Signals of Spring – ACES: Promising Results from a Classroom Ocean Literacy Program

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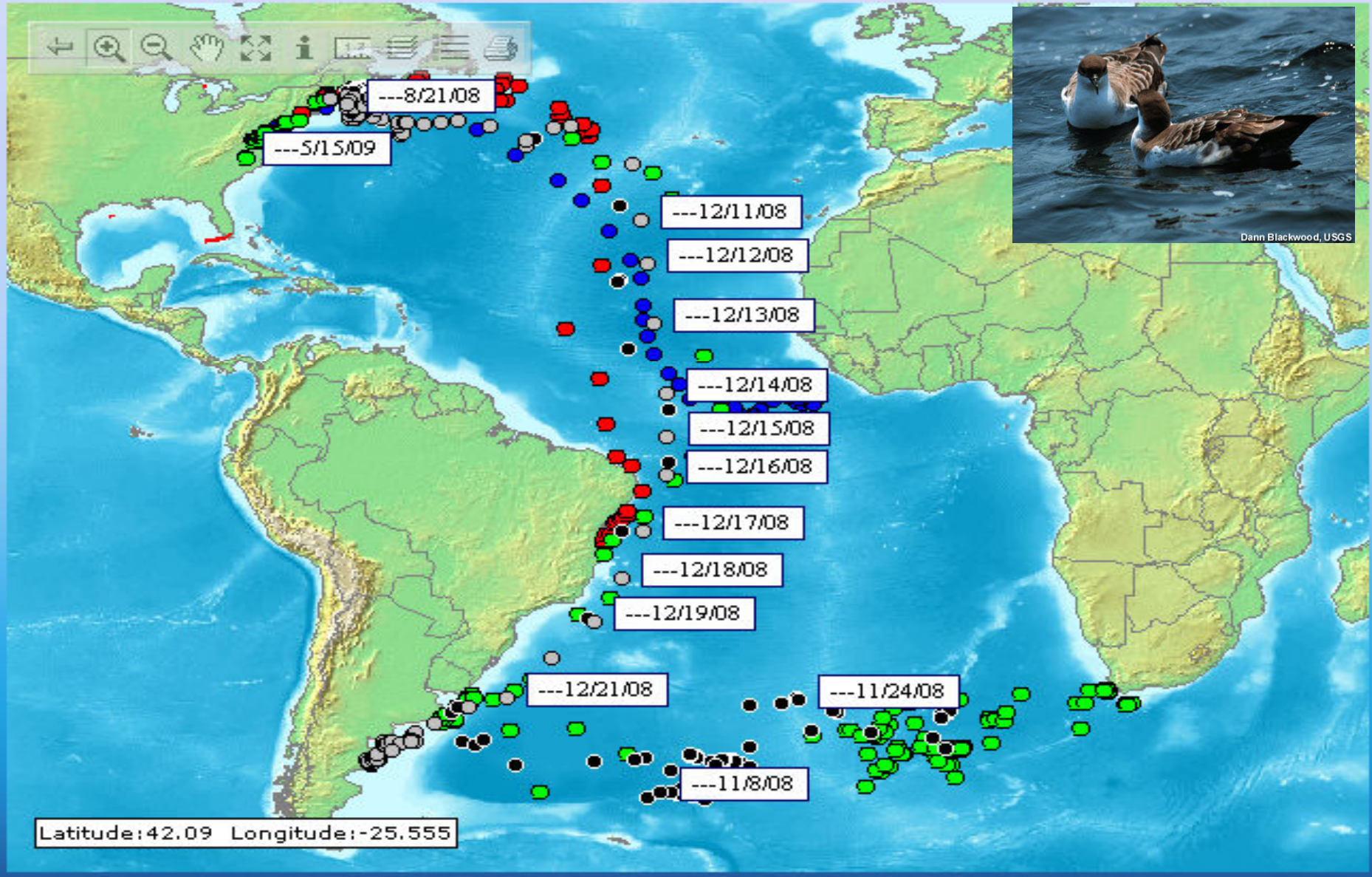
NOAA-sponsored Signals of Spring - ACES

- Students use Earth imagery to explain the movements of marine animals that are tracked by satellite

- Brief history of Signals of Spring
  - Collaborators
  - Current & Future plans

Greater Shearwater (Final Map for 2010)

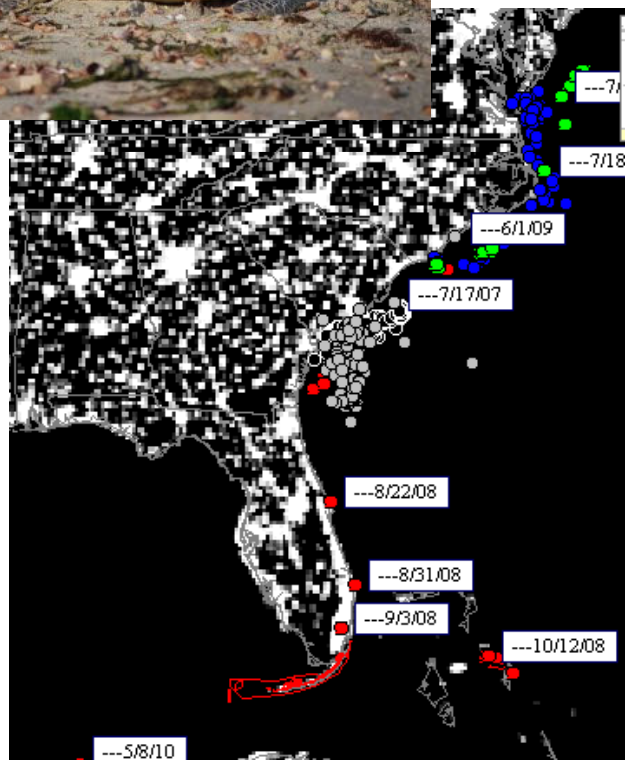
Note: Blinking dots represent the most recent location of the animal.



Goals of ACES

- Improve the ocean literacy of teachers and students.
- Assist teachers in incorporating a wealth of NOAA environmental data, including remote sensing and other maps, and digital STEM assets into classroom instruction.
- Establish ways to integrate the ocean into local standards-based curricula.

ACES Classroom Program



I. Content Lessons

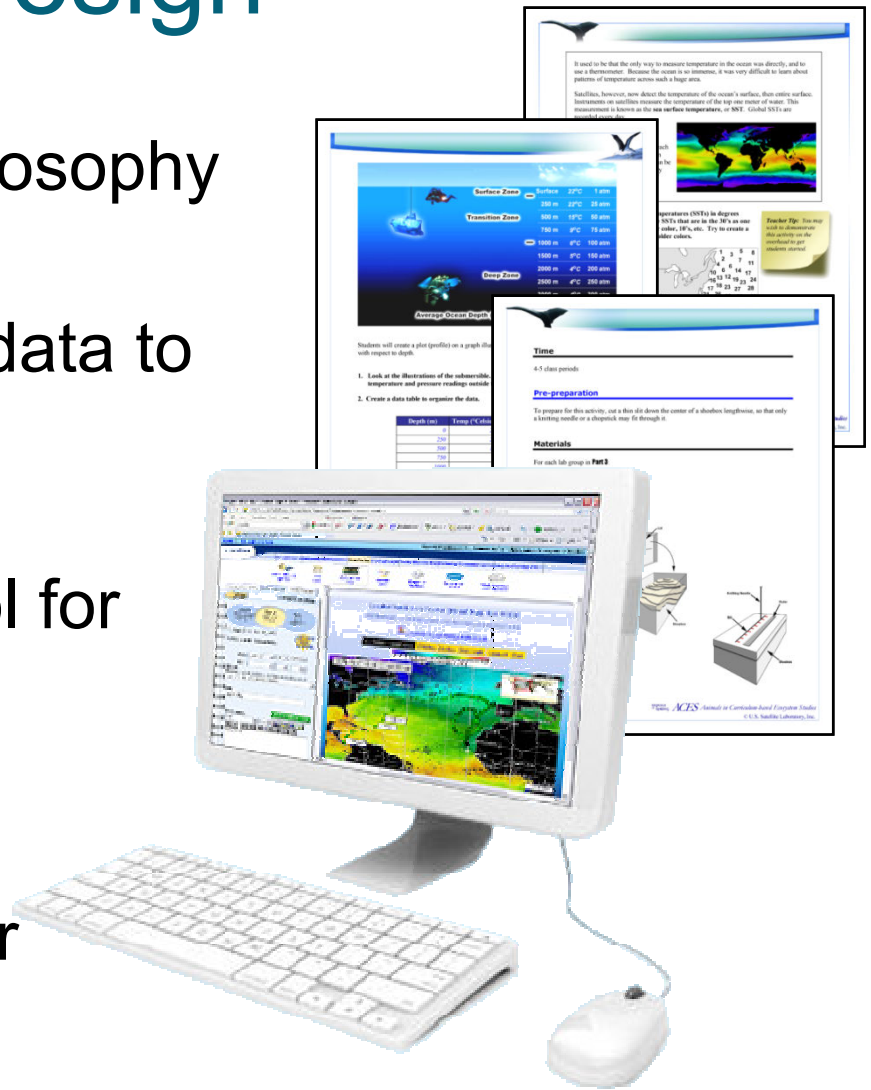
II. "Expert Team" Research

III. Analysis of Animal Movements

IV. Issue-based Investigations

Instructional Design

- Social constructivist philosophy
- Capitalize on authentic data to improve process skills
- Use technology as a tool for building understanding
- Present students with Socioscientific Issues for analysis



Research Effort

- Study ‘High Fidelity’ schools using a variety of instruments (Century, Freeman, Rudnick, & Leslie, 2008)
- Use social constructivist theoretical framework, consistent with program design
- Mixed methods – data collection and analysis
- Data sources include- content tests (not all high fidelity), student work, questionnaires, student focus group interviews, teacher interviews, classroom observations, etc.

Qualitative Findings

- Major Themes:
  - *Student engagement through animal tracking.*
  - *Recognition of personal influences on the ocean*
  - *“Systems thinking”*

Theme 1:

Student engagement through animal tracking

It made me like science better too. Like, science, science, out of all the subjects, I didn't like science at all. I was always really bored, and I didn't like that. But, we started looking at the different animals, you know, getting into it, and it was more interesting for us than other things in other classes. So, when we had got on, she, showed us that you could go on and look at the animals, I didn't really believe that we as a class was gonna do that, but now that I can do that, I like biology more, it's more fun. I like science now, it gets to feel like we are in a program with other scientists, figuring out like, what animals do, instead of learning about it from the teacher.

– *Desiree, Black Female, MI,* Grade 12

Theme 1:

Student engagement through animal tracking

I think, when you see the dots that are screen that are moving and stuff, it makes you want to learn more about it—like why they are going there and what they're doing, so it inspires you to go look it up and learn more or something.

– *Alex, White Male, ID,* Grade 8

Theme 2:

Recognition of personal influences on the ocean

Yeah, I would say that they most important thing is how everybody, everyday, has something to do with the ocean, whether you're near the ocean or not. So, whether you throw something away, like, if you just throw something out your window, like when you're driving, it could end up in the ocean. So everybody, has something to do with the ocean.

– Wendy, White Female, VA, Grade 12

Theme 2:

Recognition of personal influences on the ocean

Allison: *Like how the plastics that we throw away can go into the ocean and hurt the fish and stuff , all the aquatic life. The rivers and streams –*

Katherine: *All smaller rivers lead to bigger ones, and then to the ocean.*

Interviewer: *Is that something you knew before this program?*

Michelle: *I didn't really.*

Katherine: *Yeah, I guess.*

Michelle: *I didn't know all about the plastics, like the water bottles, and –*

Allison: *Like all the plastics that we throw away, some can make it to the ocean and they don't disintegrate and so they stay in the ocean until someone comes along to clean it up, or the fish eat it.*

Theme 2:

Recognition of personal influences on the ocean

Alison	Like how the plastics that we throw away can go into the ocean and hurt the fish and stuff , all the aquatic life. The rivers and streams –
Katherine	Like how the plastics that we throw away can go into the ocean and hurt the fish and stuff , all the aquatic life. The rivers and streams –
Interviewer	Is that something you knew before this program?
Michelle	I didn't really.
Katherine	Yeah, I guess.
Michelle	I didn't know all about the plastics, like the water bottles, and –
Alison	Like all the plastics that we throw away, some can make it to the ocean and they don't disintegrate and so they stay in the ocean until someone comes along to clean it up, or the fish eat it.

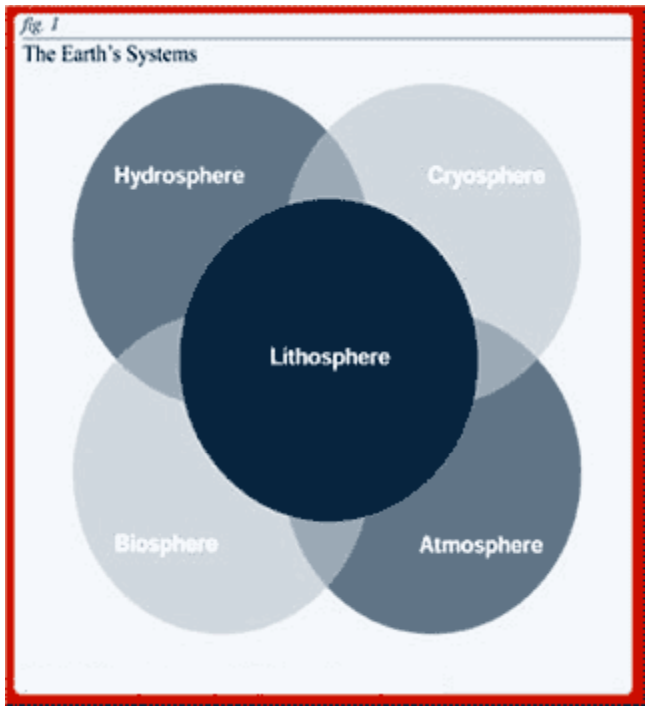
- 7th graders, IA

Theme 3:

"Systems Thinking"

- Described in literature as understanding complex systems such as those that naturally occur in the natural and physical world

  (see, for example: Assaraf & Orion, 2005; Hmelo, Holton, & Kolodner, 2000; Penner, 2000)



Credit: USGS

Theme 3:

"Systems Thinking"

Turtle 14750 and 72766 seem to be swimming on the continental shelf of Africa down towards the southern part of Africa. I noticed that all the turtles around the globe that I looked at seem to be spending some time on the continental shelves. This is because the continental shelf is full of food, nutrients, and sunlight to make it a paradise for turtles. They are also probably laying eggs on the coast of africa and mexico, which is why they spend so much time there.

- high school student expert team, VA

Theme 3:

"Systems Thinking"

Keisha moves in the pattern she does because of the phyoplankton. There is a high concentration of chlorophyll along the coast, which means the phytoplankton is abundant there. The movement of Keisha relates to the equatorial currents such as; North Equatorial current and the equatorial counter guinea current. Upwelling must be occuring on the coast because if the phyoplankton is thriving then there must be a high supply of nutrients. Upwelling brings a rich supply of nutrients from the depths of the sea to the surface.

- high school team, MI

Quantitative Data Analysis

- Reliability and validity established for questions (Plankis, 2009)

- Quantitative analysis
  - Descriptive statistics
  - Wilcoxin test
  - ANOVA
  - Effect size

Sample Quantitative Findings- full content survey

Descriptive Statistics: Pre/Post Survey Items

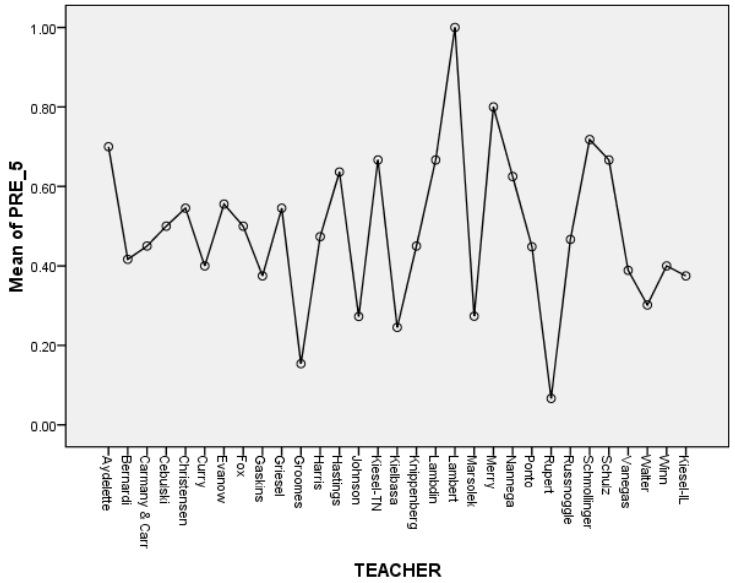
Survey Item Number	Pre N	Pre Mean	Pre SD	Post N	Post Mean	Post SD
5	753	0.44	0.50	612	0.81	0.39
6	753	0.17	0.37	612	0.31	0.46
8	753	0.61	0.49	612	0.79	0.41
9	753	0.15	0.36	612	0.28	0.45
10	753	0.49	0.50	612	0.60	0.49
11	753	0.26	0.44	612	0.40	0.49
12	753	0.48	0.50	612	0.64	0.48
13	753	0.22	0.42	612	0.45	0.50
14	753	0.30	0.46	612	0.40	0.49
15	753	0.54	0.50	612	0.68	0.47
16	753	0.59	0.49	612	0.73	0.45
17	753	0.65	0.48	612	0.81	0.39
18	750	0.42	0.49	610	0.51	0.50
19	753	0.52	0.50	612	0.67	0.47
20	753	0.58	0.49	612	0.68	0.47

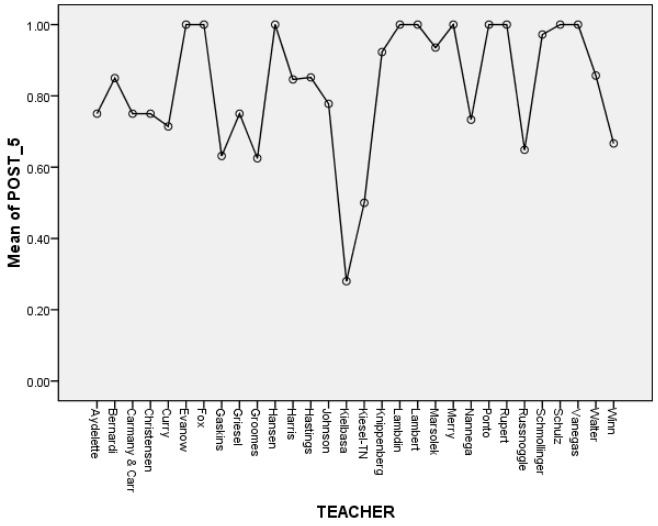
Sample Quantitative Findings – by grade level

Item 5: The most important producers in the ocean are a) coral b) phytoplankton c) d) seaweed.

Grade Level	Pre N	Pre Mean	Pre SD	Post N	Post Mean	Post SD
7	104	0.26	0.44	121	0.64	0.48
8	81	0.53	0.50	84	0.94	0.24
9	195	0.40	0.49	112	0.78	0.42
10	200	0.52	0.50	170	0.89	0.31
11	114	0.46	0.50	105	0.79	0.41
12	58	0.45	0.50	20	0.75	0.44
Total	752	0.44	0.50	612	0.81	0.40

Sample Quantitative Findings –by teacher (same item)





Teacher	Pre N	Pre Mean	Pre SD	Post N	Post Mean	Post SD
Aydelette	10	0.70	0.48	8	0.75	0.46
Bernardi	24	0.42	0.50	60	0.85	0.36
Carmany/Carr	20	0.45	0.51	20	0.75	0.44
Cebulski	2	0.50	0.71	-	-	-
Christensen	33	0.55	0.51	12	0.75	0.45
Curry	10	0.40	0.52	7	0.71	0.49
Evanow	9	0.56	0.53	7	1.00	0.00
Fox	8	0.50	0.53	12	1.00	0.00
Gaskins	24	0.38	0.49	19	0.63	0.50
Griesel	11	0.55	0.52	8	0.75	0.46
Groomes	13	0.15	0.38	8	0.63	0.52
Hansen	-	-	-	19	1.00	0.00
Harris	19	0.47	0.51	13	0.85	0.38
Hastings	11	0.64	0.50	27	0.85	0.36
Johnson	11	0.27	0.47	9	0.78	0.44
Kiesel-TN	3	0.67	0.58	8	0.50	0.53
Kielbasa	53	0.25	0.43	50	0.28	0.45
Knippenberg	20	0.45	0.51	13	0.92	0.28
Lambdin	27	0.67	0.48	14	1.00	0.00
Lambert	9	1.00	0.00	11	1.00	0.00
Marsolek	106	0.27	0.45	62	0.94	0.25
Merry	15	0.80	0.41	11	1.00	0.00
Nannega	16	0.63	0.50	15	0.73	0.46
Ponto	29	0.45	0.51	11	1.00	0.00
Rupert	15	0.07	0.26	9	1.00	0.00
Russnoggle	105	0.47	0.50	37	0.65	0.48
Schmollinger	39	0.72	0.46	36	0.97	0.17
Schulz	12	0.67	0.49	11	1.00	0.00
Vanegas	18	0.39	0.50	5	1.00	0.00
Walter	53	0.30	0.46	84	0.86	0.35
Winn	20	0.40	0.50	6	0.67	0.52
Kiesel-IL	8	0.38	0.52	-	-	-
Total	753	0.44	0.50	612	0.81	0.39

Implications

- Results are promising
- First step toward more rigorous research on ocean in formal education
- Much more research needed, along with establishment of Fidelity of Implementation
- But, the ocean/aquatic education needs to be included in NSES to tie this work to student outcomes

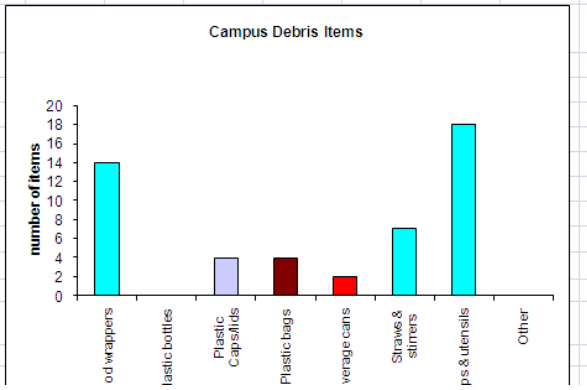
Getting involved in ACES

- Campus Debris Survey

Based on "Plastics in the Ocean"

of items you found on your
vey in the column entitled
"Number of Items."

10	List the START time of the survey here:	
11	List the END time of the survey here:	
12	Enter BEFORE or AFTER lunch here:	
13		
14	**Enter**	Number of items
15	Food wrappers	14
16	Plastic bottles	
17	Plastic Caps/lids	4
18	Plastic bags	4
19	Beverage cans	2
20	Straws & stirrers	7
21	Cups & utensils	18
22	Other	
23	**Grand Total**	
24		
25	Enter *Debris-Rate* (Total # items/unit of time) here:	
26		
27	**Comments and Interpretation:**	



Lesson: Campus Debris and the Ocean

Based on "Plastics in the Ocean" Benicia Water Education Program developed by Oikonos for the City of Benicia

Overview

This lesson is designed to allow students to actively make connections between trash found on their campus and debris found in marine ecosystems. Students will learn about debris and how it affects marine animals, and they will participate in a campus debris survey. Students will analyze their data using charts and an excel workbook. Finally students will create a public service campaign aimed at maintaining a debris-free campus.

Objectives

Students will be able to:

- ✓ Describe the impacts of marine debris on marine animals.
- ✓ Follow a scientific procedure to survey campus debris.
- ✓ Relate campus debris to marine debris using the concept of watersheds.
- ✓ Compare the debris found on campus to debris collected at the California Coastal Survey.
- ✓ Create a public service campaign to raise awareness of the danger of debris to a marine ecosystem.

Materials

- ☐ Gloves
- ☐ One kitchen sized garbage bag for each pair of students
- ☐ Campus Debris Data Sheet
- ☐ Campus Debris Data Summary Excel Workbook *or* Campus Debris Data Summary Data Sheet
- ☐ Computer lab with internet access and Microsoft Excel*

*** NOTE:** If computer lab or internet access is unavailable, simply print out the necessary sections from the Signals of Spring – ACES website for students to read in **Part 1**. If possible, project some of the images from the website in color. For **Part 2**, if Excel is unavailable, students will construct the graphs by hand instead of using Excel.

Getting involved in ACES

- National Water Study

Sevier County high School, Sevierville, TN

SCHS Honors Biology 1st period
Lat: 35.87 N, Long: 83.53 W
Date: 03/30/2009
Name of water body: Witt Creek
Type of water body: creek, fresh water
Nitrogen: 0 mg/L
Phosphorus: 2.0 mg/L
Turbidity: 10.0
Temperature: 14.0 °C
pH: 7
Dissolved Oxygen: 11.3 mg/L
Notes / Other Observations: We sampled benthic macroinvertibrates. We found organisms in all three water quality categories. We conclude, based on the high biodiversity and chemical tests, that the creek ecosystem is surprisingly healthy. We did find an abundance of trash.

8 2009 2010

For more information about ACES

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