grows/446405002/





How Are We Adding to the PROBLEM?

Local Context For Learning

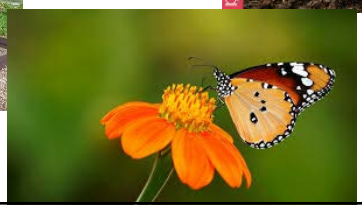
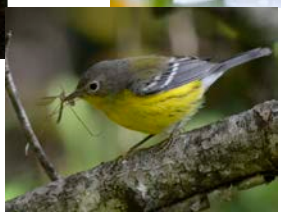
WHAT IS WRONG WITH THIS?

How do other people in the world solve their water problems?

Local Context for Learning





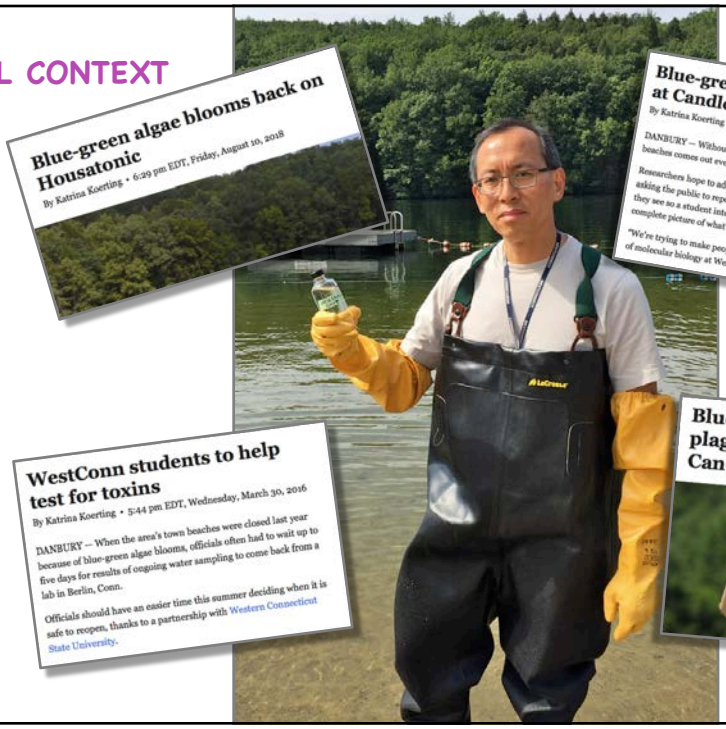




Strong Partnerships, University Resources, and Dedicated Experts



LOCAL CONTEXT

ISSUE DEFINITION



Blue-green algae blooms back on Housatonic

By Katrina Koerting • 6:29 pm EDT, Friday, August 10, 2018

Blue-green algae testing expands at Candlewood Lake

By Katrina Koerting • 12:00 am EDT, Saturday, July 21, 2018

DANBURY — Without fail, a list of cyanobacteria toxin levels for 10 area beaches comes out every Friday from Western Connecticut State University.

Researchers hope to add a few more places to their testing though, and are asking the public to report any cyanobacteria, or blue-green algae, blooms they see so a student intern can gather a sample and develop a more complete picture of what's happening around Candlewood Lake.

"We're trying to make people aware," said Ed Wong, an associate professor of molecular biology at Western.

WestConn students to help test for toxins

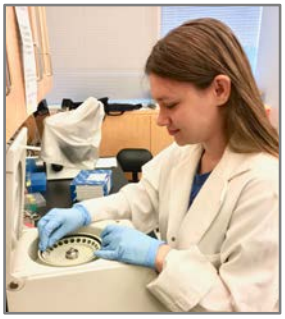
By Katrina Koerting • 5:44 pm EDT, Wednesday, March 30, 2016

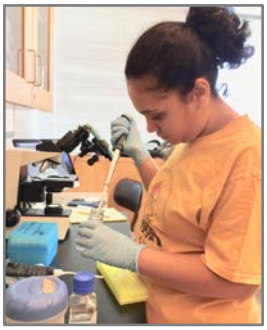
DANBURY — When the area's town beaches were closed last year because of blue-green algae blooms, officials often had to wait up to five days for results of ongoing water sampling to come back from a lab in Berlin, Conn.

Officials should have an easier time this summer deciding when it is safe to reopen, thanks to a partnership with Western Connecticut State University.

Blue-green algae blooms plague Housatonic, while Candlewood sees relief

Photo Credit: Sam Wong; Danbury News-Times





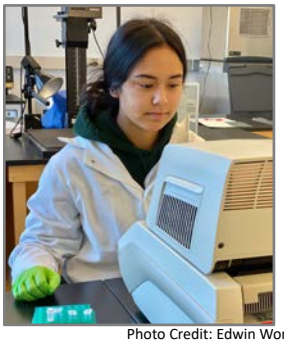


Photo Credit: Edwin Wong

Photo Credit: Ghada Hafez

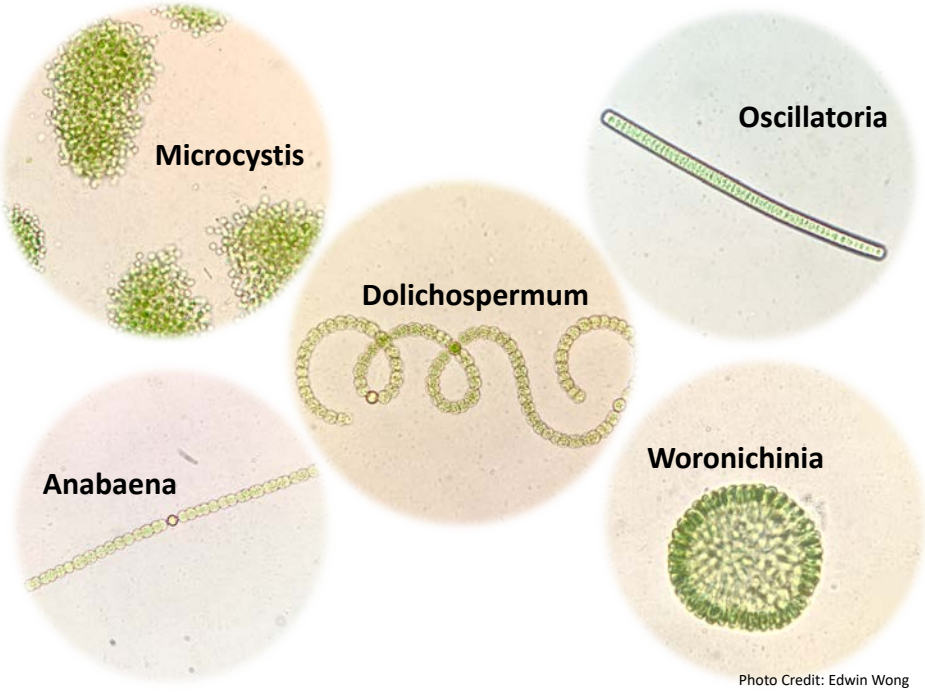
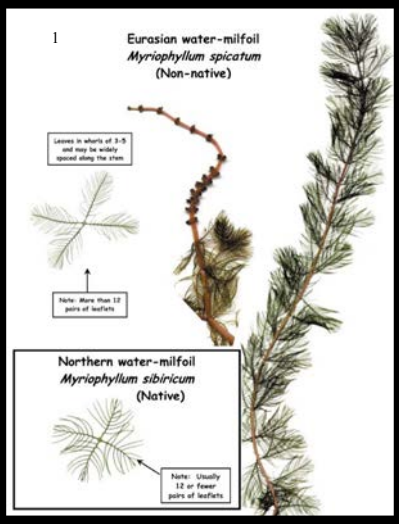


Photo Credit: Edwin Wong

Eurasian Water Milfoil



- Invasive species from Europe, Asia, and North Africa
- Can be up to 175 cm long, or roughly 5.7 feet
- Become a significant issue in recent years due to changing lake conditions[2]
- Many methods of control have been attempted, but none have been successful
  - Milfoil Weevils, unsuccessful (2008-2013)
  - Chemicals propose
    of New Fairfield (2

1. Borman, S. "Eurasian Water-Milfoil, Myriophyllum Spicatum (Non-Native)." *DCIST Publications*, Door County Invasive Species Team , map.co.door.wi.us/swcd/invasive/Publications.htm.

[2]Marsicano, Laurence J., et al. "An historical account of water quality changes in Candlewood Lake, Connecticut, over a sixty year period using paleolimnology and ten years of monitoring data." *Lake and Reservoir Management* 11.1 (1995): 15-28.

Methodology : Integrating Teachers

<u>Collecting Data:</u>

Once at a site, we scanned through all channels for the 48 carp systematically.

"*If we heard a fish, we would pause, and place the yagi closer to the water. If we could still hear it, we could confirm that the fish is at that site.*

We then pinpoint its location within that site, and record its number on our maps. The location was then input digitally in Google Maps per individual fish."

Triploid Grass Carp Tracking Project on Candlewood Lake

Dr. Theodora Pinou
Western Connecticut State University

Larry Marsicano
Candlewood Lake Authority

April 6, 2017
Science Building Rm. 125

- This study demonstrates that the carp are surviving in the milfoil beds. It suggests that areas of high milfoil concentration and managed recreational activity support high concentrations of grass carp. The slide below is the same cove over 2 years. It supports a significant number of grass carp in a predictable fashion. Significantly less milfoil was observed in 2017.

Allen's Cove, Sherman

July 13th, 2016

July 18th, 2017

LEARNING With LOGGERHEADS

Third graders analyze real-time data while contributing to the conservation of an endangered species.

By Christine Lener and Theodora Pinou

Kids tracking sea turtles? No, it's not a description for a new nature show on TV, it's a lesson, and it could be happening in your classroom! Sea turtle biologists worldwide are currently working together to track turtles to learn about sea turtle behavior and migration in an effort to conserve these endangered animals. We developed a unit using a modified version of published tracking activities (Sera and Eckert 2003) for third-grade students in which students develop and share computer-generated maps that are based on authentic data. With this information, students can evaluate sea turtle life history, behavior, and environmental hazards, just as scientists are doing today. Now, with only an internet connection, your students can engage in the global mission of sea turtle conservation while at the same time learn about the importance of technology in conservation and understanding of biodiversity.

help them monitor and map sea turtle movements. Scientists then post these data onto a collaborative sea turtle monitoring site, seaturtle.org, so they can communicate with colleagues globally about sea turtle movements throughout the world's oceans.

This sea turtle site is also accessible to educators on any basic internet server to teach students about sea turtle migration and mapping. In preparation for the activity, it's best if teachers reserve a computer lab ahead of time. In cases where computers are limited, teachers can group as many as three children to work cooperatively or rotate children between computer stations and manual mapping of the tracking points. Teachers are strongly recommended to prepare for this exercise by accessing the tracking data beforehand and modifying the points of latitude and longitude

Satellite Telemetry

Humans are able to track sea turtles across the world's oceans and follow their extensive migrations in real time through satellite transmission technology or telemetry. How does telemetry work? A biologist attaches a transmitter to the carapace (shell) of a sea turtle, usually at a nesting beach. When the turtle surfaces to breathe, the transmitter's antenna sends signals to satellite receivers that pinpoint the turtle's location and migratory pattern. A sea turtle can surface as often as every 10 minutes, sending multiple data points to satellite processing centers. Scientists translate these signals into points of latitude and longitude, which

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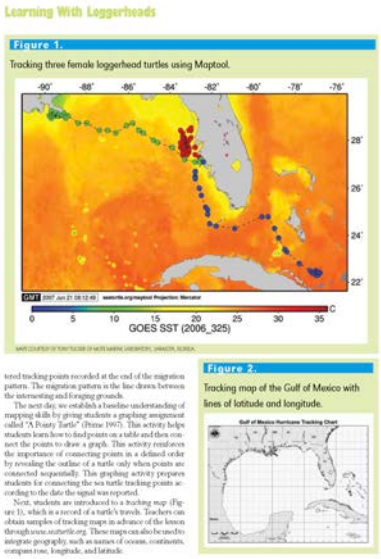

Learning With Loggerheads

Figure 1.

Tracking three female loggerhead turtles using Maptool.

-90° -88° -86° -84° -82° -80° -78° -76°

28° 26° 24° 22°

0 5 10 15 20 25 30 35

GOES SST (2006_325)

tered tracking points recorded at the end of the migration pattern. The migration pattern is the line drawn between the internesting and foraging grounds.

The next day, we establish a baseline understanding of mapping skills by giving students a graphing assignment called "A Prouty Turtle" (Prime 1997). This activity helps students learn how to find points on a table and then connect the points to draw a graph. This activity reinforces the importance of connecting points in a defined order by revealing the outline of a turtle only when points are connected sequentially. This graphing activity prepares students for connecting the sea turtle tracking points according to the date the signal was reported.

Next, students are introduced to a tracking map (Figure 1), which is a record of a turtle's travels. Teachers can obtain samples of tracking maps in advance of the lesson through www.seaturtle.org. These maps can also be used to integrate geography, such as names of oceans, continents, compass rose, longitude, and latitude.

Figure 2.

Tracking map of the Gulf of Mexico with lines of latitude and longitude.

Gulf of Mexico Hurricane Tracking Chart

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PUBLISHING WITH TEACHERS BUILDS TEACHER CONFIDENCE

USING TECHNOLOGY TO STUDY ENDANGERED SPECIES In CLASSROOM

- Seeing Through The Eyes Of A Sea Turtle! - YouTube video on The Wandering Biologist - https://www.youtube.com/watch?v=ZRqPXDTTwTc&feature=youtu.be
- An Encounter Between Two Turtles With TurtleCams - YouTube video on The Wandering Biologist - https://www.youtube.com/watch?v=0vJtOkoRuXA&feature=youtu.be
- https://www.paralenz.com/2018/11/life-from-a-sea-turtles-perspective-with-paralenz/ SEE what Paralenz Says!
- An Aggressive Encounter Between A Hawksbill And A Green Turtle - https://www.youtube.com/watch?v=xkEZ_pA7580&feature=youtu.be

FOR:

1. ISSUE DEFINITION
2. LOCAL CONTEXT FOR LEARNING

LOCATION AND LUCK

1. University Embedded in Community and serves one of the largest School Systems in the State.
2. University Researchers, State Expert Partners, and Strong Business Partners support this STEM Outreach.
3. Leveraging Resources as Much as Possible (i.e., Graduate program, Teacher Education program, Library, Danbury Family Engagement Center), Partnering with Local Nonprofit organizations with existing programs (i.e., HVA) .