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# Fish farming for the future

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It's lonely swimming against the mainstream currents of fish farming—just ask Richard Buchanan. Through his company, AgriMarine Industries, this professional engineer has been dumping his energy and life savings for the past six years into the development of a floating, closed-containment aquaculture system. With this, he aims to address the problems of disease transfer, fish escapes, and fish waste that have plagued the Canadian fish-farming industry over the last decade. However, until Buchanan manages to attract investment, all he'll have to show for his efforts is a 1/10th scale model made of Styrofoam on display in his mostly vacant Campbell River office.

"I'm confident that we can bring it from the model to a working prototype. I'm confident in the design," Buchanan recently told the Georgia Straight.

Buchanan—who has been involved in various capacities with the Vancouver Aquarium for more than two decades, and who splits his time between Vancouver and Campbell River—has seen all sides of this controversial industry, which has an annual production worth about $200 million in B.C. In the early 1990s, AgriMarine was farming fish off Vancouver Island using conventional net pens; however, the firm lost entire years of production in 1992 and 1994 due to phytoplankton, or algae, blooms. After suffering another catastrophic algal loss in 1996, AgriMarine bailed on traditional fish farming.

Then in 2000, AgriMarine was selected by the B.C. government to develop a land-based fish-farming system in Cedar, south of Nanaimo. After the two-year trial was finished, Buchanan says AgriMarine proved it could raise healthy salmon in a closed-containment system, four concrete ponds with electric pumps that poured 1,500 gallons of seawater per minute through each. At the time, the fish were sold to the Vancouver Island–based grocery chain Thrifty Foods under the label "Eco-Salmon". However, the costs of pumping the water proved to be prohibitive, and that's when Buchanan turned his efforts toward developing a floating system that would reduce pumping costs by as much as 90 percent. (It took an average investment of 20 kilowatt-hours of power to raise a four-kilogram fish.)

Six years later, Buchanan thinks he has the answer: floating tanks of reinforced concrete and Styrofoam that would separate the farm and marine environments, allow the collection and treatment of waste from the tanks, and enable the careful monitoring of fish-farm conditions. However, at an estimated construction cost of $1 million per tank, the required start-up capital has been a considerable deterrent to outside investment. Unable to attract adequate private interest, Buchanan has turned to government. Originally, AgriMarine partnered with Scott McKinley of UBC's faculty of land and food systems and applied to the federal Western Economic Diversification (WED) fund for a $1-million grant to build a single tank and get a working model in the water at an already-approved site at Middle Bay north of Campbell River. Under the Agri?Marine–UBC partnership, once a working farm is in the water, McKinley and his team of researchers will study the environmental science and economic feasibility of Agri?Marine's technology.

"We know from our experience at Cedar that the biology works; now we need to marry it with this new technology. It's been a challenge to raise the money," Buchanan admits. "I'm hopeful the government will give us enough for a tank so we can test the impacts and do the science."

However, the UBC–AgriMarine proposal may be in jeopardy. A spokesperson for WED, which is currently undergoing an internal review of funding priorities, has suggested that AgriMarine may fall through the cracks. "WED does not fund for-profit commercial enterprises," Bernée Bolton told the Straight, adding that the proposal is still undergoing a process of due diligence.

Even if the partnership implodes, Buchanan isn't deterred. He is already looking at possible alternatives, including funding from another not-for-profit federal initiative, Sustainable Development Technology Canada. In addition, Buchanan recently helped to form the Middle Bay Sustainable Aquaculture Institute, a nonprofit group that will chase funds with the goal of floating a closed-tank system as soon as possible.

Among politicians and environmentalists, a growing number of people believe industry should look harder at new technologies instead of putting bandages on the old.

"I think it's really promising," says Shane Simpson, the NDP MLA for Vancouver-Hastings who also sits on the Special Committee for Sustainable Aquaculture. "The industry is defending net-pen technology, and some of them are not willing to open the door. I definitely don't dismiss the role of government in research and development."

The committee, a bipartisan group of six NDP and four Liberal MLAs that held public hearings this spring in more than a dozen coastal communities, is holding another eight public meetings in October and will present a report on its findings to the legislature by next May. Closed-containment was a frequent topic at the hearings.

Since 2000, when the Coastal Alliance for Aquaculture Reform (CAAR) came about, member First Nations and environmental groups such as the David Suzuki Foundation and the Georgia Strait Alliance have been touting closed-containment technology as the way to eliminate the risk of fish escapes, the transfer of sea lice to migrating wild stocks (see below), and the impacts of fish waste.

The David Suzuki Foundation, a member of CAAR, is a vocal proponent of AgriMarine's closed-containment proposal and has urged the feds to get

behind it. According to DSF marine campaigner Jay Ritchlin, industry reluctance to embrace new technologies is a function of inertia and the amount of capital already invested in conventional fish farms. Ritchlin adds that the battle to promote closed-tank technology hasn't been helped by past government pilot projects that were deemed not economically viable, conclusions that the foundation argues were based on flawed analysis. For example, in 2000 the then–NDP government awarded Marine Harvest a pilot aquaculture project on Salt Spring Island to test the closed-pen technology of Nanaimo-based Future SEA Technologies Inc. Ritchlin says economic analysis failed to take into account economies of scale and efficiencies, and the economic value of environmental costs and benefits; as well, the duration of the project was too short to fully assess a functioning closed-tank farm. In other words, the pilot project seemed predetermined for failure given the method of analysis.

"Our goal is to try and find solutions to maintain a healthy marine environment and human environment," Ritchlin says. "The demand for food will likely be too high to be met with wild stocks alone, so we're not against fish farming. We believe closed-tank aquaculture is a very promising solution."

In the past, the largest deterrent to closed-containment fish farming has been relatively high energy demands, meaning fish farms must be located close to a reliable source of power. However, Ritchlin says this also represents an economic benefit to industry because operations will be that much closer to processing facilities and markets. In addition, better control over fish-farm plagues such as disease, predation, and escapes, all huge costs to industry, could translate into savings and profits.

Though fish farmers have been rearing salmon fry and smolts in closed tanks for years, growing them to market size hasn't been done yet in Canada, at least not profitably. Clearly, industry is skeptical of the viability of closed containment. Despite the growing evidence surrounding the impacts on wild juvenile salmon of sea-lice epidemics originating from fish farms, the accounted for and unaccounted for escapes of non-native Atlantic salmon into West Coast waters, and the detrimental effects of concentrated fish waste on the adjacent marine environment, the industry insists that it is doing better at mitigating the environmental impacts of open-net pens.

Skepticism was evident at the public hearing held June 7 in Campbell River by the Special Committee on Sustainable Aquaculture.

"Investment in new technology would be happening if there was a business case for it," Patrick Marshall, general manager of the Campbell River Economic Development Corporation, told the committee, adding that he questions government investing public money to help a private company develop technology.

Grieg Seafood BC Ltd., which operates five fish farms on the west coast of Vancouver Island, also shared doubts with the committee members.

"We're open to investigating new technology, but at the end of the day we've got to be competitive. We've definitely got some doubts about the viability," says Peter Gibson, managing director of Grieg Seafood.

A spokesperson for Marine Harvest—which was purchased last May for $1.8 million by Norway's Pan Fish, becoming part of the world's largest fish-farming empire—says the firm's experience with closed containment on Salt Spring Island proved the technology wasn't viable—at least not at the time.

Open-net fish farms, such as the one pictured above, let water, pollutants, and sea lice travel from the facility into the sea. David Suzuki Foundation photo.

"There were significant additional costs. The systems were quite high-maintenance, and it was difficult to maintain the proper dissolved-oxygen levels," says Clare Backman, Marine Harvest's environment and compliance manager. "We're not an R?&?D company; we're primarily involved in growing fish, but we'd be foolish to ignore any new technology developments. The upshot is that it has to be viable."

Mary Ellen Walling, executive director of the B.C. Salmon Farmers' Association, was asked for comment on closed containment but did not return phone calls by deadline.

Buchanan and AgriMarine aren't the only ones developing closed-containment technology. Mari?culture, a firm based in Washington state, has patented a system called SARGO that uses floating, closed tanks made of plastic. However, David Meilahn, Mariculture's operations manager, concedes that industry hasn't exactly been pounding on the company's door.

"We don't have anything in the water right now. People are really shying away from fish farming in the States right now because of all the regulations. We have definitely received more interest in Canada and South America," Meilahn says.

Pending financing, Mariculture hopes to float a SARGO system this fall and grow chinook salmon near Campbell River in a partnership with Yellow Island Aquaculture.

Norway, which produces more than half the world's farmed salmon, has experience with closed containment going back almost two decades. The Norwegian firm Aqua Optima grows cod, halibut, tilapia, and other species of fish in closed-tank facilities in Europe and Asia. Eighteen years ago, disease outbreaks prompted Norwegian farmers to start growing Atlantic salmon to up to six kilograms in closed tanks. However, vaccines solved the disease problems and salmon farmers have mostly returned to open-net pens. Still, Aqua Optima managing director Idar Schei says salmon can be grown economically in closed tanks.

"Of course, investment costs are higher for these systems than sea cages, but from a technical and biological standpoint, no problem. Today, with the risk of sea lice, fish escapes, storms, and algae blooms, the operating costs should not be much higher for closed tanks," Schei told the Straight in an e-mail while travelling in Europe.

There's one fundamental and troubling problem with fish farming that closed containment does nothing to address: the high environmental cost of producing fish feed for farmed fish. It is estimated that it takes anywhere from two to four pounds of wild fish—such as mackerel, herring, sardines, and anchovies—to grow one pound of farmed fish. In essence, we're fishing out stocks lower down the food chain to create feed pellets for fish farms. It amounts to a transfer of protein from developing-world marine ecosystems in the southern hemisphere to the First World fish aquaculture industry, long decried by UBC fish scientist Daniel Pauly—who famously referred to fish farms as protein-consuming, floating pig farms—as a wasteful, inefficient use of an already imperilled marine resource.

The David Suzuki Foundation's Ritchlin admits that supporting closed-containment technology is an accommodation and that many conservationists would rather see the industry shift toward growing herbivorous freshwater species such as carp and tilapia, which have been cultivated for thousands of years in China and the Middle East.

"Safe, sustainable feed. That continues to be a big concern with finfish aquaculture," Ritchlin says. "In some ways, closed containment is a compromise. Although it doesn't solve all the problems, it proposes a major step forward."

As for Buchanan, he's shown the patience of a salmon waiting for the right water volume and temperature before swimming upstream. "It's been a little frustrating, there's no doubt," Buchanan says.

If events unfold as he hopes and Western Economic Diversification comes through with funding, he'll soon be pouring concrete for his first working prototype and helping to spawn a new, greener direction for a troubled industry.