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Aquaculture – a bright future for Maori

The recent Maori Fisheries Conference in Napier from March 30 to April 2, the aquaculture session grew keen attendance from delegates and iwi representatives.

A panel consisting of iwi representative Harry Makarae, Craig “Laws” Lawson of Te Ohu Kai Moana, the managing director of Greenshell NZ Ltd, Peter Vitasovich, and the chief executive of Aquaculture New Zealand, Mike Burrell, was given a briefing on where aquaculture in New Zealand is heading, and the importance of the role Maori will play in the future.

Clearly, aquaculture is a coastal activity primarily sited away from pollution of the big cities, and is therefore supported by local communities. Aquaculture by its very nature is labour-intensive, and an excellent employer and supporter of these communities.

Aquaculture is the fastest growing food producing industry around the world, and in the northern hemisphere, recent research figures have aquaculture products making up 48 percent of the seafood available to consumers, and growing at 1.4 percent per annum.

This is significant, and as our wild marine fish resources continue to decline in most parts of the world, these nations will continue to rely on aquaculture to supply a quality, sustainable seafood resource.

With this in mind, the aquaculture industry has gone through a serious restructuring phase to consolidate their resources and skills as they look forward to driving our New Zealand aquaculture industry to reach a target of $1 billion of sales by 2023.

To achieve this they will require good leadership direction from central government, and both regional and local government support.

Aquaculture is still in its fledgling stage in New Zealand, where 898 farms take up 5557ha, or 0.2 percent, of our water space within three nautical miles of the coast. They produce 95,700 tonnes of quality seafood valued at $288 million, made up principally of New Zealand greenlip mussels, salmon and oysters.

Mussels are by far the largest producer, returning $2178 per tonne, followed by salmon, which return $11,773 per tonne, and oysters, which return $9284 per tonne. That’s $288 million from 5557ha. I believe no other farming sector can produce these dollars from this small amount of space and remain sustainable.

To meet the challenges of the future, the industry has formed Aquaculture New Zealand in an effort to bring cohesion, stability and marketing direction to the industry.

The greatest difficulty currently facing the industry is preventing it from growing is the development or creation of new aquaculture management areas. All too often this responsible section of our marine industry is slammed down by the “not in my backyard” syndrome, as more and more affluent city people buy lifestyle blocks near or around our coastal communities.

Their complaints focus mainly around the passive visual aspects, and yet in many cases they fail to recognise that an active visual aspect is far less boring and often creates talk around the table.

Another difficulty as the dynamics of the industry continue to change, with the development of fin fish farming, beyond that of salmon, into the areas of kingfish, hapuku and flounder, the use of sea cages is a compatible activity with its existing floating marine structures, such as mussels.

However, one of the greatest challenges facing aquaculture farmers is trying to get approval to change from single species to multi-species aquaculture management areas. The continuing and ever-increasing cost of compliance is another factor.

Yet New Zealand enjoys the status of being one of the few, if not the only, countries in the world able to export live shellfish and fin fish directly from the sea into the United States and many countries bordering the Pacific rim and Europe.

We have no need to use de-purification processes, and our industry has a proven track record of being able to close the industry or part of it down within 24 hours of a bio-toxin or other such alert.

With this responsible and positive commitment from the industry, one has to ask why local government officials spend so much time making it so difficult for the aquaculture industry to carry out its business, when the full benefits to the local community and New Zealand have yet to be tapped.

The conference affirmed the appointment of Harry Makarae as the iwi representative to the new board of Aquaculture New Zealand. In the next few months the other nine interim board places will be affirmed by the various stakeholder groups before the inaugural annual meeting in mid-year.
GREEN LIGHT BECKONS FOR KOURA FARMING

The farming of koura, or freshwater crayfish, will be allowed to continue and develop sustainably under changes to regulations agreed on March 14.

“My colleague, the Conservation Minister, Chris Carter, and I believe that with appropriate controls in place, koura farming can be conducted sustainably and without placing the wild koura population at risk,” said the Minister of Fisheries, Jim Anderton.

“We have therefore agreed to amend the Freshwater Fisheries Regulations to allow for farming of koura in advance of the completion of the wider freshwater review that is being undertaken.”

There are differences between the Freshwater Fish Farming Regulations administered by MFish, and the Freshwater Fisheries Regulations administered by DoC.

The proposed amendments would allow new licences to be issued for new farms where broodstock could be sourced from existing farms. DoC and MFish would also consider applications for collecting limited quantities of wild koura under supervised and controlled circumstances to improve broodstock quality. Anderton said. “Koura is a high-value delicacy that offers the New Zealand aquaculture industry a new string to its exciting and increasingly diverse bow.”

Carter said the key was to continue to protect wild koura from poaching. That meant putting in place a framework that did not allow the laundering of wild stock through farms.

“The proposed amendments to the regulations will ensure that the wild fishery is absolutely protected for the time being,” Carter said.

“The more problematic proposition of the harvest of wild koura will be looked at in greater detail through the freshwater review. However, with a thriving koura farming industry, there should be no need to harvest from the wild and threaten this precious taonga.”

As provided for under the 1992 Fisheries Deed of Settlement, Maori will be allocated 20 percent of any wild koura available for collection to improve the quality of broodstock. It is estimated that the policy work and the necessary process to amend the regulations will be completed by the middle of the year, subject to Cabinet approval.

Regulations will also be changed to legally protect non-harvested freshwater fish species. Many of these, such as mudfish and other non-migratory galaxids, are endangered and subject to species recovery programmes. It was important that their legal status reflected their significance as part of New Zealand’s rich endemic biodiversity, the ministers said.

AQUACULTURE USE OF SOYBEANS UP

Soybeans are contributing to the growth of aquaculture, the world’s fastest growing food segment, and the soybean checkoff is working to develop ways to include soy in fish food.

Aquaculture is growing at nine to 11 percent globally per year, and is expected to consume an estimated 8.8 to 11 million tonnes of soybean meal in the next decade.

“The soybean checkoff recognised the bright future of aquaculture and has gotten in on the ground floor with our investment in new technologies to increase soy inclusion in fish diets,” says Terry Ecker, the chairman of the United Soybean Board International Marketing.

Soy-based diets for select marine fish have been developed and are being demonstrated in several projects in the Philippines, Vietnam and China. Research efforts are focussing on identifying barriers to soy inclusion in the diets of marine fish such as salmon, pompano, amberjack, Mediterranean sea bass, sea bream and cobia, as well as increasing the soy inclusion in marine shrimp diets.

“China’s aquaculture industry went from using no soy meal a decade ago to over 150 million bushels annually,” says Ecker. “Advances in aquaculture are one of the reasons why China is our number one export customer.”

MUSSELS AND WINE IN MARKET PUSH

Combining the marketing strengths of Marlborough’s sauvignon blanc wine and Greenshell mussels could be of mutual benefit, says the owner of the Astrolabe wine label, Simon Waghorn.

He was speaking at the inaugural Icon Culinaire, the New Zealand Mussel Industry Council Awards dinner, in which a panel of judges chose his Astrolabe Awatere Sauvignon Blanc 2006 as the best match with Marlborough Greenshell mussels out of 63 entries.

The marketing manager of Marlborough Winegrowers, Tom Trolove, predicted that the wine industry would support pushing a food match with mussels. “I can’t believe it’s taken 30 years for the coin to drop. It’s just a no-brainer.”

“Wine in the region has often led the way,” said the Minister of Fisheries, Jim Anderton, who presented the award. “Positioning our iconic Greenshell mussels alongside our wine will increase the value of the brand.”

The mussel industry was now over seven times as large as it was 20 years ago, with exports of $166 million a year. It was the only native New Zealand species exported in large numbers. “But for all the success, we have a miniscule 0.02 percent of global seafood sales,” Anderton said.
“We have to develop new, high-value opportunities and new markets. That’s why this evening is an important event. It shows what a powerful image can be created from producing delicious food and wine, and promoting them together as a total gourmet experience.”

The runners up in the awards were Villa Maria Richmondbrook Sauvignon Blanc 2006, and Morton Estate Marlborough Sauvignon Blanc 2006.

**HARBOUR FARM STRIKES A HURDLE**

Southern Marine Farms Ltd has struck a hurdle in its plans to expand its seaweed farm in Bluff Harbour to include oysters, mussels and kina.

The company has a marine farm licence to grow the seaweed *porphyra columbina* (nori), and wants to amend its coastal permit to add the new species.

Its application to Environment Southland says that as less than half of the site at Bluff Harbour is of suitable depth to deploy longlines for growing oysters, mussels or cockles, the remainder of its site will be used to continue cultivating seaweed.

However, it has become a sensitive issue with the Invercargill City Council, the Southland Trailer Yacht Squadron and the Department of Conservation, which initially objected to the company’s plans.

A report by Environment Southland consents officer Kylie Galbraith released on March 12 said short-term oyster production would concentrate on building juvenile stocks for growing on-site or on another marine farm site.

“Any farming of paua and kina will be on an experimental small scale, with the animals fed exclusively on seaweed grown on the farm.” The various species will be sourced locally, except for Greenshell mussels, which will be sourced from Ninety Mile Beach, the usual supply area in New Zealand, the report said.

The Invercargill City Council wants the regional council to decline the application for the harbour site because of noise, visual and access issues.

The yacht club said the harbour might be overcrowded, with marine farms leaving little room for recreational boating, and the proposed mussel longlines and buoys in the deep-water channel could be navigational hazards.

However, a DoC spokesman said it had told the regional council that it was satisfied with the company’s application.

**NEW BOSS FOR NZ AQUACULTURE**

The New Zealand Aquaculture Council has appointed Mike Burrell as chief executive officer for the industry organisation New Zealand Aquaculture Ltd.

His appointment was part of the New Zealand Aquaculture Strategy, which the Minister of Economic Development, Trevor Mallard, launched last July.

Mike Burrell was previously with the international economics and finance consultancy LECG Ltd, where he developed the aquaculture sector strategy. He has a background in industry development in New Zealand and internationally, and holds a master’s degree from the London School of Economics.

One of his early tasks will be to work closely with the government to advance the implementation of Aquaculture Law Reform.

NZ Aquaculture Ltd was the vehicle to drive a vision for the aquaculture industry to have collective representation with national recognition that avoided duplicated effort and cost, said the Aquaculture Council’s chairman, Callum McCallum.

The strategy is a 10-point plan to focus the industry on its goal of achieving $1 billion in annual sales by 2025. It had been extremely well received, said McCallum.

**ANTIBIOTIC GAINS APPROVAL**

The in-feed antibiotic Aquaflor® (florfenicol) has become the first antibiotic approved for controlling mortality in freshwater-reared salmonids due to *Flavobacterium psychrophilum* (coldwater disease). The disease causes mortality rates of 30 to 45 percent annually in hatchery-reared trout and salmon.

Unlike sulfa drugs and tetracyclines, Aquaflor was developed specifically for use in food animal species. Developed by the Schering-Plough Animal Health Corporation, Aquaflor Type A Medicated Article has been proven worldwide to be effective against a wide range of bacteria in several aquatic species. It is also highly palatable and has an excellent safety profile for fish, human food and the environment, the company says.

Studies have shown that Aquaflor can be used in trout and other freshwater-reared salmonids, from sac fry to food fish, with no reduction in feed consumption or growth. The product’s short, 15-day withdrawal period gives producers ample flexibility when marketing fish.

Trials conducted with the United States Fish and Wildlife Service have shown Aquaflor to be highly effective against coldwater disease. In steelhead trout, for example, fingerlings treated with Aquaflor had 60 percent lower mortality than untreated controls, even though initiation of treatment was delayed far beyond what would be typical in most field situations.

Trials have also shown that fish consume feed medicated with Aquaflor at the same rate as unmedicated feed, even when the dose is 10 times the recommended rate.

Aquaflor is highly stable, both as a packaged premix and in feed following high-temperature extrusion. For salmonid feeds, it can be incorporated prior to pelleting or coated.

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**SCOTTISH ACTIVISTS RELEASE FARmed HALIBUT**

Police put fish farms across Scotland on alert from mid-March after the Animal Liberation Front released thousands of halibut from a farm into the wild.

They caused hundreds of thousands of pounds of damage to the farm, located near Kilmelford, Argyll, and wrecked a boat, an office and a crane. Marine experts said it was highly unlikely that the escaped fish could survive in the wild.

Police said they would warn fish farms to step up security amid fears that groups such as the ALF are planning further attacks.

The latest incident fuels fears that anglers and fish farms are becoming the new hate figures for animal rights groups following the ban on fox hunting.

A trout farm and deer park near Lanark was attacked in March, and a group calling itself the Lobster Liberation Front recently destroyed 60 lobster pots at Port Logan, near Stranraer.

“There is no animal experimentation going on. This is farming for food. Our members farm fish, just as other farms farm livestock and crops,” said Richard Slaski, the secretary of the British Marine Finfish Association.

Fish farming employs about 70,000 people across Scotland and generates more than £500 million a year. The industry accounts for 50 percent of money raised by food exports from Scotland.
PAUA FARM joins burgeoning industry

The black muscular foot of the paua is considered a delicacy and is extremely valuable in Asian circles. It is central to some of the best oriental seafood recipes, and some chefs say it’s best served raw in sushi, although Maori prefer it creamed with a piece of fried bread. But cooking skills don’t matter in this game.

It won’t be the recipes of Marc Ferris that are put to the test once the new land-based paua hatchery at Turanga Ararau is up and running. It is his experience and knowledge as a marine scientist that’s of value, as demand for paua increases.

“Aquaculture is the fastest-growing primary industry sector in New Zealand and around the world, and I’m definitely excited about it. It is the way of the future,” Ferris said.

Getting wet for a paua could become a memory, and Turanga Ararau has boarded the ship in a potentially multi-million dollar industry.

What used to be an old Telecom work shed in Kahutia Street, Gisborne, will be a 350sq m paua farm. The two buildings will house a wet laboratory, water storage room, pumping room, broodstock room, spawning room, nursery and larval swimming tanks.

“Aquaculture is an expensive undertaking in New Zealand and is solely for commercial benefit. It’s high risk and high gain. It takes three years before you see a return on your money.

“What we’re doing is a commercial venture as well as educational, but it is a kind of a model for iwi because we’re an iwi-owned facility. It will be a place where people can go and see how it’s done.”

Plans for the hatchery started in 2005 with funding provided by Te Puni Kokiri, the Ministry of Fisheries and Te Runanga o Ngati Porou. Most of the materials used were either bought cheap or recycled.

“We pulled down two crayfish holding plants and brought them here, and used the old freezer panels on the inside of the building to keep the nursery cool.”

They bought 14 v-tanks for $1000 each, specially made for the nursery stages for paua culture, from a guy in Napier who couldn’t get his hatchery working. They would have cost $2500 new.

“You can save money doing things a certain way, but some people spend a lot doing things the wrong way. I made quite a lot of the equipment myself. There are corners you can cut financially but sometimes you can’t, so you have to pay the money in those areas.”

The cost of building the hatchery is only one of many barriers. Being a “blue sky industry,” as Ferris describes it, involves a lot of trial and error: “A lot of things haven’t been done before with aquaculture. That’s what’s attractive to me. I get to try out different things and see if they work or not.

Some people think it’s easy and jump in feet first without a business plan and it goes bust. It all comes down to research and experience. A lot of planning has to be done. A lot of questions need to be asked and there are always lots of problems to be solved.”

Past research has found that marine-based farming in coastal waters is not too productive because of the mud shelf. Land-based technology is proving to be the way to go for Marc Ferris and his team. “We had to move on-shore so we could fully treat our water and remove any solids (faeces). Because of sediment inputs and the slight onshore winds, it stirs up the silt and is no good for the animals.”

The hatchery applies sewerage treatment technology to aquaculture and has a flow-through recirculating system consisting of mechanical and biological filters, pumps and holding tanks to improve water quality and provide disease control.

“When we first started there were no recirculating paua hatcheries in New Zealand and now there are two,” he said.

Nationwide, 44 paua farming licences have been issued. Like the Turanga Ararau hatchery, many are still in the development stage. Although small and unfinished, the hatchery aims to grow 280,000 paua at 10mm a year to start with. “There’s not much room to expand at the moment, but there are techniques we can use to try to double that.”

By using selective breeding they can breed stock from different regions of New Zealand that produce faster and healthier offspring. “If you don’t do that, you’re starting off behind the eight-ball,” said Ferris.

It takes four to six months to get 10,000 to 15,000 paua to 10mm. The hatchery is aiming for three cycles a year with the expansion of the facility, but a lot of research needs to be done to see what works best. “The results will determine how many we can produce before we can move forward and produce commercially.”

As well as being a commercial venture, the hatchery is also a “learning vessel”. Turanga Ararau is the only tertiary provider with a marine farm on the site available to students, so they
will receive practical experience at the site from the ground up. “It gives them the edge, because most paua farms don’t take people without experience.”

The construction of the new farm provided them with valuable knowledge as they could help it come together and ask questions. The NZQA-accredited course has been running for six years and offers level three and four National Certificates in Aquaculture and Marine Studies.

Ferris says there were about 34 students during the first couple of years, and last year nine students were offered work at the largest land-based paua farm in the South Pacific in Whangarei. Unlike other jobs, aquaculture requires commitment and passion, as paua need loads of care and attention.

“If you choose aquaculture you have to be passionate about it rather than just think of it as an eight-to-five job. You should be able to look at your animals and know how they’re feeling without them having to tell you,” Ferris said. “You’re dealing with live animals in a controlled environment all the time. You cannot just go away, because the animals don’t go on holiday. It doesn’t take much to kill them.”

But there is more to keeping a paua and hatchery alive. It’s more complex than a recipe for an oriental dish or creamed paua, and businesses have known the answer for years. “A big part of sustaining a paua farm is your staff and the people you have working for it. They have to want to succeed and believe in the venture.”

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US NEWS

US ALLOWS DEEP-SEA FISH FARMS

The Bush administration wants to be able to issue 20-year permits to allow ocean farming of shellfish, salmon and saltwater species in federal waters for the first time.

A plan announced on March 12 by the United States Commerce Secretary, Carlos Gutierrez, would allow companies to operate fish farms from three to 200 miles offshore, but without some of the rules on size, season and harvest methods that apply to other commercial fishermen.

According to the US Department of Agriculture, the value of US aquaculture sales exceeded US$1 billion in 2005. Fish farms already operate on inland and coastal waters up to three miles offshore, which fall under state jurisdiction, but concerns have arisen about their waste water.

“We believe we can do it in a way that is environmentally sound, that makes sense for our economy. And given that we are importing so much farm-raised fish, we might as well do it ourselves,” Gutierrez said.

About 70 percent of all the seafood eaten in the United States comes from overseas, contributing to a trade deficit of about US$9 billion in fish. Almost half is farm-raised.

EXPLOSIVE GROWTH CHANGES SALMON INDUSTRY

A recent report on market competition between wild and farmed salmon has shed new light on the impact salmon farming has had on the North American wild fishery.

Great Salmon Run: competition between wild and farmed salmon, was released by the wildlife trade monitoring network TRAFFIC. It says that farmed salmon has grown from two percent of the world supply in 1980 to 65 percent in 2004.

About 75 percent of salmon consumed in the United States is now farmed, causing the Alaska salmon catch to drop in value from over US$800 million in the late 1980s to less than $300 million.

The growth in farmed salmon has changed the kinds of salmon products that are available, altered the timing of production and raised market quality standards. The report makes recommendations to policymakers, environmental groups and the fishing industry to address economic, environmental and trade questions.

“The debate should not be about wild versus farmed, but whether each method of production is being done right,” says Dr Gunnar Knapp, professor of economics at the University of Alaska, Anchorage, who was one of the study’s authors.
The Firth of Thames, a huge pocket of warm, nutrient-rich water southeast of Auckland, holds the key to the success of raising kingfish, one of the most promising species on the New Zealand aquaculture stage.

Thousands of 200mm-long fingerlings are waiting at the National Institute of Water and Atmospheric Research’s hatchery in Northland to boost the aquaculture industry. 

The beauty of kingfish farming stems from the economic use of space pioneered by the salmon industry and its value on the global market.

New Zealand’s aquaculture earnings are low internationally at less than $2000 a tonne, compared with Australia’s $30,000 a tonne from higher-value species such as tuna and prawns.

But with the prospect of raising 1200 tonnes of kingfish in one 10ha block, estimates of market value are up to 30 times what mussels earn for the industry.

But for all the potential, kingfish farming is an idea that has yet to prove its worth. A land-based farm at Parengarenga Harbour in Northland folded three years ago owing more than $7 million, and other operations have yet to show significant commercial success.

Nonetheless, NIWA and the industry body, New Zealand Aquaculture, are convinced that new and high-value species such as kingfish are the only way to move from an industry now worth $300 million a year to one worth $1 billion a year by 2025.

The chairman of NZ Aquaculture, Peter Vitasovich, says the success of salmon shows the potential of New Zealand’s coastal waters and technology for fish farming, and kingfish is the next big thing.

The ease of converting mussel farms into salmon farms in recent years has created an export industry worth $80 million from an area that takes up less than two percent of the space occupied by mussel farms.

NIWA’s acting chief executive, Bryce Cooper, says kingfish are worth much more per unit of space than mussels, and there were even efforts to look at how the two could be grown together: “That can give greater returns and not necessarily require large tracts of new sea space.”

But unlocking the Firth of Thames is mired in red tape. A national ban on new aquaculture areas ended two years ago with the introduction of new management laws.

And despite the government supporting the industry’s growth targets, not one local authority has managed to get its head around the new rules in the past two years, and aquaculture growth has stalled.

Environment Waikato, the regional council that covers Thames, is still only thinking of a change to incorporate kingfish, with months of public consultation still to come over the mere possibility of establishing rules for finfish farms in the Firth.

Even a Sha trial farm could be months away, but Environment Waikato environmental planner Graeme Silver says the delays are necessary if years of objections and appeals are to be avoided.

“It’s about providing the community with the certainty that environmental sustainability will be in place before it goes commercial,” Silver says. “How long it takes depends entirely on how contentious it gets.”

International setbacks have sullied perceptions of fish farms: Thailand converted mangroves into shrimp farms, Norwegian and Scottish salmon farms harm biodiversity, and Chinese carp farms have become overcrowded and suck up resources.

“There have been horror stories from overseas about fish farms, and there may be people that have heard those and will be worried,” Silver says.

The Wilson Bay block, where the first kingfish farms in the Firth of Thames could be tested, backs on to the western Coromandel Peninsula between Waikawau and Kirita Bay, and close to a cluster of tiny towns whose residents know the value of aquaculture and the potential cost of those who fight it.

Four hundred hectares of mussel farms in Wilson Bay are a sight to behold, with black buoys stretching as far as the eye can see. The aquaculture management area raises about 20,000 tonnes of mussels a year, is only 40 percent developed and holds potential for a further 800ha that would provide about 50,000 tonnes of Greenshell mussels a year.

“The growth of the industry has seen the provision of jobs for those who would have left the district,” says the mayor of Thames-Coromandel, Philippa Barriball.

She heads a forum to facilitate the shift to finfish farming in the Firth of Thames, working with the neighbouring Hauraki District Council, local iwi, fish farmers and Environment Waikato to help the consultation process.

She says the benefit goes beyond industry estimates of $21 million a year in wages and associated community income for every 10,000 tonnes of mussels harvested from the farms they have at present.

Salmon farms in Marlborough have generated 54 full-time jobs a hectare, she says. The kingfish equivalent for a Sha farm in the firth would put at least 270 jobs into the community.

That would keep people in the area, mean more children in schools, more dollars in tills and other flow-down effects such as making the Coromandel towns more attractive for doctors and teachers. “Every dollar earned will go through the community three times, so for a small community it’s very important,” Ms Barriball says.

With tourism a major player in the region, and a large majority of her ratepayer’s more worried about the views from their holiday homes than the local economy, she knows she has to walk a fine line. The region’s natural environment is critical to its residents, but she sees the firth as the right place for fish farming.

“We would far rather see that area developed than a pristine greenfields environment like the eastern coast (of the peninsula).

“Finfish would require a smaller footprint for a higher yield, so there is potential there to have a much smaller impact. We are committed to delivering that.”
NEW ALTERNATIVES to fish meal

The world’s farmed fish industry no longer relies entirely on fish meal to feed its most valuable products such as salmon and trout, says an aquaculture scientist at the University of Idaho.

A big reason was a doubling of the price of fish meal in 2006, the result of a number of factors, including lower catches in Peru associated with an El Niño event, said Ronald Hardy, who directs the university’s Aquaculture Research Institute at Hagerman, Idaho, the epicentre of United States farmed rainbow trout production.

China’s growing economy allowed it to buy one million of the six million tonnes of fish meal sold around the world each year. “That changed everything,” said Hardy, who was a moderator at the annual meeting of the American Association for the Advancement of Science about advances in sustainable seafood production.

He said prices surged from the US$700 tonne high he’d seen during his 30-year career to $1400 tonne in 2006. “High prices for fish meal are here to stay, making alternatives such as soy protein concentrate and wheat gluten affordable alternatives,” Hardy said. In addition, higher prices for fish meal would stimulate innovative approaches to recovering protein from seafood processing by-products, much of which is currently discarded.

Aquaculture supplied 45 percent of the world’s fish in 2006, but had to find ways to grow beyond fish meal and oil supplies to feed a growing population’s appetite, he said.

Decades of research had shown that proteins derived from grains such as corn, wheat and barley could provide the protein-rich ingredients needed in feeds for farmed salmon and trout. Growing ethanol production, particularly the use of corn to make the alcohol-based fuel, could be a boon to some types of fish farming. Dried distillers’ grains contain the 28 to 30 percent protein that tilapia and catfish require.

Trout and salmon need 40 percent protein in their diets and ethanol producers could also meet that, Hardy said. Producing the high-protein byproduct, however, meant turning existing processes upside down.

Ethanol producers now ferment the whole corn kernel, which reduces the amount of protein in the byproducts below the needs of trout and salmon.

First removing the byproducts, protein and oil, then fermenting the remaining starch for fuel, yielded a high quality and valuable fish feed, Hardy said. About 10 percent of ethanol plants in the US now use that process.

Protein concentrates produced from soybeans, wheat, barley and canola can also supplement fish feeds to offset fish meal, especially if they are combined. Each of these protein concentrates is deficient in an essential amino acid, but combining them offsets the nutritional deficiencies to some degree.

Much of the work on plant protein-based feeds has concentrated on reducing phosphorus concentrations to protect water quality.

Research in Idaho helped lead the way because of its concentration of trout farms, which produce nearly 75 percent of trout eaten by Americans.

In the 1990s, water quality in the Snake River suffered from an overload of phosphorus from a host of sources, fish farms among them. Reducing phosphorus in trout farm effluents and a periodic lack of fish meal fed interest in grain-based fish feeds, Hardy said, and led to increasing use of alternatives available now.

Fish oil will be harder to replace. People eat fish partly because it contains Omega-3 fatty acids, which are recognised as being essential for a healthy diet.

Fish fed corn oil or soy oil, however, resembled the plant’s chemical profile more than a fish. New research was exploring phased, rather than constant, doses of fish oil to maintain the healthy oil profile of farmed fishes. Recent developments in the definition of organic and sustainable fisheries from Great Britain promise to help out there as well.

Fish trimmings, or processing scraps, from sustainable fisheries can produce marine protein and oil, potentially yielding up to 20 percent of the world’s supply, Hardy said. “Alaska has two internationally certified sustainable fisheries, the pollock and salmon fisheries. Processing byproducts is a promising source of sustainable marine protein and oil for the growing aquaculture industry.”

In the past, the cost of converting seafood processing byproducts to meal or oil in Alaska was too high to produce cost-effective products until fish meal prices increased.
The Ministers of Fisheries and Conservation announced in mid-March that changes would be made to the Freshwater Fisheries Regulations to better allow for farming of koura (freshwater crayfish). These regulations are administered by the Department of Conservation, and the difficulties faced by koura farmers operating under them have been highlighted in the pages of *New Zealand Aquaculture* in the past.

In announcing the proposal to amend the regulations, the ministers acknowledged that “differences” exist between DoC’s Freshwater Fishing Regulations and the Freshwater Fish Farming Regulations administered by MFish. Koura farmers have had to navigate both regimes, as well as grapple with the requirements of the Resource Management Act and applicable district and regional plans.

The current proposal is to amend the regulations so that licences can be issued for new koura farms where broodstock can be sourced from existing farms, and to allow limited quantities of wild koura to be collected in certain circumstances. The more difficult issue of harvesting wild koura is to be dealt with separately in a wider review of freshwater regulations.

Current and prospective koura farmers no doubt welcomed these announcements, albeit cautiously, given their experiences to date. The reality is that koura farming is just one face of the wider issue of the overlap between MFish and DoC’s roles when it comes to managing freshwater fisheries. The approaches and priorities of the two agencies, as set out in their empowering legislation, are about as divergent as it is possible to be.

DoC is directed by section 6 (ab) of the Conservation Act, “to preserve so far as is practicable all indigenous freshwater fisheries, and protect recreational freshwater fisheries and freshwater fish habitats”. MFish, on the other hand, must “provide for the utilisation of fisheries resources while ensuring sustainability”. The demarcation line between these two regimes and their conflicting objectives has never been adequately resolved.

The reality is that many of our freshwater fisheries species - both indigenous and introduced - have significant commercial potential. Clearly, realising that potential is exactly what “utilisation while ensuring sustainability” is about. The preservation and recreation focus of DoC sits far less comfortably with commercial use, however.

There is no reason, in principle, why freshwater fisheries should be managed any differently from marine species. Yes, some are iconic, some are endangered and some have complicated and little-understood life cycles and breeding patterns. But marine species share all of those features. Many freshwater species are vulnerable to habitat changes and pollution, but so are many inshore marine species.

Thus far, only a few freshwater species have been shown to have aquaculture potential. Again, the same is true of marine species. Neither in the marine context, nor in freshwater or on land, has aquaculture been shown to have major adverse effects on the environment. The major reform of the marine aquaculture regime recognised that the RMA provides a more appropriate regime for assessing and managing those effects than the Fisheries Act.

While that reform left freshwater and land-based aquaculture largely untouched, the same logic surely applies. That’s not to say that the RMA hasn’t presented problems for some koura farmers in the past, but that’s another story.

The details of the proposed changes to the Freshwater Fisheries Regulations are still in development, but they will need close scrutiny. That will be even truer of the “wider freshwater review”. Major changes will be required if the potential of freshwater species, and the entrepreneurs and innovators who seek to utilise them, is to be realised.

Justine Inns joined Oceanlaw as a senior associate. She previously spent more than a decade as an advisor to various iwi (tribes), including several years with Ngai Tahu, responsible for implementing the iwi’s Treaty of Waitangi claim settlement.
SEAHORSE AQUARIUM promotes Marlborough Sounds

BY DR ANDREW MORGAN

Right at the doorstep to the Marlborough Sounds on the shores of Picton, Seahorse World provides a unique opportunity for the public to understand more about local natural and physical resources. Seahorse World provides a window into the Marlborough Sounds and promotes conservation, sustainable development and water space use alongside key industries such as fisheries and aquaculture.

It promotes the Marlborough Sounds experience to the local community, wider New Zealand and the tourism industry. Seahorse World is fast becoming a major wildlife and heritage attraction. Since undergoing significant upgrades and redevelopment, the aquarium now also features terrestrial, rare and endangered animals such as tuatara, gecko, skinks and weta.

The project has been supported by the Department of Conservation and local iwi, and is partly funded by the Marlborough District Council. Displays also include commercial marine species of the Marlborough Sounds, more ornamental animals that seem both weird and wonderful to the public, and heritage displays on the maritime history of the sounds.

There is a main marine tank stocked with schooling fish of both commercial and non-commercial species, and shallow tanks with coastal fish species such as rays and carpet sharks. A crayfish tank sits next to a large seahorse breeding display, while the freshwater tanks are filled with whitebait, koura and eels.

With growing concern over climate change and changing weather patterns, increasing fossil fuel consumption and the need for alternative sources of energy and primary production, conservation of our natural resources is becoming increasingly important.

While science and technology is increasingly relied upon to find answers, there is a growing need to communicate effectively to the public that the world’s ecosystems are fragile and will change in unpredictable ways without changing the climate.

More of our flora and fauna may not be around for future generations to enjoy. Seahorse World is a strong advocate of preserving that heritage and sustaining the existing wildlife and resource potential of the Marlborough Sounds for future generations.

Seahorse World also caters for a variety of other interests, as it has a new two-screen cinema featuring arthouse films from Europe and the United Kingdom, and space for wildlife films and documentaries, seminars and talks.

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Human activities in coastal areas are a significant mechanism for the dispersal of marine fouling organisms, particularly the movements of recreational and commercial vessels, and aquaculture activities. Awareness of the role of aquaculture was largely precipitated in the late 1990s by public attention regarding the Asian kelp Undaria pinnatifida. Around this time fouling also became recognised as a significant threat to aquaculture operations. This was particularly evident within the mussel industry, where a population explosion of the sea squirt Ciona intestinalis resulted in the decimation of shellfish crops in parts of the Marlborough Sounds and approximately $10 million in lost production.

Subsequently, other fouling pests have emerged whose adverse effects on aquaculture have been recognised. These include the sea squirts Didemnum vexillum and Styela clava, and a number of other animals and seaweeds, including native species.

The ease with which vessel movements and aquaculture activities can spread pests reflects the fact that floating or suspended structures, and marine farming materials such as ropes, floats, racks, baskets and pontoons, provide ideal habitats for foulers.

Some organisms on aquaculture structures can proliferate at densities that cause major problems for marine farmers, with biosecurity risks to other aquaculture operations arising because the infested farm acts as a “reservoir” for the further spread of the pest.

The local spread (eg, within bays) of many fouling pests is facilitated by microscopic life-stages (eg, animal larvae) that adult populations release, which drift with water currents as part of the plankton. Often this can lead to the establishment of the pest on adjacent structures such as other marine farms, jetties and vessel moorings. In this way such structures can act as “stepping stones” for pests to spread within aquaculture regions.

Natural dispersal is limited for most fouling organisms, however, and spread across large areas or between marine farming regions occurs via inadvertent transport with human activities. For example, infested materials from a marine farm (ropes, floats, pontoons, shellfish stock), or associated equipment (vessels), may be transferred to other localities as part of routine aquaculture operations.

Where such transfers occur without the application of treatments to reduce biosecurity risks, there is a good chance that associated fouling organisms will survive. Given that many fouling species are a threat to the viability of aquaculture operations, the industry clearly has some incentive to ensure that these risks are reduced.

**IS EFFECTIVE MANAGEMENT REALISTIC?**

Recent New Zealand experience suggests that even when pest organisms become well-established, the benefits gained from even limited management success have the potential to greatly outweigh the consequences of uncontrolled fouling. To be effective, however, management requires support from all marine stakeholders whose activities can spread pest organisms. There are a number of ways in which aquaculture companies can contribute to the effective management of fouling pests, such as:

- Identify existing and future pests that threaten the aquaculture industry, and develop coordinated response plans for high-risk species before they become established. Priority should be given to high-risk species for which management is most feasible and cost-effective.
- Contain the further spread of pests from infested aquaculture structures if eradication is not possible.
could be reduced to a level that minimises the risk of natural dispersal to other vectors (eg, vessels) or nearby structures, and pests could be eliminated from aquaculture vectors (equipment, vessels) before transport to other regions.

- Prevent incursions of new pests onto aquaculture structures. For vectors of spread such as service vessels, this could include maintaining effective antifouling coatings, hull inspections to check for the presence of target pests, and hull cleaning.

- Eradicate pests from farm structures before they become well established. A number of treatments have been developed for this purpose, but their application may only be worthwhile if the risk of reinvasion can be managed, and a surveillance programme is in place to detect pest incursions before they become widespread.

The aquaculture industry is currently using these types of approaches to manage the sea squirt Didemnum vexillum in the Marlborough Sounds. Didemnum is one of the more significant fouling pests that the industry is likely to face, yet it is also one of the most manageable.

Didemnum appears to disperse only short distances (hundreds of metres) by natural mechanisms, hence it relies on human activities to spread across greater scales. Furthermore, in New Zealand this species is largely confined to artificial structures, which makes it relatively easy to define surveillance zones and detect when it is present.

Most importantly, a number of response tools have been developed that are highly effective in eliminating Didemnum from vessels, equipment and structures, such that eradication of the organism is technically feasible, given reasonable effort, long-term commitment and quality assurance.

The key to the ultimate success of the Didemnum eradication programme hinges on whether there is sufficient support from other coastal operators and government agencies. Attempts by the aquaculture industry to deal with Didemnum and other pests may ultimately be futile if such efforts do not have the support and participation of key stakeholders at a regional and national level.
For many years Asian countries have successfully farmed sea cucumbers from hatchery-produced seed for grow-out on marine farms to meet an insatiable demand in the region for this product.

Current information suggests that utilising better husbandry and hatchery management practices could result in significant improvements. Relative to the amount of broodstock used and gametes produced, production is low and investment of resources is high. Significant gains could be made in terms of manpower, resources and financial returns.

Previous articles have highlighted the potential for this industry to exist in New Zealand by enhancing the numbers of sea cucumbers that exist naturally on mussel farms with hatchery-produced seed. Aspects of broodstock management, husbandry and spawning have been discussed. In continuing this line of thought, aspects of fertilisation, embryo quality and early development for hatchery production of New Zealand’s endemic species Stichopus mollis are highlighted here.

**EMBRYO QUALITY**

Any repeated spawning of individuals late in the season can be of very poor quality in terms of the amount of gametes produced and the quality of hatched embryos. The ripeness and redevelopment of gametes in the gonad contributes to embryo quality. Once spawned, the ratio of sperm to eggs interacts and affects the success of fertilisation. High sperm numbers may cause abnormal development through to hatching and subsequent rearing of larvae.

It is possible once eggs are fertilised to assess embryo quality and the success of spawning. Features characteristic of normal development during cell division are assessed. Symmetry of shape and the rate of cell division measured as a proportion of total numbers is recorded and quantified.

This gives an early indication of the quality of the batch. Generally at least 80 percent of embryos should show features characteristic of normal cell division and embryo development.

**HATCHING**

Techniques have been developed to separate viable hatched embryos from those of poor quality. The effects of polyspermy and the proportion of the batch of eggs considered viable is assessed between 15 to 24 hours post-fertilisation. At this stage they can be graded visually pre and post-hatching, and the numbers of viable embryos determined.

Features typical of normal development can be scored to create a qualitative index compared against the hatch rate. Low hatch rates are used to decide whether to keep a batch or ditch it.

The natural behaviour of typical embryos that have hatched can be used to separate them from poor performers. Quality hatched larvae tend to be a teardrop shape and will move in a forward-spiralling motion.

**EARLY DEVELOPMENT**

The initiation of growth of internal organs is critical to early development. An inward movement of external tissue occurs at the posterior end of the motile-hatched embryo. This is observed visually as a “U” shape extending inwards from the rear.

While larvae move in a forward spiralling motion, observations reveal that cell division occurs internally and a primitive gut develops. This occurs between 24 to 48 hours after hatching, after which the larvae has a fully developed intestinal tract and is ready to feed.

Folding over of the epidermis occurs during this period, and further development of locomotive and feeding structures is observed. Larvae still move in a forward, spiralling motion.

The success of this phase of hatchery production has a significant bearing on subsequent larval rearing. Although there are a number of issues to face with rearing larvae through to settlement, these are mainly logistical and focus on algal nutrition, stocking densities and water quality. This will be discussed in the next issue.
onto pellets.

Aquaflor is the first in-feed antibiotic in aquaculture to be classified by the US Food and Drug Administration as a veterinary feed directive, or VFD drug. It established the category in 1996 to help the agency more closely control new therapeutic products, primarily antimicrobials, and their use in food animals. Fish farmers may obtain VFD drugs through normal feed distribution channels, but will require a signed directive from a licensed veterinarian.

Fisheries biologist Dr Dave Erdahl of the US Fish and Wildlife Service said he didn’t think the VFD process would be a major issue for most producers raising trout and other freshwater-reared salmonids.

While Aquaflor is relatively new to the US market, it has been used for more than 15 years in Japan, Europe and Latin America to treat diseases in other farm-raised aquatic species.

See www.Aquaflor-USA.com

BUOY BOUNCES BACK

The Cawthron Institute has redeployed a research buoy in Tasman Bay to assess water column conditions after making some adjustments to improve its performance.

The continuous data collection buoy will be anchored off the mouth of the Motueka River, where it will help identify the relationships between river flow and growth conditions for fish and shellfish resources. Instruments either on the buoy or tethered to the anchor line will measure the water’s speed, direction, salinity, temperature, turbidity and other factors.

A control module and modem transfers data directly to the Cawthron network and website. Paul Barter of Cawthron developed a new reinforced communications cable for the system, as the old one sometimes lost the Telecom link due to abrasion.

This cost time in repairs and the loss of ability to see real-time data while the cable was out of action.

The head of the project, Paul Gillespie, says Cawthron is also extending the buoy’s uses, with the Tasman District Council adopting the buoy site as a monitoring location to establish a baseline for seabed environmental conditions.

INSURANCE COVER FOR FARMS

Paua, mussels, kingfish and salmon are some of the aquaculture species in New Zealand that can be insured. Policies provide cover for stock loss from storms, disease, environmental problems and other perils, plus equipment, vessels and buildings.

One company, SSML, started insuring aquaculture in the United Kingdom 20 years ago. The initiative came from fishing vessel owners in the Scottish Isles who sought cover for their farms as they shifted from hunting to farming.

The trend continues today, with one of the prime examples being bluefin tuna in Australia and other parts of the world.

“As the pressure on wild stocks and the cost of wild capture continues to increase, we anticipate a commensurate growth in the aquaculture industry and remain very supportive of new developments,” said Chris Kennedy of SSML.

INDUSTRY NEEDS TO WORK TOGETHER

A breakthrough discovery in managing norovirus by finding a way to grow it was a highlight of the sixth International Conference on Molluscan Shellfish Safety held in Marlborough from March 18 to 23.

Conference delegates heard of the breakthrough in a teleconference broadcast by two scientists in America. The conference attracted about 200 regulators, researchers and others involved in the aquaculture industry from all over the world.

A keynote speaker, Doug McLeod, from Scotland, said regulators should be white knights protecting consumers and the reputation of shellfish, not Don Quixote figures fighting windmills. McLeod is the chairman of the Association of Scottish Shellfish Growers, a trade association for growers of mussels, oysters and scallops.

Regulators, scientists, researchers and the industry needed to take a more collaborative approach to ensure consumers were protected but industry was not hampered by a line-up of potential concerns or emerging threats, McLeod said.

A boat trip around the Marlborough Sounds was an eye-opener for some of the European contingent as they watched two vessels harvesting mussels, as they were used to seeing them harvested only after purification in fresh water.

COURT ACTION POSSIBLE

Court action could follow if the West Australian government does not achieve the correct mix when establishing a crayfish farming industry alongside the wild catch industry.

The government guaranteed no further commercialisation of the industry when it ceased issuing pot licences in 1963. Commercial rock lobster fishing had to be within the management plan.

Gill said it looked as though the government might step outside the plan and begin allocating part of the resource for commercial purposes. He said that this could lead to court action.

The government’s scoping paper suggests that it will pay for the collection of pueruli, juvenile lobsters, which means that those would grow them out gain an advantage over those in the wildstock fishery. Pot holders could also choose between the wild and the aquaculture sectors.

KINGFISH FARM COMMISSIONED

Oceania Aquaculture is to commission an A$10 million kingfish farm at Port Giles on the Yorke Peninsula, South Australia this year.

The farm will include two 40ha sites, and the company predicts that it will employ about 35 full-time staff and turn over about $3 million in the first year, and $12 million in the fifth year. Final approval on the leases is currently pending.
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