

## Fish grown in closed containment systems offer big environmental advantages, proponents say

By Randy Shore, Vancouver Sun November 19, 2012

Twenty-three thousand Atlantic salmon smolts will arrive at the 'Namgis First Nation's salmon farm in January, just a fraction of the millions of similar fish that grow to maturity each year in B.C.

What's different about these fish is that they will never swim in the ocean, never come in contact with wild salmon and never be treated for sea lice.

'Namgis Closed Containment Salmon Farm is the first commercial-scale, land-based fish farm for Atlantic salmon in North America. It's part of a global trend of large closed-containment farms also being pursued in Denmark and in Chile.

The 'Namgis smolts will grow to maturity in just 12 to 15 months in a facility nearing completion not far from Port McNeill on Vancouver Island. The 'Namgis farm uses five 500-cubic-metre tanks capable of producing a total 500 tonnes of fish each year.

The system is the first of five identical modules to be built on the site, when the designs and systems are proven, for total capacity of 2,500 tonnes a year, about the same as a net-pen salmon farm.

Despite the extra costs associated with land-based salmon farming, the product needn't cost much more than net-pen Atlantic salmon. The carefully controlled environment in an advanced closed-containment system allows the fish grow to maturity twice as fast, in a smaller space with less feed than net-pen salmon.

Concerns about the spread of disease and sea lice between wild and farmed salmon make a commercially viable land-based Atlantic salmon farm something of an environmental Holy Grail.

And that search has intensified since the report of the Cohen Commission found that net-pen salmon farms have the potential to harm B.C.'s wild sockeye salmon stocks. The report urges an immediate freeze on new net-pen farms along sockeye migration routes.

The 'Namgis project is intended to be a hothouse for innovation with the goal of advancing closed-containment technology for Atlantic salmon to commercial viability as quickly as possible. For that purpose, 'Namgis has attracted \$8.5 million from philanthropic, conservation and government sources, coordinated by the conservation foundation Tides Canada.

"We put together this innovation fund to explore land-based aquaculture as an alternative to open net aquaculture, primarily as a way to better protect the marine environment and wild salmon," said Catherine Emrick, who co-ordinates the fund at Tides Canada.

The 'Namgis First Nation spent years challenging the provincial and federal government in court over the "mismanagement" of the net-pen salmon industry near their traditional territories, according to Chief Bill Cranmer.

"We had seen the effects on our sockeye salmon returns on the Nimpkish River and the effect of the sea lice on the chum," said Cranmer. "Eric Hobson at Save Our Salmon told us we could use litigation, but we should also provide an alternative."

From that seed planted six years ago, a partnership has grown including Tides Canada Salmon Aquaculture Innovation Fund (\$3.7 million), Sustainable Development and Technology Canada (\$2.65 million), Aquaculture Innovation and Market Access Program, (\$800,000), Aboriginal Affairs Canada (\$257,000), Coast Sustainability Trust (\$113,000) and the 'Namgis First Nation (\$1 million.)

To survive and thrive, land-based systems have to compete on both price and quality with net-pen Atlantic salmon, while using an infrastructure that requires significantly more money to build and to run.

Closed-containment systems are already used in B.C. to grow Atlantic salmon to 100-gram one-year-old smolts, which are then transferred to mature in ocean-based net pens.

But using land-based systems that grow salmon to maturity have a number of advantages over net-pen farming, according to aquaculture systems researcher Steve Summerfelt of the Freshwater Institute in West Virginia.

The advantages can be summed up in a single word: Control.

- . Control of light and temperature allows growth rates that are double those of ocean-raised Atlantic salmon.

- . Control of effluent and solid waste protects B.C.'s marine environment and the nutrients recovered can be sold as fertilizer.

- . Control of the growing environment protects farmed fish from predation, bad weather and disease, eliminating the need for pesticides and antibiotics.

Along with additional control, land-based systems come with additional costs. 'Namgis will cost nearly \$30 million when it is completed, compared with a Fisheries and Oceans Canada (DFO) estimate of \$5 million to install and stock a net-pen operation.

Pumping, heating, cooling and lighting all require energy, which adds about 30 per cent to the costs of running land-based systems over ocean-based farms.

The project will marry an array of technologies, such as variable speed pumps, high-density rearing environments and biofilters, and employ creative new uses for proven systems such as geothermal heating and cooling and heat exchangers that draw energy from groundwater to maintain optimal temperatures in the tanks, according to operations manager Cathal Dinneen.

The 'Namgis were a natural partner for the project because they are the B.C. First Nation most affected by the collapse of wild salmon stocks, said Hobson, also a board member of the K'udas Partnership, the company formed to build and operate the project with the 'Namgis.

"The 'Namgis have occupied the land at the mouth of the Nimpkish River and the Broughton Archipelago for 5,000 years and it's only in the last 20 that the salmon have been wiped out," said Hobson. "There are 27 net-cage farm sites in the Broughton Archipelago, so they are very eager to prove that you can grow salmon on land."

A 2010 DFO analysis of land-based and in-ocean closed containment systems found land-based aquaculture has potential to be profitable with available technology, even without charging a premium price in the market for a sustainable product.

"Even 3½ years ago we didn't know if this would work," said Hobson. "(Save Our Salmon) wanted to mitigate the impacts of net-pen farming and come up with a vision for the long term."

Recent studies have found that more than three quarters of the world's wild fish stocks are being fished to capacity or headed to extinction, while global demand for seafood is rising steadily, according to the United Nations Food and Agriculture Organization.

"We knew we needed to move these fish onto land and we needed to be able to clean the water, so we didn't create another environmental problem on land," Hobson said. "What we found out was that not only was the technology already there, but it was off the shelf."

Cost projections based on the enhanced technology being used at 'Namgis and the results of growth trials convinced SOS and Tides Canada that a true closed-containment system could finally produce a superior product at a price that is competitive with net-pen operations. Recirculating aquaculture systems - land-based farming systems that the industry calls RAS - are being used to raise trout, catfish, yellow perch, Arctic char, eels and tilapia in North America, Chile and Europe. Sturgeon and coho are being raised in RAS systems in B.C. But while Atlantic salmon have been grown to maturity in research facilities and boutique-sized projects, they have never been grown to harvest size in a commercial-sized RAS system.

Without the help of angel investors - governments and philanthropists - it might have been many years before anyone was willing to invest private funds in land-based Atlantic salmon farms.

"It has to be this way," said Hobson. "It has never been tried before so there was little chance of attracting traditional investors."

Tides Canada recruited expertise for the project from cutting edge researchers such as Freshwater's Summerfelt to advise the K'udas project. Systems for water recirculation and waste capture developed by the Freshwater Institute are being employed in commercial RAS systems all over North America and will be incorporated into the 'Namgis project. The 'Namgis project has also sought out the most experienced growers in the industry for guidance to complete the first of five production modules this winter.

K'udas board member Per Heggelund operates a RAS-based farm capable of annual production of 180 tonnes of coho, which he sells in Over-waitea stores under the Sweet-Spring brand. SweetSpring coho is regarded as the most sustainable farmed salmon on the market by Greenpeace.

"'Namgis has learned a few things from us on the design side and about some of the pitfalls from our mistakes," said Heggelund. "(SweetSpring) is operating the fifth generation of RAS technology and we are proving that out, growing fish to three kilos in 12 months."

#### WASTE POTENTIAL

The path from environmental hazard to revenue stream

. Bell Aquaculture uses leftovers from processing - heads, tails, guts and gills - from its yellow perch farm in Indiana to make Fish Rich 2-2-2 Organic Fertilizer, a significant additional revenue stream.

. Waste water from recirculating aquaculture systems is naturally rich in nitrogen and is used to grow aquaponic greenhouse vegetables, algae and even brine shrimp suitable for use as fish feed.

. Solid waste from aquaculture tanks is used to create nutrient-rich compost for farmers and gardeners.

[rshore@vancouver.sun.com](mailto:rshore@vancouver.sun.com)

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