

# Reading, Writing and Recirculating

How one Maine school is redefining science education through aquaponics

By David Munson

The gurgle of bubblers, the churning of pumps, the trickle and drip of nutrient-rich water: they're the sounds of aquaponics and, for scores of students from Midcoast Maine's small coastal communities, they're the sounds of success as well.

Housed in a small hillside greenhouse overlooking the North Atlantic, Herring Gut Learning Center's popular aquaponics programs are a far cry from the dusty chalkboards of the traditional science classroom. Students learn

key concepts in science, math, reading and writing by working shoulder-to-shoulder with their teachers in a small-scale aquaponics operation. The hands-on approach taken at Herring Gut inspires both excitement and a sense of responsibility in students, building their self confidence as they learn to man-



Above: a student tests the water quality of the fish tanks.

Left: Students determine the sex of tilapia

age the complexities of an enterprise that combines aquaculture, horticulture and business.

"I like working in the greenhouse – it's more fun working with the fish and the plants than just sitting inside doing notes all day," said Jerry Ames, a high school senior taking biology at Herring Gut. "There's always something different happening in the greenhouse."

Herring Gut is a not-for-profit education center in Port Clyde, Maine that specializes in experiential learning. In addition to an aquaponics greenhouse in which vegetables, herbs and houseplants enjoy a harmonious relationship with hundreds of tilapia, the school also has an oyster hatchery and two indoor trout production systems. Several nearby school districts make use of Herring Gut's unique facilities, sending student groups from alternative education and enrichment programs for regular classes with Herring Gut staff.

"This is a really unique opportunity for the students," said Jim Masterson, a teacher from St. George School whose alternative education class visits the center three times per week. "They learn science, math, reading and writing skills - and they learn to work together to get things accomplished."

Herring Gut, which takes its name from the original moniker given to the town of Port Clyde, was founded in 1999 by Phyllis Wyeth. Wyeth's goal was to provide the children of Maine's fishing families with opportunities to build a sustainable future for their communities through aquaculture and marine stewardship. With the generous support of a variety of individual donors, foundations, government agencies and other organizations, Wyeth's dream flourished. The school has grown dramatically over the past decade, helping hundreds of students find success through its aquaculture and marine science programs.

The aquaponics program at Herring Gut began with the addition of a greenhouse in 2003. Four 250-gallon tanks now house hundreds of tilapia, whose wastewater is used to support various herbs and vegetables in a series of troughs, as well as strawberries and houseplants grown in hanging baskets. Students learn laboratory and record keeping skills as they monitor water quality, determine feeding regimes, troubleshoot system problems and monitor the health of the plants and fish in their care. In addition, the stu-



*Top: Herring Gut Learning Center's campus.*

*Bottom: The greenhouse, Spring, 2007*

dents learn business skills by harvesting, packaging and selling their crops to local restaurants and food cooperatives.

"Last year, the students working with the aquaponics system were able to provide fresh basil and other products to local consumers through direct sales and sales to local restaurants and markets," said Jeffrey Chase, Executive Director of Herring Gut Learning Center. "Not only were they successful in supplying their community with a sustainable product that is not readily available, they were able to learn science along the way - and they really enjoyed it."

At Herring Gut, the opportunities to teach science through aquaponics is only limited by one's imagi-

nation. From fish anatomy and nitrogen cycling to vegetative propagation and composting, the greenhouse is a living laboratory where students are able to make connections between what they learn in the classroom and what those concepts mean in practice. High school biology classes, middle school math and science groups, gifted and talented programs and teacher training seminars all benefit from the varied programs taught using the aquaponics facility, and the greenhouse is a popular spot when the snow and wind of the Maine winter is howling outside.

Herring Gut staff are proponents of aquaponics in the larger community as well, exchanging ideas and expertise with aquaponics entrepreneurs and

educating the public regarding the important role aquaponics can play in ensuring a thriving and sustainable future for the world's food supply. Outreach programs at Herring Gut include seasonal tours of the greenhouse that

introduce hundreds of summer tourists to the concept of aquaponics, not to mention the exceptional taste of tilapia-grown tomatoes. Science teachers in area schools are becoming proponents of aquaponics as well, working with Herring Gut to set up their own small-scale systems right in the classroom.

Throughout the aquaponics program, Herring Gut students use the scientific method and the school's cutting-edge technologies to solve problems and

improve their approach. Student-run investigations track food losses, examine pH trends, improve crop yield and gather a wide variety of other data. These projects not only improve the efficiency of the aquaponics system, they also deepen the students' understanding of scientific principles.

As with most aquaponics operations, the Herring Gut facility itself is an ongoing experiment. Keen observations and thoughtful questions lead to answers, insights and more questions, encouraging students to explore new techniques and consider solutions in ways that step far beyond the cookie-cutter science offered by many textbooks. Their investment in the aquaponics project makes their efforts more meaningful – and critical thinking skills are the key to their success.

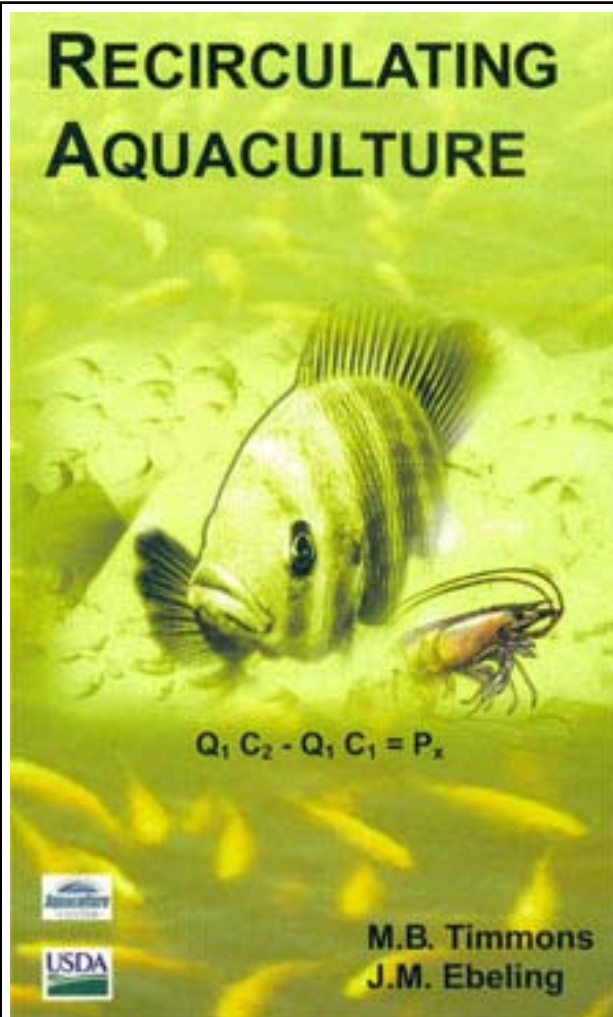
"You really have to watch these guys to figure out what's going on," said senior Jacob Morse as he netted another tilapia for transfer to

a new tank. Morse's younger brother recently began raising algae in the oyster hatchery program. "You can learn a lot if you take the time to really think about how to make things run better."

**About the Author:** David Munson is the Director of Communications at Herring Gut Learning Center. He can be reached by phone at: 207-372-8677.



*Left: Students monitor water quality; Top: transplanting seedlings spring, 2007; Bottom: rainbow trout hatchery*



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### About the New Book

*Recirculating Aquaculture* replaces our previous popular text *Recirculating Aquaculture Systems* that has been used as the primary resource for the Cornell University Short Course since 1994. *Recirculating Aquaculture* has been expanded by over 200 pages, including a new chapter on denitrification by Dr. Jaap van Rijn (Hebrew University of Jerusalem) and an expanded biofiltration-nitrification section consisting of chapters on processes and design. Also of special interest is an expanded and updated chapter on aquaponics written by Dr. James Rakocy (University of the Virgin Islands). Numerous design examples have been added to each chapter and an expanded appendix of engineering design tables.

*Recirculating Aquaculture* has had contributions from numerous educators, commercial growers, extension specialists and researchers, who are well known in the aquaculture community; most are prominent members of the Aquacultural Engineering Society.

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