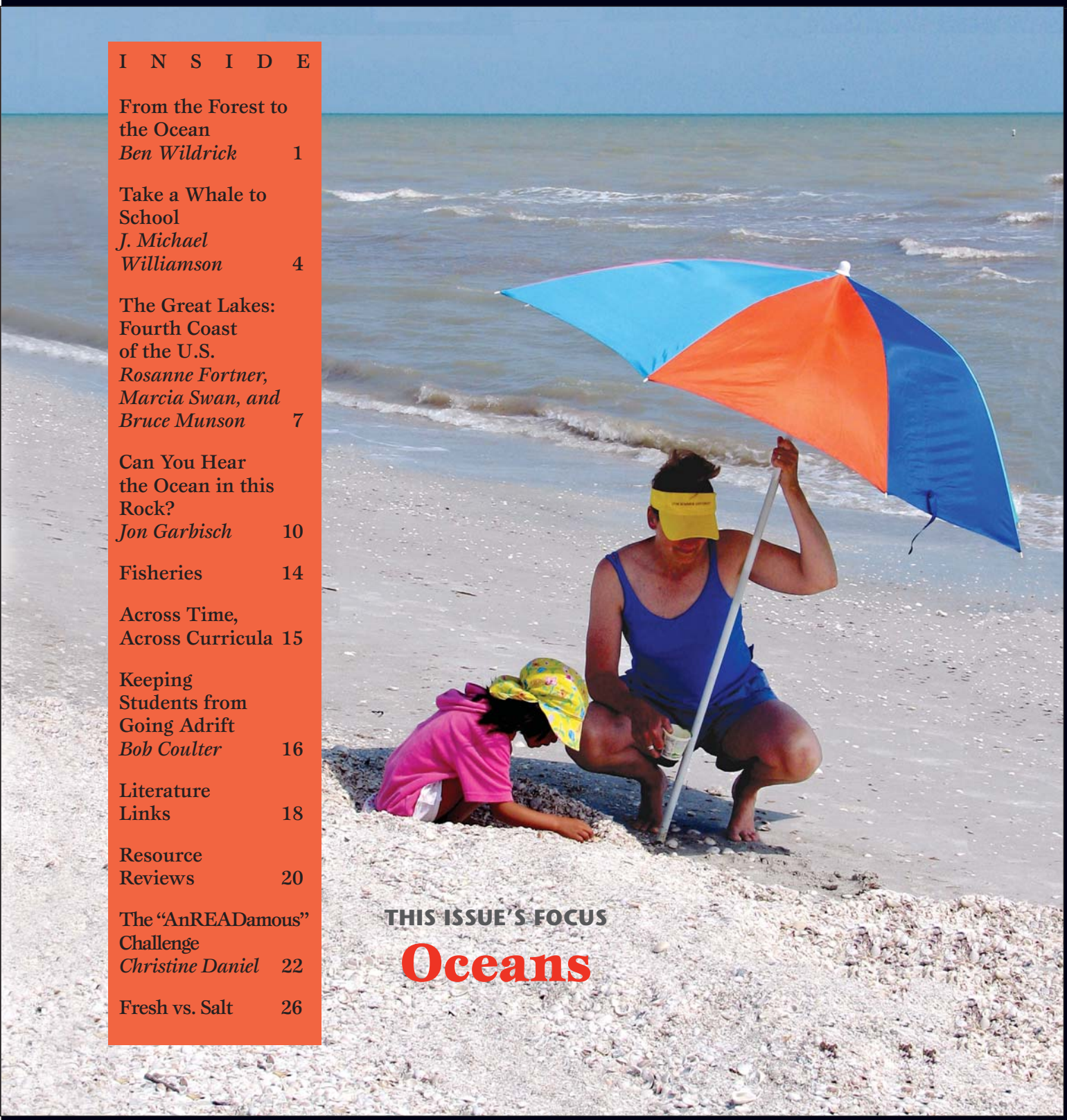
May/June 2007

VOLUME 20 ISSUE 5

TEACHERS' INNOVATIONS IN K–8 SCIENCE, MATH AND TECHNOLOGY

Connect®

INSIDE



THIS ISSUE'S FOCUS

Oceans

Oceans

What does the word ocean evoke in you or in your students? Is it a shoreline, sand and shells, as in our cover photo, or a vast region of unknown phenomena, discovery or danger? Some classes can take a quick field trip to the shore. Most cannot. Many can invite experts into the classroom. But if you are not in one of those fortunate positions, you will find new ideas and approaches in this issue of ***Connect***.

Authors explore links between fresh water and salt, including anadromous fish, as well as innovative uses of software, stories in the fossil record, mapping and modeling. Literature Links suggest books that can expand the thinking of younger and older students. Around the globe, cultures are moving from thinking of oceans as a vast unknown and as potential dumping ground towards a focus on oceans as crucial to life on Earth. These articles offer specific examples of curriculum and pose larger questions about how to pursue the study of oceans and their role in a constantly changing system.

Will her design withstand the incoming tide in this small bay?
FRIENDSHIP, MAINE

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published by SYNERGY LEARNING™

***Connect* is published five times per year (bi-monthly through the school year) and offers a wide range of practical, teacher-written articles. Each issue is thematic and supports hands-on learning, problem solving and multidisciplinary approaches.**

Editor: Casey Murrow

Associate Editor: Heather Taylor

Circulation: Susan Hathaway

Design and Production: Judy Wingerter

Connect (ISSN: 1041-682X) is published five times per year, September, November, January, March and May, by Synergy Learning International, Inc., PO Box 60, Brattleboro, VT 05302. Tel. 800-769-6199, Fax 802-254-5233, email connect@synergylearning.org.

Periodical postage paid at Brattleboro, VT 05301 and additional mailing offices. (USPS 005-389).

POSTMASTER: Send address changes to ***Connect***, PO Box 60, Brattleboro, VT 05302-0060.

How to subscribe (print version): send $25.00 for a one year subscription ($31.00 Canada/Mexico, $44.00 other foreign, in U.S. funds). Volume discounts are $20.00 each for five or more subscriptions sent to the same address. Back issues are $6.00 each, ten or more issues $4.00 each postpaid. Mail to Synergy Learning, Inc., PO Box 60, Brattleboro, VT 05302-0060. Or call 800-769-6199.

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Printer: Vermont Graphics

PHOTO CREDITS: Cover, Inside front cover, Casey Murrow; page 1, 2, 3, Brookwood School archives; p. 4, 5, 6, J. Michael Williamson; p. 7, 8, 9, Lyndsey Manzo; p. 10, RFG; p. 11, 12, 14, EduArt; p. 22, 23, 24, 25, Christine Daniel; back cover, Heather Taylor.
ILLUSTRATIONS: Page 5, J. Michael Williamson.

Ed Press Awards for ***Connect****:*
1990, 1992 Distinguished Achievement Awards
1996 Winner: Honor Award for Excellence in Educational Publishing

Connect is printed on Chorus Art paper, 50% recycled; manufactured acid and elemental chlorine free.

Synergy Learning International, Inc. is a 501(c)(3) not-for-profit corporation, engaged in publishing and professional development for educators, pre-k to middle school. We are dedicated to supporting schools, teachers and families with challenging science, math and technology learning for children.

Take a Whale to School

by J. Michael Williamson

I have been teaching about the oceans and marine sciences since 1973, and I have been researching blue whales since 1980. In that capacity, I visit schools, make presentations, and spread the word about whales and the importance of the marine environment. Among other various questions, such as, "How close have you been to a whale?" students always ask, "How big is a whale?" I tired of the same mundane answer of, "They are as big as a school bus." So one day I decided to make a model that I could take to schools to show students how BIG a whale is.

An idea takes shape

While stuck in one of Boston's notorious traffic jams, I made a prototype of a model using an extra piece of paper and my Swiss army knife. I then enticed my senior seminar class at Wheelock College in Boston, Massachusetts to develop this project as part of a class activity on problem solving. Their challenge: Make a life-sized whale model that fits into a duffle bag and can be carried by one person.

Eventually Lucy was "born." Since that time hundreds more Lucies have been created. I not only made Lucy the Inflatable Whale for myself, but I also developed an instruction booklet that allows anyone who wishes to make his or her own inflatable whale.

Classes, community groups, church groups, and museums all over the country and world have constructed their own whales. Institutions such as the Boston Museum of Science and the Bermuda Underwater Exploration Institute have exhibited their own inflatable whale models.

When I began this project, I had no idea the impact that Lucy would have on students of all ages. Watching the students' eyes get larger as the inflating whale gets larger is an experience in itself. I now have Lucy III. The first two models saw at least 20,000 students pass through their interiors.

One day while visiting a school in Connecticut, a teacher came running up to me, grabbed my arm, and said, "You can't believe what just happened!" At this point in the day, after what seemed like the 200th fifth-grade class, I had no idea what might have happened. Excitedly and seemingly breathless, the teacher said that they had a student with autism who hadn't uttered a real word, much less a sentence, in two years; when the girl saw Lucy and the other students, she said to her teacher, "I want to go in the whale."

Lucy, The Inflatable Whale

Creating Lucy: you can do it!

The learning experiences begin with the problems of constructing the whale. Where do I begin? How do I interpret the instructions and organize the crew? It usually takes four or five adults about five hours to construct the whale. The more students you have helping the longer it takes, but that is part of the adventure.

The construction is like a sewing project in that you lay out patterns and cut pieces that are then assembled. In this case though, the 3- to 6-mil plastic pieces are joined with tape instead of fabric joined by thread. The instruction booklet provides complete directions and a materials list with everything you need to know to build

your own whale. The guide has been field-tested, and I have had relatively few questions on construction. I am glad to help with any questions you might have.

The whale-building crew uses some math, some simple materials (like packing tape, plastic, string, measuring tapes, and a three-speed house fan), some problem solving, some organizational skills, and some ingenuity to complete the project. The first time the whale inflates is a real show stopper. The inflation of the finished whale is usually a media event for the school and the local papers. If you are building a whale, seize this opportunity!

Educational units on life science (whale anatomy), physical science (air pressure), and mathematics are included in the booklet. Students can research questions such as:

- How does the whale stay inflated?
- What is the surface area and volume of the whale?
- Why is the surface area to volume ratio (SA/V) so important to a whale?
- How is the SA/V ratio different from that of plant plankton (phytoplankton)?
- Why is the SA/V ratio different?

Within the instruction booklet, I include some seed activities that can lead to more investigations.

The students use proportions (Table 1 shows part of this chart) to determine the placement of the eye, the flipper and the dorsal fin, using data taken from actual whales. They use mathematics to calculate the surface area to volume ratio of the whale (Figure 2).

The eye is located about 22% of the whale's length back from the tip of the snout. How long is the whale model? So where does the eye go? The flipper is about 35% of the whale's length back from the tip of the snout. So where does the flipper go? The breadth of the flukes is about 23% of the whale's length (wow!!). So how wide do we make the flukes?

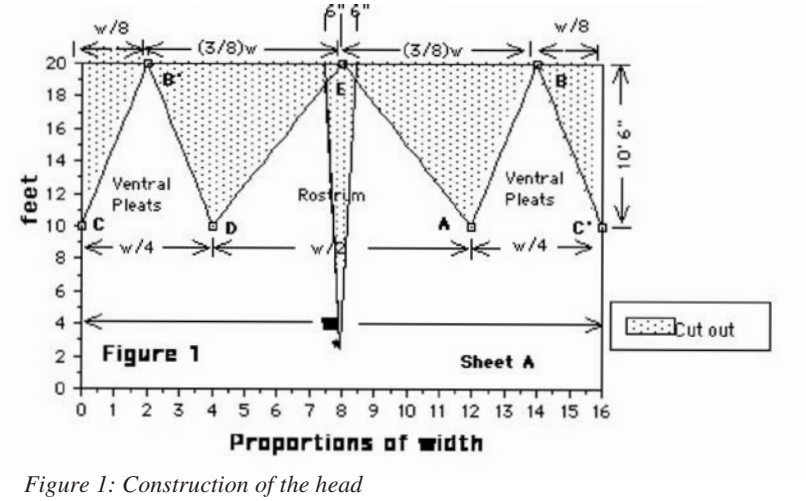
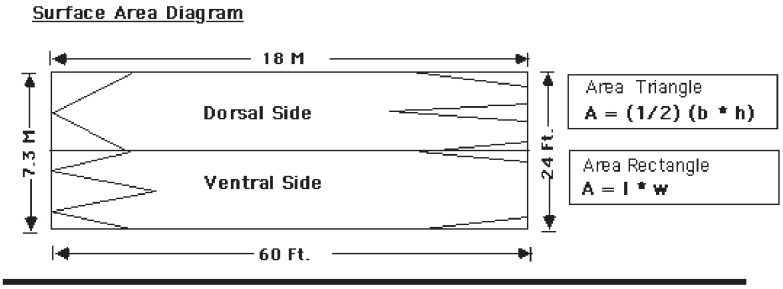


Figure 1: Construction of the head



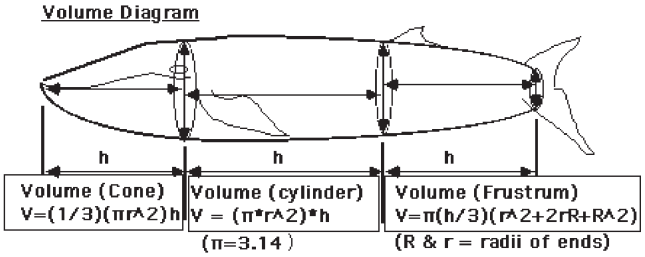


Figure 2: Mathematics–Surface area and volume

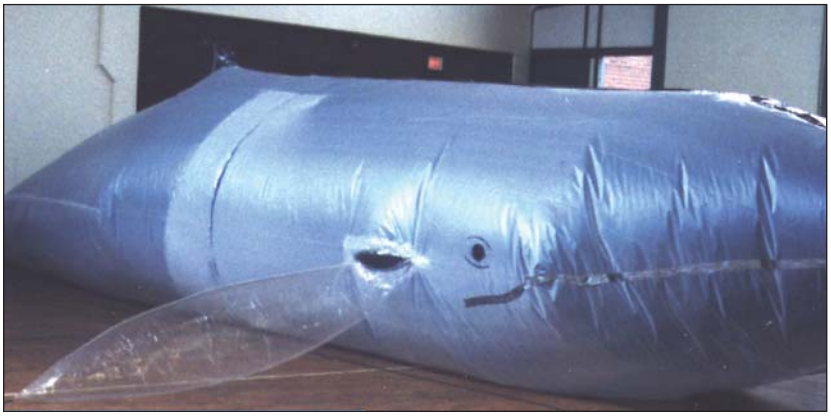


Table 1

ANATOMICAL DIMENSIONS FOR YOUR WHALE

Use the average body dimensions in percent body length of YOUR model.
Balaenoptera musculus *(based on available data from a whaling station)*

Specimen Number	14	19	3	4	1	9	20	12	21	22	24	Avg.
Sex	f	f	f	f	f	f	f	f	f	f	f	
Total Length (feet)	77	75	74	74	72	72	70	67	65	66	61	69.8
	%	%	%	%	%	%	%	%	%	%	%	
Tip of Snout to eye	21.8	21.7	21.6	22.1	20.9	21.5	20.3	21.6	20.	21.	220.	21.2
Tip of Snout to blowhole	18.9			18.8			17					18.3
Tip of Snout to posterior base of pectoral fin	34.4	34.7	34.1	35.4	33.8	35.5	34.4	36.2				34
Tip of Snout to posterior base of dorsal fin	76.9	77.3		78.9	72.0		75.7					76.2
Length of pectoral from posterior base fin	10.6		11.1	10.3	10.8	9.0						

Lucy should be the launching point, not the destination, of your learning journey.

The adventure

The voyage of learning should never be complete. Lucy offers one more leg of the journey. Lucy The Inflatable Whale offers a hands-on, minds-on, multidisciplinary adventure that most students and teachers never forget. The inflatable whale models have been used as reading rooms where upper class students read stories to lower classes, as senior projects in biology, as temporary classroom areas to study scientific concepts, as bible school's Jonah and the Whale activities, and other unique learning experiences. Remember, Lucy should be the launching point, not the destination, of your learning journey. It can be fun and exciting to teach science if you aren't afraid to answer a student's question at times with, "I don't really know, but I do know how we can find out."

You can visit WhaleNet at http://whale.wheelock.edu to download more educational resources and information on the marine mammals that inhabit the oceans of the world. WhaleNet offers real-time satellite tagging data on marine animals. There you can find active and archived satellite tracking data on over 100 other whales, dolphins, porpoises, seals and sea turtles. The Lucy page is at http://whale.wheelock.edu/whalenet-stuff/LucyPage.html. There you can order the instruction booklet ($10.00) and find links to providers of materials to make your very own Lucy. Log on and reap the educational rewards of the deep!

"Bob" The Whale in Vermont

J. Michael Williamson is the Director of WhaleNet and an Associate Professor of Science at Wheelock College in Boston, Massachusetts. He is also the Associate Director of the Mingan Island Cetacean Study (http://www.rorqual.com), and he has 30 years of experience in whale research.