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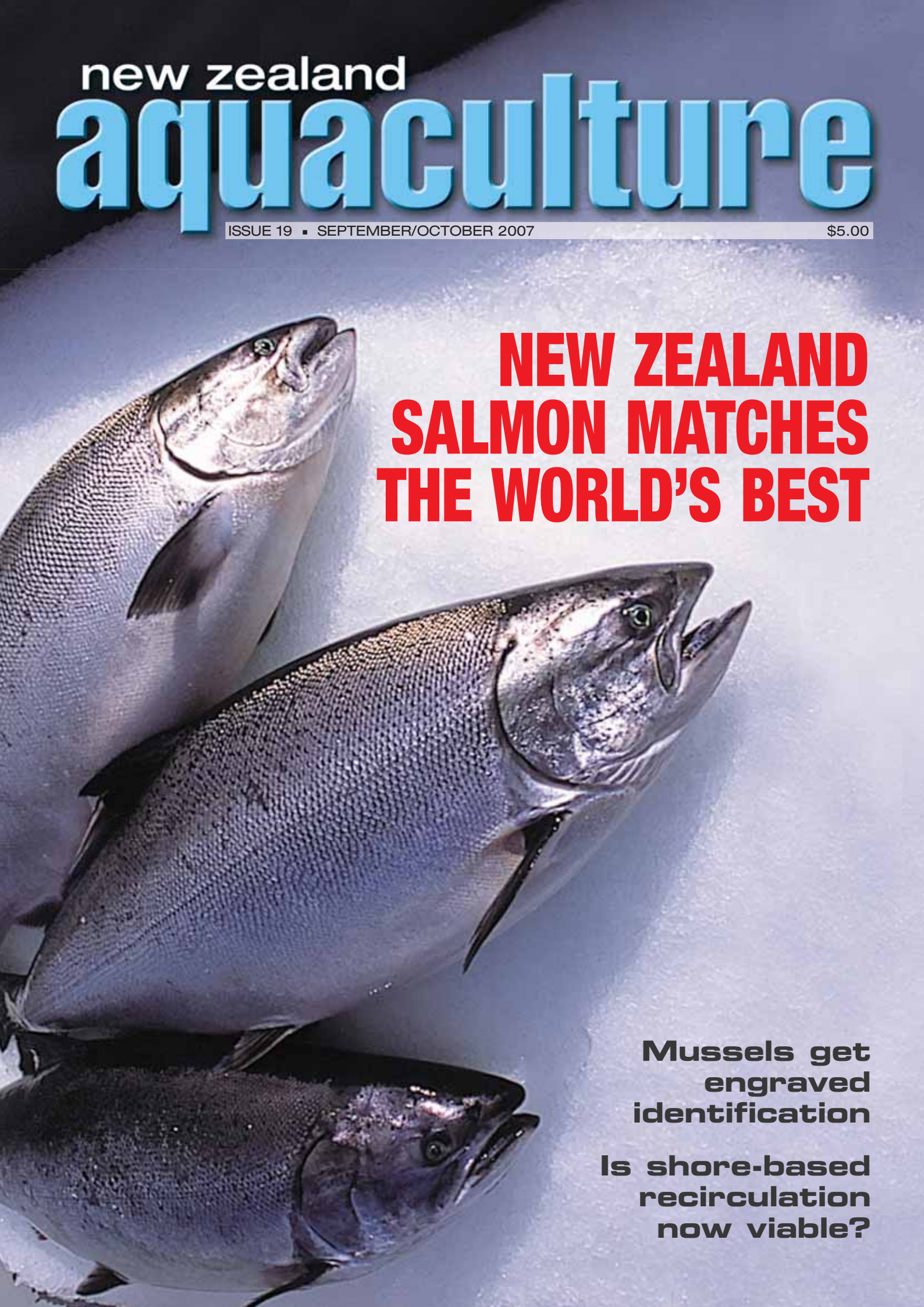

NEW ZEALAND SALMON MATCHES THE WORLD'S BEST

Mussels get engraved identification

Is shore-based recirculation now viable?

CONTENTS

ON THE COVER: Farmed king, or chinook salmon, ready for processing. Photo courtesy of the New Zealand King Salmon Company

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BY KEITH INGRAM

Marine reserves won't feed the nation

Welcome to this latest edition of *New Zealand Aquaculture*. In this issue we enter our fourth year, and one must wonder where the past three years have gone as we continue to strive to showcase New Zealand's aquaculture industry as being an environmentally friendly, sustainable producer of quality seafood that no other country can match.

This is a true statement, for we are the only country that can export live shellfish to the United States without having to put the seafood through a depurification process. If we detect a problem, a bio-toxin, we have the reputation for closing that section of the industry down within 24 hours.

These strong claims are a sign of our proven ability, and hence our highly valued reputation. You would think that with all this behind us, the government and the public of New Zealand would be encouraging greater utilisation and production of quality seafood at an affordable price.

Unfortunately, as we know, this is frequently not the case. All too often we fall victim to the not in my backyard, or NIMBY syndrome from complainants who, in many cases, have little association with the aquaculture management area.

These protagonists, with little justification and less financial commitment, are successfully applying a huge financial burden onto the aquaculture industry in trying to either defend or acquire new aquaculture space to sustain future growth.

Meanwhile, across the ditch in South Australia, the state government has just injected A$137 million into a seafood cooperative research centre that will provide up to 1000 new jobs, with a view to doubling Australia's $2.1 billion industry within 10 years.

The centre is to support the Australian seafood industry to keep up with the escalating demand for seafood through new methods of fish farming, aquaculture and adding value to wild-caught fish.

The state's fisheries minister, Rory McEwen, is quoted as saying, "The centre will deliver $700 million more into South Australia's seafood industry over seven years." This is just one state. Imagine what we could do in New Zealand with a quarter of this commitment in New Zealand.

But the government is trying. The former Environment Minister, David Benson-Pope, announced in June 7 that the government had allocated close to $400,000 to help four key regions plan for future marine farming. It is the first allocation from $2 million available to regional councils over five years.

The government is encouraging regional councils around the country to explore the options and go through the process to establish which areas should be set aside as aquaculture management areas where marine farms could be permitted in their coastal management areas. Up until now, regional councils have been quick to identify areas where they can charge coastal occupation fees, but have been reluctant to reinvest this income back into creating management areas.

The Northland Regional Council has been allocated $230,000 from the fund, which the government has identified as a priority area for aquaculture development.

Benson-Pope says the fund was mainly targeted to help identify areas where aquaculture should not go, support environmental studies, help with consultation costs, encourage Maori involvement and support cultural, social and economic impact assessments.

Aquaculture now employs around 2500 people and turns over close to $1 million a day, and the government is trying to support the industry because it recognises the huge benefits that can be returned to the New Zealand economy through sustainable, renewable aquaculture.

Who could argue with this commitment? Unfortunately, reforming aquaculture rules around the country have run into stiff public opposition, especially around Whangarei Harbour, which has been declared off-limits to marine farms after an earlier public battle.

This in an area that is crying out for employment opportunities.

When one stops to look at the demographics and notes that currently we have around 5000ha of productive aquaculture space producing $1 million a day, just think what the industry could do if this space was increased from 5000 to 10,000ha, or in our wildest dreams, 20,000ha. The sky is the limit, but aquaculture growth and employment and an economic boost to our local cultural communities is being lost.

Sadly, our NIMBY detractors are the very same promoters of marine reserves, and think nothing of trying to create a proposed network of some 403 no-take marine reserves around the coast, some as large as 47,000ha. Somehow we seem to have our priorities wrong.

On the positive side, we read that the failed Parengarenga kingfish farm in the Far North is due to reopen late this year. The farm has been completely overhauled and can now close any of the 32 race ways, the crux of the original failure, for servicing, repairs or maintenance.

FARMING PLANS OPPOSED

Environmentalists want further commercial marine farms barred from Whangarei Harbour and the Bay of Islands.

The call was made on July 12 in submissions to the Northland Regional Council's proposed new rules on aquaculture management areas, which could open up any part of the coast to marine farms, as long as stringent conditions are met. At present, marine farms may be set up only in 18 designated Northland areas.

A spokesman for the Whangarei Heads Citizens' Association, Peter John Coates, said Whangarei Harbour had just one oyster farm, in Parua Bay. The harbour was a nationally recognised wildlife refuge that should be out of bounds to fish farms, he said.

"Fish farming invariably degrades the area through the deposition of waste, abandoned structures and general pollution. This is happening in the Bay of Islands, Kaipara and Parengarenga Harbours." That must not be repeated in Whangarei Harbour, Coates said.

While the new plan means that potential marine farmers, not ratepayers, have to meet the cost of applications, opponents say they would be hit by the cost of fighting applications in the Environment Court. Coates said legal appeals could drag on indefinitely and were a cost the community should not have to bear.

The Bay of Islands Coastal Watchdog group expressed similar sentiments. "There is a severe lack of quality research and ecological information on the impact of aquaculture on important ecosystems, life support systems and biodiversity," the group said.

Murray Rae, of the Houhora Marine Protection Group, said the adverse effects of aquaculture were complex and poorly understood. It was important that monitoring and research be carried out with a holistic approach.

Public submissions closed on August 5.

KINGFISH FARM MAY REOPEN

A Parengarenga kingfish farm that closed a year ago with debts of $7.6 million could reopen by summer.

The Parengarenga Incorporation has signed an agreement with a New Zealand company to resume production at the farm on incorporation land 90km north of Kaitaia. The farm was designed to produce 600 tonnes of fish a year, and was touted as the first land-based kingfish farm in the southern hemisphere when it opened in 2004. But problems with the Danish equipment and high overhead costs resulted in the business failing to break even during its first 18 months.

The director of the Parengarenga fish farm, John Ellis, with one of the last kingfish to be harvested from the farm shortly before it closed last year.

John Ellis, a director of the subsidiary that operated the farm, says the incorporation has been talking with the company since last October. A joint venture document is with their respective lawyers. "I'm 100 percent certain the farm will reopen. The date is the issue," he said.

Ellis would not give details of the company, except to say that it is researching equipment modifications aimed at resolving water quality issues in the farm's 32 raceways, which are 20m long. It is also negotiating with the National Institute of Water and Atmospheric Research's Bream Bay fishery to improve the supply of fingerlings to the farm, which is believed to be insured for $10 million.

Ellis hopes the farm, which will employ up to six people, can be restocked with fish before October. "We won't start up until we're ready to go into full production."

BROODSTOCK KEY TO EFFICIENT PRODUCTION

The National Institute of Water and Atmospheric Research says its research into improving aquaculture broodstock will help the industry achieve its target of $1 billion of annual sales by 2025.

The institute says the challenge is to transform the developing kingfish, paua and groper farming sectors into commercially successful and robust industries. Elite broodstock, and systems for regularly producing high-quality seed, would help the sector achieve its potential.

Dr Jane Symonds, a scientist with extensive experience in finfish breeding, is heading NIWA's research into applying selective breeding and DNA marker technologies to generate high-performing and commercially important broodstock that can produce vastly superior seed when compared with wild stock.

To complement this, new methods are being developed to maintain and manipulate broodstock for year-round quality seed production, a pre-requisite for building efficient, large-scale aquaculture production.

Dr Symonds worked for New Zealand King Salmon in the 1990s before moving to Canada, where she established that broodstock selection could dramatically improve commercial production efficiency.

GM FISH FOUND IN CHRISTCHURCH

Government biosecurity staff seized what it said were genetically modified aquarium fish from four Christchurch premises on July 19.

A spokesman for the Ministry of Agriculture and Forestry, David Yard, said the Zebra danio fish were brought to its attention by concerned members of the public who had seen them for sale online.

Test results confirmed that about 300 of the fish had been genetically modified with a red fluorescent protein to make them a bright reddish-pink colour, Yard said. However, the fish posed an extremely low biosecurity risk, as they were not likely to enter the food chain or have an environmental impact.

Yard said the presence of the fish in New Zealand was not authorised, making them illegal and in breach of the Hazardous Substances and New Organisms Act. The seized fish were killed, bagged and burnt.

FOOD AND DRINK INVESTMENT WELCOMED

Aquaculture New Zealand says the government's decision to invest $19 million in "high-end" food and beverage exports should boost opportunities for the aquaculture sector.

The chief executive of the government agency, Mike Burrell, says the decision is very exciting, as the investment should attract a raft of new ideas, networks and business links, and help the industry achieve the economic transformation necessary to reach $1 billion in sales by 2025.

"We are an export industry that has already embraced innovation at the production end, and we're excited that we'll be able to take our culture of innovation and future-focused development into the export and marketing of our products," Burrell said.

Market development will form the backbone of the overall sector strategy. Its aims are to improve industry economics through sustainable growth, with the focus on producing premium and innovative products.

The fish may have been imported from Singapore earlier this year, and cleared for entry because of an incorrect declaration by the importer. MAF is now trying to track down offspring from the consignment, but admits this may be difficult. It is asking for tip-offs from the public.

WAKATU SEAFOOD EYES AUSTRALIA

Nelson's Wakatu Incorporation is not ruling out becoming involved in aquaculture in Australia, because New Zealand's industry is "gridlocked", its chief executive, Keith Palmer, said on July 2.

He went to Australia in July to look at aquaculture, in particular finfish farming. "I'm going with a perfectly open mind," he said before his departure. "We want to look at it and see what is happening and what is working, but also to explore their relationship with government and 'bureaucracy', and what the difference is (compared with New Zealand)."

Wakatu Incorporation, a privately owned company, owns Aotearoa Seafoods, which processes about 10,000 tonnes of mussels a year.

Palmer said that the Australian aquaculture industry was booming, but New Zealand's sector was gridlocked by a bureaucratic system, with no new aquaculture management areas created since aquaculture reforms came into effect in January 2005.

Palmer said Wakatu was not ruling out also getting involved in aquaculture in Australia because of the progress there. The company wants to establish a 770ha mussel farm west of d'Urville Island, but the Ministry of Fisheries turned down its application for a permit in June. MFish said the proposed farm would have covered important fishing grounds, limiting commercial fishers, but Wakatu plans to seek a judicial review in the High Court.

Palmer said Wakatu Incorporation only applied for a permit for two 120m-long trial lines to start with, which was what the Marlborough District Council issued a resource consent for four years ago. "I fail to see how two lines totalling 250m would affect the whole fishery in Tasman Bay."

However, MFish's national aquaculture manager, Dan Lees, said the application the ministry assessed was for a staged approach to the whole 770ha area. He said that with new aquaculture laws, good planning was needed to ensure that aquaculture went into the right places.

IWI SEEK QUICK AQUACULTURE SETTLEMENT

Iwi from the top of the South Island are seeking an early settlement to their aquaculture claims in the Marlborough Sounds. Te Tai Ihu says it may prefer to take a cash settlement, estimated at up to $30 million, instead of waiting for its 20 percent entitlement of new marine farm space.

Little new space would be available in the sounds before a final allocation date of 2013 set by the government, the group's chairman, Richard Bradley, said on June 15. Bradley said he had been trying for months to arrange a meeting with the Minister of Maori Affairs on the issue.

STUDY TO ENHANCE SCOTTISH SALMON FARMING

The Scottish salmon farming industry is to embark on the first industry-wide assessment of its sustainability.

Independent experts in energy, economic and social impacts, aquaculture and the environment will identify the challenges facing the industry, and recommend solutions to enhance its performance.

The Scottish Salmon Producers Organisation and the Highlands and Islands Enterprise commissioned the study. It will cover waste generated within the production cycle, energy utilisation, carbon emissions and the socio-economic benefits of salmon farming. A comparison with other food-producing businesses will also be included.

The results are expected to provide information on salmon farming practices, assist in preparing environmental impact assessments, and inform customers and the public on the sustainability of Scottish salmon farming.

DON'T IGNORE PHEROMONES

by Professor Ronald J Roberts

The suggestion of an influence of pheromonal effects on salmonid egg producers in the northern hemisphere has brought back memories of former problems in gilthead sea bream, Sparus aurata, culture in the Mediterranean and Red Seas. These fish taste delicious, but demand in the 1960s and 1970s led to serious overfishing.

Gilthead sea bream are protandrous hermaphrodites. All the fish are male during their first year of reproductive life, and many also in their second year. From then on, some males change sex and become functioning females.

Each year the proportion increases, so gradually the ratio of females to males increases. In the autumn, males become ambisexual, and must decide whether to become female or revert back to being male.

The number that progress to femaleness is controlled through social and pheromonal signals. Thus there was a major headache for anyone trying to maintain a breeding population until the introduction of highly potent gonadotropin-releasing hormone implants, which ensure females retain their sexual nature.

Females also have a breeding period of several months, and may produce up to twice their body weight in eggs, so they require a diet of excellent quality.

With technical developments in breeding and the introduction of selection programmes and special diets, mariculture is allowing a threatened fish species to become an exotic staple of local cuisine again.

I do not know whether salmon breeders can learn any lessons from sea bream. But clearly, if the gilthead bream is anything to go by, pheromones are very important, and we ignore them at our peril.

CODE ADDRESSES ABALONE VIRUS

The Australian Fisheries Research and Development Corporation says it has almost completed a biosecurity code of practice for the disease abalone viral ganglioneuritis. The code addresses procedures such as identifying and reporting the virus, decontamination processes, standard operating procedures for land-based abalone farms, quarantine procedures and dead stock disposal.

The code is a response to an outbreak of the virus, which now affects the fishery along 200km of Victoria's southwestern coast. The problem is being described as the worst environmental disaster ever seen in the region.

The executive director of Fisheries Victoria, Dr Peter Appleford, has denied that the government ignored the threat by not destroying stock on farms when the virus was first detected.

NEW ZEALAND SALMON REIGNS SUPREME

BY MARK BARRATT-BOYES

What coals are to Newcastle in England, salmon is to British Columbia in Canada. Canada produces 17 times more farmed salmon than New Zealand, and North American consumers have many species to choose from, including chum and sockeye.

But now there's a new fish on the shelves, chinook, also known as quinnat or king salmon, flown all the way from New Zealand by the New Zealand King Salmon Company.

Chinook originally came from British Columbia but its wild catch and farmed stocks are now in short supply, with concerns about overfishing and polluted waterways. Environmentalists say damage from pesticides and antibiotics used by salmon farms is killing wild species, and they want farming banned.

"It's interesting that a fish indigenous to British Columbia is being grown in New Zealand and shipped (flown) out here, and we're not doing it ourselves," says a Canadian salmon importer, Joe Collins.

The exports are currently worth less than NZ$1 million a year, but New Zealand King Salmon says it welcomes the business. "The price is the highest we have anywhere in the world at the moment," says New Zealand King Salmon's chief executive, Paul Steere, "so they really appreciate and value the attributes of chinook."

Of New Zealand's $323 million of domestic and export sales generated by aquaculture, $88 million comes from salmon. New Zealand's total production is about 8500 tonnes from 12 producers. New Zealand King Salmon, a vertically integrated salmon farming, processing and marketing company based in Nelson, is easily the biggest.

It harvests 5300 tonnes of salmon each year, generating a turnover of $65 million, nearly half of which comes from exports. That is 70 percent of New Zealand's salmon production, or 40 percent of the world's farmed king salmon.

New Zealand raises more chinook salmon than anywhere else in the world, and while it's a fragile fish that is difficult and costly to farm, its flavour and colour make it popular. Because it is prized, NZ King Salmon says it can get premium money for it with its customer-focused strategies.

As well as being the world's largest salmon, chinook is also soughtafter for its high omega 3 content. The meat is said to be fattier and the flavour is different from other salmon species, so it's something new for people to try.

According to the Alaska Department of Fish and Game, the

The company harvests about 30 tonnes of salmon per week

The gutting line

chinook salmon (Oncorhynchus tshawytscha) is the largest of all Pacific salmon, with fish commonly exceeding 13kg. The largest on record is a 57.15kg monster taken in a fish trap near Petersburg, Alaska in 1949.

In North America, wild salmon range from Monterey Bay off California to the Chukchi Sea off Alaska. Spawning chinook salmon in fresh water range in colour from red to copper to almost black. Males are distinguished by their "ridgeback" condition and their hooked nose or upper jaw. Juveniles in fresh water are recognised by well-developed parr marks that are bisected by the lateral line.

Like all species of Pacific salmon, chinook salmon are anadromous. They hatch in fresh water, spend part of their life in the ocean, and then spawn in fresh water. Chinook salmon may become sexually mature from their second through to their seventh year, so fish in any spawning run may vary greatly in size.

Spawners bound for the extreme headwaters in Yukon Territory, Canada, will travel more than 2000 miles during a 60-day period. Chinook salmon do not feed during the freshwater spawning migration, so their condition gradually deteriorates. Each female deposits from 3000 to 14,000 eggs in several gravel nests, or redds, which she excavates in relatively deep, moving water.

The newly hatched fish, called alevins, live in the gravel for several weeks until they absorb the food in their yolk sacs. The juveniles, called fry, wiggle up through the gravel, and remain in fresh water until their second year, when they become smolts and migrate to the ocean.

Juvenile chinooks in fresh water feed on plankton, then later eat insects. In the ocean, they eat a variety of organisms, including herrings, pilchards, sandlances, squid and crustaceans. The salmon grow rapidly in the ocean, and often double their weight during a single summer season.

The life cycle of the farmed king salmon begins as an egg or ova obtained from captive, mature females. The milt is obtained from mature males, also reared in captivity, which have been carefully selected from family groups that have been closely monitored for several generations for rapid growth, good flesh colour and texture, and good adaptability to seawater.

The females are stripped of their eggs, milt and water is added, and the mixture is gently stirred and then placed in trays and incubated. Dead or infertile eggs are regularly culled.

The ova are hatched in King Salmon's two commercial hatcheries, one just downstream from the Waikoropupu Springs at Takaka, in Golden Bay, which has some of the world's clearest fresh water, or at Tentburn, in Canterbury.

Because most males mature at the undesirable size of 1kg or 2kg, most of the stock on site is female. The ova take about 35 days to hatch, which happens around June or July. The alevin, or freshly hatched fry, live off their yolk sac for about 25 days. When the sac is almost gone, the fry start looking for food, and the staff begin an intensive feeding programme.

The fry are normally kept indoors until they weigh about 0.3g and are feeding properly. They are then placed outdoors into concrete raceways, where they grow rapidly.

Throughout their lives, the salmon are fed with extruded feed imported from Australia and Chile made from safe and sustainable sources with ingredients that are BSE and GM-free. The pellets may contain fish meal, fish oil, vegetable protein,


Fresh at the farm


Salted salmon ready for the smokehouse

wheat and starch, poultry protein, vitamins, minerals and binders, and carophyll pink. Typical proportions of the feed are protein 45.2 percent, fat 21.5 percent, carbohydrate 14.2 percent, plus ash, moisture, vitamins and minerals to provide a balanced and nutritious diet. All the ingredients are also traceable.

Steere claims that New Zealand is the only country in the world that doesn't use antibiotics, vaccines and chemicals in its husbandry of chinook.

"To the best of our knowledge and based on signed confirmation from the feed suppliers, it is our clear policy and practice that we do not use genetically modified organisms, antibiotics, vaccines, steroids, other growth enhancers or any unnatural substances or chemicals in the diet of our salmon," says Steere.

Processing value-added packed samon

Now called smolt, the fish undergo major metabolic changes to prepare them for life in seawater. They are counted and graded, and some time between November and June they are starved for three days before being transferred in special tanker trucks equipped with aeration, circulation and oxygen monitoring equipment to four sea cage sites in the Marlborough Sounds.

By this stage the fish generally weigh between 20g and 300g, depending on the strategy required for year-round high quality harvesting, he says.

At varying selected weights and staged timing, the salmon are carefully discharged into the sea cages, where they grow for between 10 and 20 months until they weigh about 3.5kg to 3.8kg, or larger, if stock management allows.

The cages are made from spirally welded pipes with nets slung within them in a variety of sizes from 14m2 to 25m2 suspended from a flotation collar. The cages are designed specifically for New Zealand conditions and are up to 18m deep. A large net surrounding around each farm protects the fish from predators such as seals or sharks.

The depth and flow of water, temperature and shelter are all important factors in determining where to place the cages, as the fish need a plentiful supply of well-oxygenated and unpolluted water. Salmon thrive in cooler water, and the best growth is achieved at a temperature of between 12 and 17 degrees Celsius.

Wind and waves can affect feeding, even with the protection of sea cage structures. Salmon are visual feeders, so they only feed during the day. Net movement during rough weather may also cause stress.

The farms are tended by full-time staff who work and live on the site, with specialist staff attending to harvesting, grading, underwater monitoring, fish health and engineering requirements.

Innovative farming techniques mean that salmon of consistently even size are harvested throughout the year. Harvesting occurs at the Marlborough Sounds sea farms every week of the year from Sunday to Thursday.

When the fish are ready they are crowded into nets, and humanely and gently stunned by a natural anaesthetic, Aqui S, developed in New Zealand, which is added to the water bath. The fish are then immersed in carbon dioxide, then bled, graded, packed into slurry bins and transported to one of four processing facilities in Nelson by barge and truck for processing the same day.

The fish is prepared quickly through highly controlled processes, allowing delivery of fresh, chilled and processed salmon to international markets within 48 hours of harvest.

The salmon is processed into a wide variety of cuts and styles, including whole fresh and frozen fish, fresh chilled fillets and steaks, kebabs, sashimi or in marinades. It is sold under three brand names, Regal Marlborough Salmon, Southern Ocean or Seasmoke.

"To guarantee quality and reliability we must own and control every single stage of production with demonstrated traceability," says Steere. "The company is totally integrated, and has full management of production and quality from the hatchery through to the market. Such control is our customer's reassurance of the quality, reliability and dependability of our New Zealand King Salmon."

The New Zealand market is growing and valuable, and now takes around half of production, with demand increasing by over 15 percent per year in the last three years.

Steere says domestic sales this year will be $37 million, up from about $12 million in 1996.

Japan and Australia account for a third each of exports, with the other third going to South East Asia and North America.

And once Air New Zealand begins direct flights to and from Vancouver from November, delivery times from Nelson will be halved to around 24 hours, making New Zealand King Salmon even fresher.

See www.kingsalmon.co.nz

GO NORTH, YOUNG MAN! BUT PERHAPS NOT JUST YET...

BY JUSTINE INNS

While regions with more established aquaculture industries, like Tasman and Marlborough, grapple with the transition from old to new legal regimes, the Northland Regional Council has been leading the way in trying to provide for the development of "new" aquaculture space. Well before the latest reforms, the council had researched and consulted on areas potentially suitable for aquaculture.

This culminated, as (relatively) recently as April 2004 with the identification of 19 possible aquaculture management areas, or AMAs. Rather than proceeding to advance these through a variation to the Regional Coastal Plan, however, the council put the work on hold and waited to see what would come out of the legislative reforms then being developed.

While the Aquaculture Reform Bill was before a Select Committee, the council became one of the strongest supporters of the insertion of the Invited Private Plan Change option, or IPPC.

The Resource Management Act has always provided for the option of "privately initiated plan changes" in respect of the plans formulated by local authorities under that act. The mechanism has been used relatively frequently to accommodate large subdivisions and other developments requiring changes to permitted land uses. A privately initiated change must go through exactly the same public consultation and statutory processes as a council-initiated change, but is driven, and funded, by private proponents, rather than the council.

In the aquaculture context, this was seen as means of getting AMAs established without councils incurring significant research and planning costs, as would be the case where they initiated the plan change. The only problem was that, in the normal course of things, the proponent of a successful private plan change still generally requires resource consents to carry out activities provided for in that plan change, but does not have the first option of applying for those consents.

In most cases that doesn't matter, because the proponent owns the land concerned. In the case of aquaculture, however, the normal process had to be "tweaked" to ensure that the plan change proponent would have the first opportunity to apply for consents.

The result is the IPPC process, which formed part of the 2004 aquaculture reforms, whereby the council "invites" plan changes in some or all of its coastal marine area.

Where an IPPC is successful, its proponent is issued authorisations allowing it to apply for consents (except in respect of 20 percent of the space set aside for the settlement of Maori claims). Not surprisingly, given that it was a proponent of the mechanism during the course of the reforms, the NRC halted work on its identified potential AMAs in favour of the IPPC approach.

The result has been a council-proposed variation to the Northland Regional Coastal Plan which does not identify potential AMAs, but sets out the IPPC process and standards and other matters to be considered by the council in inviting, and then assessing, IPPCs.

The formation of a consortium of aquaculture and iwi interests aimed at cooperating, rather than competing, on developing new AMAs, and a recent injection of $230,000 of government funds to support the council's planning process, has bolstered hopes that Northland might be the first region in the country to see new AMAs established.

There is only one fly in the ointment or, rather, just over 300 of them. When public submissions on the proposed plan variation closed in February this year, 333 submissions had been received, with only six percent generally supporting the proposed variation.

While some of the industry and iwi submissions raised technical issues as to how IPPCs would be assessed, the council describes the submissions as being dominated by concerns about potential impacts on existing uses, and a lack of certainty about where marine farms will be allowed.

The irony is that a process designed to relieve the council of the burden of identifying areas suitable for aquaculture has met community resistance, precisely because it doesn't tell the community which areas are likely to be suitable for aquaculture!

So the NRC still has considerable work ahead of it before it can get to the point of inviting private plan changes, let alone assessing or adopting those changes. This work may have as much to do with educating and informing the community as refining the proposed plan provisions. Many other regions will be watching with interest.

Justine Inns is a senior associate with Oceanlaw. She previously spent more than a decade as an advisor to various iwi (tribes), including several years with Ngai Tahu.

FROM ACROSS THE DITCH:
Recirculation comes of age

BY JOHN MOSIG

1. A typical re-circulation farm. This one, which concentrates on barramundi production, is 30 minutes by road from the Melbourne Wholesale Fish Market. It has just doubled its capacity to over 200 tonnes

2. These 12-month-old Murray cod were grown from 1g fry in less than 12 months in a temperature-controlled recirculation system in western Victoria

3. A typical re-circulation farm in an industrial estate. Nothing picturesque. It's all about output.

G'day. One of the big issues in Australian aquaculture, particularly down the more densely populated, by antipodean standards, eastern coastal fringe, is environmental sustainability. There's a perception, one the mainstream media is only too keen to fuel, that aquaculture is akin to agent orange, and will destroy the environment as we know it.

That the environmental footprint of aquaculture is far gentler than other food-producing industries seems to have escaped their notice. As the manager of the Bream Bay Aquaculture Park, Andrew Forsythe, put it when I paid a recent visit, land cleared and converted to livestock protein production would take 200 years to return to a totally natural habitat. In the case of aquaculture, once the production cages or longlines are removed, it is only a couple of years before the substrate would show no sign that the site had ever been a fish farm.

However, sound science doesn't come into it once self-interest and deep-seated emotionalism takes over. Whether it be the "not in my back yard" brigade or the tree huggers, government policy tends to follow the vocal element of the electorate.

Nor does the fact that if they want to sit on the sundecks of their holiday shacks hopping into bowls of mussels and stacks of smoked salmon, the NIMBYs are going to have to have a fish farming industry, because as the wild catch falls far short of demand, there's no other way to produce healthy seafood.

As a consequence of the voce populi, biosecurity and zero environmental impact have become synonymous with aquaculture in the minds of regulators. And while compromises have to be made, the risk management imposed on the industry has come at a cost – in some cases, certainly in Oz, at the cost of industry development.

As one potential investor put it as he shifted his investment focus from Victoria, with 25 percent of the nation's population crammed into three percent of its land mass, to neighbouring and more aquaculturally pragmatic South Australia: we don't need to farm in Victoria, we just need to sell in Victoria.

That aside, one thing to come out of this overly protective attitude has been the coming of age of re-circulation

Oxygen injection has helped lift stocking densities to over 100kg/m^3. Shown here is an O_2 concentrator and storage tank

technology. The sector has long been considered to be the happy hunting ground of snake oil salesmen flogging beaut schemes that could be set up in our double garage and took an hour after work to operate. Even large commercial ventures drawing on the best available water-cleaning technology found it difficult to squeeze the cost of production into the prevailing market value of the end product.

But that has changed dramatically over the last decade. And although this is a significant factor, it hasn't all come about through more efficient and cheaper technology. The goalposts have been moved, and for all time. The catchcry of the aquaculture sales department has finally come true.

We are running out of fish. Demand has outstripped supply. The last of the hunter-gatherers has come in from the cold. The ratio varies, but the accepted wisdom has the proportion of farmed seafood consumed globally as between 44 percent and 52 percent. At the time of the World Aquaculture Society's

conference in Sydney in 1999 the FAO figure was 20 percent.

More than an increase in consumer demand and more efficient technology, what has brought re-circulation technology into its own has been increased productivity and risk management. After several decades, the sector has moved from a glorified sewage treatment plant stuck onto some fibreglass tanks to a sophisticated fish production unit. Balancing the use of powerful technology such as ultra-violet treatment, ozone and O_2 injections with the husbandry needs of the fish and the economic drivers of farming has enabled growers to boost stocking densities to unprecedented levels, thus reducing all-important fish space cost by as much as 80 percent in some cases.

Improvements in dietary efficiency and the selection of more farm-efficient genotypes have also contributed, but the most significant impact has been the change in weather patterns. Without getting drawn into the reasons for it, the global climate is more volatile than has ever been recorded. Extremes are the order of the day. I live in a state that saw half its forests destroyed by fire three summers ago. This last summer we burnt out the other half.

Since then the ashened earth has been lashed by torrential rain. You've had your share of it across the ditch too, from what I hear, with blanketing unseasonal snow, and days of steady rain interspersed with frosty dry spells. That's not good weather for farming a cold-blooded animal like fish.

This is where re-circulation technology has really come into its own. A climate-controlled indoor fish farm operates at optimum conditions all day, every day. Re-circulation technology can constantly deliver a quality product to the marketplace throughout the year. More than that, with all the talk of carbon miles, it can be situated close to the markets. Victoria's biggest barramundi producer is only half an hour's drive from Melbourne's chief post office. Well, not during peak hours, of course.

What we said was part of the future of aquaculture back in the late 1980s has finally arrived. Production is all about control over balance and stability, and finally all the ducks have lined up for the re-circulation sector. In some respects we may wish they hadn't, but we live with the times. And we can lock that nasty old "akwaculture" industry away to satisfy the anxiety of those concerned citizens and insecure politicians.

AQUACULTURE STRATEGY CONCERNS MAORI

BY IAIN GILLIES

IT IS UNDERSTANDABLE that anyone with an interest in coastal developments, whether aquaculture or housing development, will be watching every move the government makes with hawk-like intensity.

The aquaculture strategy announced in Nelson has not exactly had an enthusiastic reception in some quarters. It fails to guarantee that Maori will not be shortchanged in the allocation of marine farm sites, says the Maori Party's fisheries spokeswoman, Tariana Turia. She feels there is nothing in the plan which talks about the quality of representative space for allocation to iwi.

There has always been the fear that tangata whenua will end up with marine farming areas which are not likely to yield a higher than average productive capacity. The Maori Commercial Aquaculture Claims Settlement Act, passed in 2004, gives Maori 20 percent of marine farming allocated since 1992 and of any new space.

If some of that space, or financial payments in place of it, have not been allocated by 2013, the government may be required to pay compensation to Maori.

Iwi concerns over this emerged last year when the Environment Court, favouring the Sealord-controlled SMW Consortium Ltd over the Tasman District Council, indicated that aquaculture farms could be allowed outside designated aquaculture management areas, or AMAs.

If new farms were started up in areas not legally defined as "new space", questions could arise over whether provision would need to be made for Maori commercial aquaculture claims.

The previous Environment Minister, David Benson-Pope, announced in May that the court decision impacted seriously on major elements of legislation, such as the allocation of space to iwi, the creation of AMAs, testing for effects on fisheries, tendering and private plan changes. He said the law would have to change.

It looks like regional councils that deal with the applications for aquaculture space will have some long nights ahead of them.

STUDENTS CHECK UP ON MUSSEL IDENTITY

BY NICK KING, CAWTHRON INSTITUTE

Tagged spat

ABOVE: Students from Queen Charlotte College's Aquaculture Academy assess harvested mussels
BELOW: An engraved mussel at harvest

To most people, one mussel looks much the same as another. What would you do if you wanted to identify individual mussels, or figure out who their relatives were? This was one of the challenges facing scientists at the Cawthron Institute in Nelson.

At about the same time, Dr John Whitehead from Queen Charlotte College in Picton was looking for interesting research projects for his aquaculture academy students. It seemed like the perfect opportunity to combine hands-on education with real-world problem solving.

Cawthron runs a selective breeding programme for Greenshell mussels that will deliver to the New Zealand mussel industry the same selective breeding benefits enjoyed by just about every other primary producer in the world. Part of this programme involves creating families of mussels which are reared in the hatchery and then grown to harvesting size on marine farms.

A family is the offspring of one male and one female mussel, and once the mussels reach harvesting size, the problem is to figure out which family each mussel belongs to. Traditional

means for identifying livestock include branding, ear tags and, more recently, DNA-based testing. Salmon breeders use implantable tags, while plant and tree breeders can often just map the location of their test subjects because they don't move around.

The first solution Cawthron looked at was to use small plastic tags glued onto the outside of the mussel shell. These had been used before on a small scale and it was expected that around half of the tags would stay on until harvesting.

In 2003, the institute enlisted extra staff and glued over 50,000 of the small tags on to baby mussels about 20mm long. Initially the tags looked good, and when the first mussels were harvested, on average half the tags were still there. The problem was that "on average" meant that some families had more than half and some had a lot fewer.

The technique for attaching the tags improved over the next couple of years, but the results were much the same. One of the most frustrating aspects of the tags was that once they fell off they were gone for good. Even more frustrating was that the byssus threads that mussels use to attach themselves would happily stick to an ID tag. Tags were often found pulled off by the byssus of neighbouring mussels.

The search began for a better way. While DNA testing was considered an option it would not be cheap, and attention turned to the simple concept of engraving an ID code onto the outside of the shell. Before this could be used on a large scale, it needed to be tested, and this is where the institute teamed up with the college's academy.

The academy was looking for interesting research projects, and took the opportunity to compare the effectiveness of plastic tags versus engraving as a means of identifying mussels. Students from the college tagged and engraved 1000 mussels in 2005, and then transferred them to their mussel line in Shakespeare Bay, near Picton. The mussels were grown to harvesting size and the students then collected, measured and checked the mussels for their ID.

The results were better than expected, and the engraved ID code was still readable on 85 percent of the mussels after a year in the water. By comparison, fewer than half of the plastic tags were still present on the harvested mussels. Because of this positive outcome, engraving was used exclusively in 2006 to identify mussels from Cawthron's breeding programme.

As it turned out, there was a considerable labour-saving due to the faster engraving process. The faster process also meant that the small mussels spent less time out of water. It is expected that the first of these mussels will be harvested late this year.

One of the greatest benefits of the Queen Charlotte College's Aquaculture Academy is that students have the opportunity to learn about science as it applies to their local industry and environment.

This hands-on learning makes science fun, relevant, and hopefully inspiring! During this project, the students were able to play an important part of a major research programme, and generate results that will have a significant impact for New Zealand's Greenshell mussel industry.

Glueing plastic ID tags on to mussel spat

MEETING THE FUTURE NEEDS OF THE AQUACULTURE INDUSTRY

BY DR ANDREW MORGAN

The aquaculture industry is relatively young compared with the livestock and horticulture industries. Resources are spread between various institutes and industry stakeholders that may compete against each other.

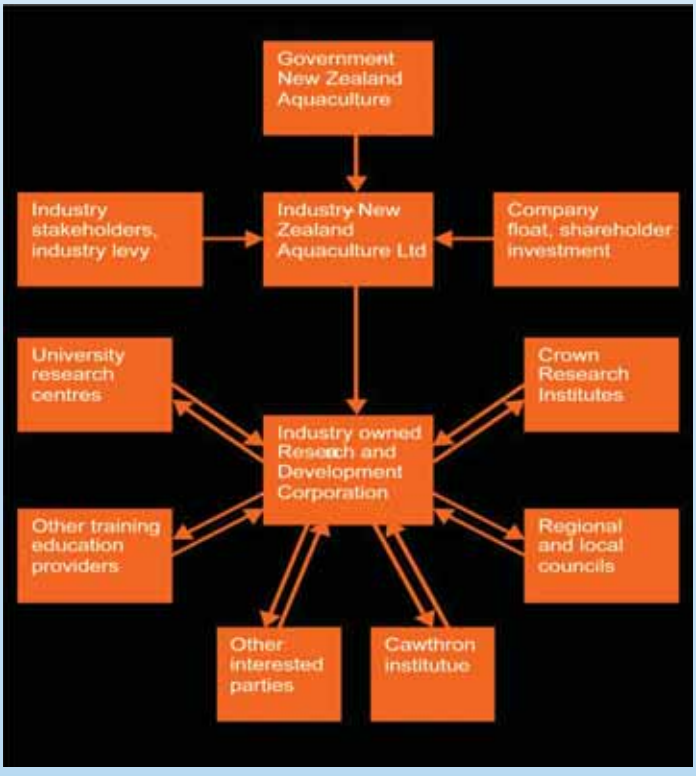
In the long run this does not make for an effective solution to process and product development in a fledgling industry. Pooling of resources and information may enable or facilitate change by giving ownership back to the industry.

The industry should take charge of managing and developing its own information and human resources for research in process and product development, in other words, a corporate body that deals with research and development and information management; an overarching entity that pools all the research, information and resources that should be owned by the industry.

Research and development in aquaculture is dispersed throughout New Zealand in various institutes and with industry stakeholders. Information abounds but few know how to access all of it. Problems also arise because interpretation of information can be difficult once gathered if it is not easily transferable into something tangible that can be exploited by the industry and used in the production cycle, process and product development.

THE LIVESTOCK INDUSTRY

Although the livestock industry involves Crown Research Institutes and centres of learning and research, they have long been at a stage where the industry itself has taken charge of its own research and development and information management systems. Perhaps the Livestock Improvement Corporation should be considered when looking for a model to follow. This is a private sector research and development company owned by the industry through its shareholders, a board of directors' appointed by the industry that represents the current and future needs of animal production, and information management systems for improving breeding stock, processes and product development.



ADAPTATION OF TECHNOLOGY

The principles of animal production are similar, irrespective of the type of industry. Underlying science in reproductive endocrinology shows how highly conserved basic processes are across species.

This means animal production technology, processes and product development can be adapted to different species from different phyla. Cawthron has successfully adapted technology in animal production from the livestock industry to domesticating shellfish production and improving selective breeding, and continues to do so. Animal husbandry in aquaculture has similar underlying fundamental principles, and enables the exploitation of technology in other industry sectors.

THE FUTURE

The aquaculture industry has been through reform and restructured itself to try and pool talent and knowledge. The government's reform and recognition of the industry's valuable contribution have resulted in the formation of New Zealand Aquaculture.

The industry itself has come up with the New Zealand Aquaculture Strategy to provide a direction for the foreseeable future, and an action plan to implement it, and consolidated itself through a new representative body, New Zealand Aquaculture Ltd. The next step is surely to take ownership of research and development and model ourselves after the livestock industry in terms of information management systems.

A shareholder-owned private sector research and development corporation, with a board representing the needs of the industry, would be the next step. Companies could then pay levies to further enable the corporation to be financially viable and continue with process and product development, animal husbandry research, and developing information management systems for the aquaculture industry.

Would it not be possible to model ourselves on the livestock industry and a company such as Livestock Improvement Corporation?

CREEK POLLUTES OYSTER FARM

Another Northland oyster farm has been put at risk from pollution, this time in Whangarei Harbour.

Nine oyster farms in the Bay of Islands are now derelict after a sewage-borne virus closed them seven years ago. An oyster farm at Parua Bay on Whangarei Harbour had its certification put at risk by septic tank systems at nearby new houses that failed after heavy rain.

The faults have been corrected, but the pollution was discovered only when the oyster farmer carried out a water purity survey. The farmer has had a six-month wait for an all-clear signal.

Unlike the Waikare oyster farmers, who sued for damages and lost, Barry Jessop could prove where the pollution was coming from, and has been told he could have sued successfully.

After farming for 17 years, including sales to Japan and America, his routine water testing showed that faecal coliform counts in the bay had suddenly rocketed, and $13,000 of newly harvested shellfish had to be dumped.

Jessop called in public health officials and went hunting for the sources of the pollution. It was tracked to a small creek running past a couple of new houses where raw sewage was flowing into the sea from a council-approved, state-of-the-art bio-septic tank system.

It took six months for the council and Northland Health to sort the problem and give the all-clear. Jessop says he's fortunate it was the off-season for oyster harvesting.

The Whangarei District Council, which approved the septic systems, said it relied on engineers to decide if they were safe. But a spokesperson said that once a system was signed off, there was no routine monitoring to make sure it was working.

Aquaculture New Zealand said that that attitude was unacceptable. The vice-chairman, Callum McCallum, said the councils must take responsibility for the risks that subdivisions pose to water quality, human health and a $30 million a year industry.

The district council said it was already doing all it was legally required to do. A councillor, Robin Lieffering, said monitoring on-site sewage systems on the coast would be costly and impractical. However, another 40 home subdivisions were planned, and Jessop said he would feel safer if every house in the bay had to connect to the council's new sewerage scheme at Whangarei Heads.