Harvesting kelp (*Laminaria saccharina*) near an Atlantic salmon farm in the Bay of Fundy – Thierry Chopin is second from right

IMTA: template for production?

CANADIAN researchers are scaling up to commercial-scale operations in a pilot project aiming to expand salmon farming environmentally via polyculture, reports **BERNADETTE TOURNAY**.

Led by Dr Thierry Chopin, professor of marine biology at the University of New Brunswick, the project addresses integrated multi-trophic aquaculture, or IMTA.

An IMTA system farms different species – fish, shellfish and seaweed – that function on different trophic or nutritional levels in the same environment.

Although by no means new – IMTA, in essence, has been practised in Asia for centuries – interest began to be renewed in the west during the late 1980s.

Dr Chopin has been promoting such systems since the mid-1990s, initially without much success. "It was only in 2000 that the adequate structure was found to appropriately develop the large inter-disciplinary research effort necessary for IMTA to become a reality in Canada," he says.

An interdisciplinary team from the University of New Brunswick in Saint John and the Department of Fisheries and Oceans (DFO) in St Andrews began working together on a salmon, mussels and kelp project in the Bay of Fundy in 2001.

The project, financially supported by AquaNet (the Canadian Network of Centres of Excellence for Aquaculture), had a total value of $3.2 million (US$2.8m) and was also supported by the university, the DFO, Heritage Salmon (now Cooke Aquaculture), Acadian Seaplants, Ocean Nutrition Canada, Canadian Food Inspection Agency, New Brunswick Innovation Foundation and the Atlantic Canada Opportunities Agency.

Under conventional economic models, as production increases costs diminish due to greater automation and economy of scale. However, as larger volumes cause prices to fall, increased profitability can only come from farming more intensively, increasing the size of the farms, moving offshore – or by re-thinking production via innovative practices such as IMTA.

In Canada, fish farming is still relatively new, with salmon the main farmed species in terms of volume and value. Researchers looking at ways to diversify production have focussed on other cold water species such as cod, haddock or wolffish which do not address the environmental issues, according to Chopin.

These species, too, are already in competition with each other on the traditional fish market.

However, by farming three different but complementary species on the same site, production can be increased, while nutrients and waste products from fish production can be recycled as fertiliser, food and energy by seaweed and shellfish.

But to develop such systems we need to re-address how we set up farms, according to Chopin.

"The most immediate change to the way that salmon, mussels and kelp are currently farmed is the way the sites are designed and how fish, seaweed and shellfish are integrated to the site grid – along with the rethinking of how food and energy is reused more efficiently in a system where one species' waste is another's treasure," he says.

While finfish and shellfish are well established, the market potential for seaweed in different industries – including pharmaceuticals and cosmetics – is largely untapped. "We are definitely interested in the use of seaweed as edible sea vegetables for humans, nutraceuticals, functional foods, phyco-supplements etc," says Chopin.

"This is a new field and seaweeds remain a largely unexplored resource. The pilot scale project was from 2001 to 2005. We are just now engaging in the development of the commercial-scale phase, which should take us from 2006 to 2011.

"At that time, we expect to have converted ten salmon farms into IMTA producing salmon, seaweed and shellfish."

And as Chopin points out, funding for the commercial-scale project comes at a time when there is more openness to innovation in aquaculture.

"The fact that our proposal to the Atlantic Innovation Fund of the Atlantic Canada Opportunities Agency was successful demonstrates that we have the support of the academic, industrial, economic, social and political structures," says Chopin.

"More and more people have heard about our project and are starting to believe in the IMTA concept. We have strong support from our industrial partners who are key players in the industry and who see the environmental and social advantages of IMTA and the benefits of value-added product diversification.

"I have been marching and preaching in the desert for a long time but I believe we are close to the oasis!"

IMTA is also being studied in Chile, Israel, Scotland, USA, South Africa and Australia – and with other combinations of fish, shellfish and seaweed.

"For fish there is potential for cod, flounder and halibut; for seaweeds, dulse and Irish moss could be candidates; while we are thinking of oysters, abalone, sea urchins, sea cucumbers and worms as alternative invertebrates," says Chopin.

"The list could be very long. What is important are the functions these organisms have in the ecosystem, their economic value and their social acceptance."

A mussel raft set next to a salmon farm – typical of the type of polyculture being advocated by Dr Chopin