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POLY CULTURE

adding value to aquaculture



Polyculture: Profiting from an eco-friendly mix

By Jerry Lockett

Last August, Inka Milewski, marine science advisor with the Conservation Council of New Brunswick, was checking out the seabed beneath a temporary salmon farm in the Bay of Fundy. It was a desolate scene. "There were dramatic differences between the farm site and an unfarmed site a few hundred meters away," she says.

The site was by no means typical and a permanent licence was subsequently denied. Nevertheless, it's a reminder that fish farms in southwestern New Brunswick discharge a significant volume of waste into the Bay each year, and there are signs that this waste is contributing to degradation of the Bay's marine ecosystem - including blooms of toxic and other nuisance algae. The widely-held belief that Fundy's enormous tides somehow flush its harbours and inlets clean is a myth. Whatever's in the water is shunted to and fro with every tidal cycle.

Although this is a serious issue for the industry, there may soon be a way to deal with the Bay's fish waste in an environmentally friendly manner, and gain an economic advantage at the same time. It's a concept called "integrated aquaculture" (a.k.a. "polyculture"). Thierry Chopin, a professor of marine biology at the University of New Brunswick in Saint

John (UNBSJ), is one of its most enthusiastic and devoted advocates.

Instead of growing fish and shellfish at separate sites, Chopin proposes a system where finfish, shellfish and seaweeds grow alongside each other. Salmon don't eat all the food pellets they are given, and they also create solid and dissolved wastes. Mussels and other shellfish feed on suspended particles in seawater, and can mop up uneaten food and solid wastes. And seaweeds rely on a supply of dissolved nutrients, especially nitrogen and phosphorus, in order to grow. Put all three components together and you have a system where salmon provide an abundant year-round supply of food for the mussels and seaweeds, which in return filter and remove nutrients from the water, providing a healthier environment for the salmon.

The farmer would benefit from economic diversification with three products to sell rather than one. Each cultivation unit could show a bigger profit and less fish feed would go to waste. If the industry is faced with effluent discharge regulations in the future, integrated systems could help sites to comply more cheaply than alternative treatments. At present, the United States Environmental Protection Agency is proposing discharge regulations, and similar measures are likely to follow eventually in Canada.

Left: Peter Lenihan and Carla MacQuarrie in the greenhouse of Future Aqua Farms Limited where the waste from Tilapia fertilizes plant produce. (Jerry Lockett photo) Right: Young kelps growing at the integrated aquaculture site of Atlantic Silver Inc. in Bocabec Bay, New Brunswick. (Susan Bastarache photo) Inset: Dr. Thierry Chopin of the University of New Brunswick in Saint John holds a spool of young kelp. (Susan Bastarache photo)



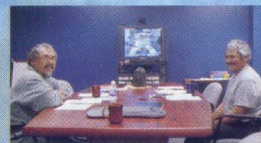
It sounds good in theory, but will it work in practice? Chopin is leading a team of UNBSJ scientists, along with researchers from the Department of Fisheries and Oceans at St. Andrews, to develop this alternative approach to aquaculture. The research is funded by AquaNet, the Network of Centres of Excellence in Aquaculture in Canada,

and after only two years, the results are encouraging. The team has successfully developed techniques of raising and growing kelp in and around an existing salmon farm in Bocabec Bay, owned by

industry partner Atlantic Silver Inc. Mussels have also been grown successfully at several salmon farm sites. TerraLynn Lander, a graduate student, has shown that these mussels have 25-30

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per cent more meat content than those grown away from the salmon. Taste tests prove that the mussels do not acquire a "fishy" taint. And the Canadian Food Inspection Agency, another partner in the project, has found that both mussels and kelp are free from therapeutants used in salmon culture.

Integrated aquaculture hasn't always been an easy sell. "I've had my period of preaching in the desert," says Chopin, "but now people are taking it seriously. There's more and more interest at industry and government levels." In March, AquaNet confirmed funding for the second phase of the project. This phase will involve three additional partners: Acadian Seaplants Limited, Heritage Salmon and Ocean Nutrition Canada - all industry heavyweights. The project will be expanded to an industrial scale and scientists will try to find the right balance of salmon, mussels and seaweeds needed to provide maximum economic and environmental benefits, and see how the system will function at this scale.

Markets for salmon and mussels are well established, but what about the

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market for seaweeds? In 2002, about 42,600 tonnes of wild seaweeds were harvested in New Brunswick, Nova Scotia and PEI. Acadian Seaplants of Dartmouth is the only sizeable commercial seaweed grower outside Asia, and is a world leader in the development of land-based seaweed cultivation in tanks. Currently the main North American markets are for seaweed extracts used in the food processing, fertilizer, health, beauty and brewing industries.

To put this into a global perspective, China cultures more than 7.9 million tonnes of seaweed annually, valued at U.S.\$4 billion, and Japan's primary aquaculture seaweed, Nori, is a popular sea vegetable with an estimated value of

U.S. \$1.5 billion annually. Worldwide, five times more seaweed than finfish is grown in aquaculture.

"I'm interested in developing more of a niche market," says Chopin, "particularly in industries that require small volume at a high price, such as nutraceuticals, pigments and sea vegetables for human consumption. Sea vegetables bring the highest price you can get from seaweeds." Seaweed as a food source for other aquaculture species such as sea urchins, which need a diet of kelp to develop the best flavour and colour, may open another new market.

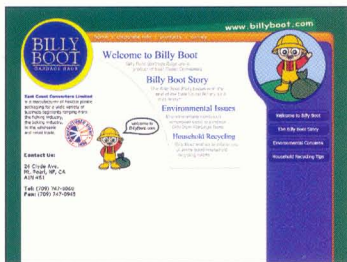
Integrated aquaculture seems such an intuitive concept, it's hard to believe no one came up with the idea earlier, but in

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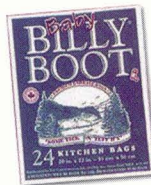
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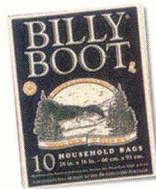


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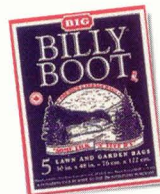
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fact they did. Similar techniques have been carried out for centuries in Asia, mostly in freshwater. And one Atlantic Canadian enterprise was recently established specifically to test the commercial possibilities of a freshwater integrated aquaculture system. Future Aqua Farms Limited, located near Halifax on Nova Scotia's eastern shore, bases its operation on a fusion of aquaculture and hydroponics, known as aquaponics.

The company raises Tilapia, a mild-flavoured freshwater fish, in a closed 30,000-litre system, housed in a 3,000 square foot greenhouse. Water circulates between the fish tanks and a hydroponic growing area for plants. The fish waste provides enough nutrients to grow crops such as spinach, lettuce, arugula, basil and watercress. Once the plants have soaked up the nutrients the clean water is pumped back to the fish tanks. At present the company markets its organic products mainly to high end Halifax restaurants and through the city's farmers' market.

The economic benefits of growing two products with one set of inputs are obvious. And the system is flexible too. The company's markets have developed in favour of plant sales more than fish, so it has scaled back fish production to maximize plant production. The ratio could just as easily be reversed to maximize fish output if that's what the market or other conditions demanded.

This pilot-scale venture has been operating for four years now, and the company has plans for expansion. "It was designed to demonstrate the techniques and cover its basic operating costs," says Dave Roberts, one of the company's four co-owners, "and it's surpassed all the commercial goals it was intended to meet. But to be commercially viable in the true sense it needs to be about three times its present size." In the meantime Future Aqua Farms also designs aquaponics systems for other companies, and plans to offer training to other would-be operators.

Integrated aquaculture still has to prove itself in the western world, but its blend of potential economic and environmental benefits is a tempting combination. It's a combination that may well appeal to an industry beleaguered by environmental critics. •



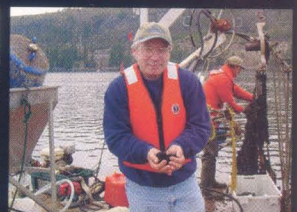
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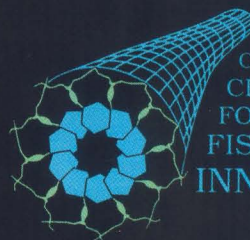
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