

The background of the cover is a close-up photograph of a crayfish resting on grey, wet rocks. The water is a deep blue, and the lighting creates highlights on the rocks and the crayfish's shell. The title 'new zealand aquaculture' is printed at the top, with 'new zealand' in white and 'aquaculture' in large red letters. Below the title, the issue information and price are listed in a thin white box. On the left side, the main article title 'KOURA FARMS need fresh water' is written in yellow and white. On the bottom right, two other article teasers are shown in red and yellow text.

new zealand
aquaculture

ISSUE 14 ■ NOVEMBER/DECEMBER 2006

\$5.00

**KOURA
FARMS**
need fresh
water

**Quick
test for
mussel
spat**
**European
eels under
threat**



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ON THE COVER:
Koura farming
requires clean
water supplies

PHOTO BY:
Vince Scully

new zealand
aquaculture

ISSN 1176-5402 ISSN 1176-8657 (web)

An informative journal
for the aquaculture industry

Published by:

VIP PUBLICATIONS LTD

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Half Moon Bay, Pakuranga 1706

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BPG Digital
PRINTERS:
Business Print Group
DISTRIBUTION: By subscription

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ARE WE SOILING our own nest?

How often do we promote our pristine marine environment as being a safe food source, and how often do we say that the way to provide a quality sustainable seafood source in the future is through aquaculture?

If we believe in this as an industry or a nation, why are we struggling to get aquaculture space? Why are we constantly at odds with central and local government to get a fair access to space, and for them to stop polluting our waters? Or worse still, give tacit approval to others to pollute our waterways and coastal marine areas.

Urban run-off is our greatest threat and probably the hardest to manage. But surely the discharge of raw, screened or filtered sewage into our rivers and coastal waters is no longer acceptable. Where are the greens when you want them? Why are these informed people not jumping up and down about the sewage discharges in the Far North, where the councils sewage overflows have destroyed a thriving and developing aquaculture industry, and now they try and justify their actions in the courts.

This costly process will only hurt the small farmers, as the bureaucrats are using ratepayers' money to keep their own backsides clean.

Further south, we note a number of outfalls along the coast, which are still, with regular monotony, the culprit of raw sewage discharges. Hamilton and Huntly are still polluting the mighty Waikato River, and Aucklanders are drinking it.

Even our capital city is guilty of destroying large tracts of coastline on either side of the discharge pipe that stops just out to sea. What happened to the idea of running the pipe a mile out to sea? And it continues around the country. We are now spraying dairy factory discharges onto paddocks in large amounts. This discharge is creeping into the groundwater, which in turns ends up in our streams and finally the coast.

Where are our environmentally concerned citizens? I'll tell you where they are. Watch the aquaculture industry! They are making sure that mussel doodoo is not going to pollute our swimming water. Or they complain of visual impacts.

This aside, it would be nice if our powers that be stopped long enough to identify the problems of sewage discharges,

urban runoff and where all the liquid effluent being dumped on the land will end up in our marine environment.

When these politicians recognise this, it will do New Zealand a lot of good if they realised the value to us all of having access to healthy seafood at an affordable price. Take mussels for an example. With the retail price of this affordable product, most folk now get their feed of mussels from the supermarket when required and don't have to walk the rocks.

While the aquaculture and seafood industry is totally committed to supplying a quality seafood product, it is imperative that our waterways and marine environment remain the pristine habitat we always promote.

Failure to do this will see us in a very short time following the example of our northern hemisphere counterparts, where much of their shellfish has to go through a de-purification process before it can be exported. The writing is on the wall.

A Kaikoura koura farmer raises a further example in this issue, where this venture, and many like it, may be stopped from reaching its potential because we accept that it is acceptable to mess our own nest. It would seem that the power of the corporate dollar seems to silence the vocal environmental accord when needs must. If this is the case, it would appear that we can no longer rely on the independence of our self-appointed watch dogs to look after the public's best interests in marine environmental issues. We therefore must accept that our own professionals are far better able to judge what's right or wrong and when to raise the alarm.

The aquaculture industry itself must take the responsibility to those who make the rules that will ultimately affect what we do downstream. All too often we are being targeted as the primary source of the problem, when in reality it is the authorities who make the rules and give the approvals to others to mess in our nest. It's about time we all questioned their rights to do this.

As we go to print, we are advised that Environment Waikato is seeking a change to their existing aquaculture management areas to facilitate other forms of aquaculture from sea cages to kelp and seaweeds. To ensure public support from the boating community, it is essential that the existing AMA use and any future changes will not impede public access to "safe haven" anchorages, night or day.



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BILL MAY PROVIDE CERTAINTY TO INDUSTRY

National's Fisheries spokesman, Phil Heatley, says the member's bill he introduced on September 1 will improve the legislative framework for the aquaculture industry.

The Resource Management (Aquaculture) Amendment Bill would allow aquaculture research to occur outside aquaculture management areas as a discretionary activity, as long as the research is confined to less than two hectares and is in association with a recognised research programme.

"It would ensure certainty for investors, encouragement for ongoing research and incentives so that the industry reaches its potential," Heatley said.

Not a single aquaculture management area had been created in the last 18 months, and regional councils, who had had high hopes for the legislation, no longer had the incentive or direction to set up AMAs.

"Marine farmers can undertake a private plan change, but the bureaucracy and costs are insurmountable, with any positive result only coming many years down the track," Heatley said.

AQUACULTURE CENTRE ON HOLD

A \$2 million application for an aquaculture excellence centre in Marlborough has failed to materialise, despite a positive shift in the government's attitude towards aquaculture.

It would be some time before the centre materialised, if at all, as the government was currently reviewing all its funding programmes, Tony Smale, the chief executive of the Marlborough Regional Development Trust, said on August 14. The region would not be eligible for funds from the regional initiative fund until March, he said.

Marlborough had benefited from the

government's RIF fund twice before, with \$1.8 million each being allocated to establish aviation and wine centres of excellence. It was frustrating that the application for an aquaculture excellence centre had to be put on the back burner for now. The centre would become a focus for aquaculture research, education and training, and the exchange of ideas and networking.

GOVERNMENT PAYS UP TO KILL SEA SQUIRTS

The Minister of Biosecurity, Jim Anderton, is to divert \$150,000 of his department's budget to kill colonies of *Didemnum vexillum*, a native sea squirt which mussel farms in the Marlborough Sounds see as a threat.

The chief executive of the Seafood Industry Council, Owen Symmans, said the mussel industry was pleased with the funding, as the *Didemnum vexillum* threat was real and serious for marine farming in New Zealand.

Graeme Coates, the chairman of the Marine Farming Association, said a dozen affected sites had received an initial clean-up, where infected structures or vessels had either been removed or wrapped in plastic.

Initial results looked promising, he said, but locals would have to ensure boat hulls were free of fouling and painted with anti-foul to prevent the organism from spreading.

EXPERTS ADVISE ON VIRUS OUTBREAK

International experts were to investigate an outbreak of gaglioneuritis virus among abalone in Victoria, Australia late in September.

Fisheries Victoria, introduced controls in August to reduce the chance of the disease spreading around Port Fairy, and the Tasmanian government had also introduced restrictions on operations in some Tasmanian waters. Two Victorian abalone farms closed as

a result of the outbreak.

Southern Ocean Mariculture, which had to destock, is trialing a 30kg batch of animals using water pumped from the Southern Ocean. The farm says it will lose about A\$10 million over three years as a consequence of destocking.

The virus first appeared in southwestern abalone farms, and then on animals in reefs near Port Fairy.

FISHMEAL PRICES SOAR

Fishmeal prices have exploded from US\$600 per tonne to \$1500 per tonne, as Australian aquacultural scientists say they predicated a decade ago.

Kevin Williams, an Australian aquaculture nutritionist, told a meeting of feed experts in August in Thailand that the finite limit to the availability of feed material sourced from wildstock fish meal was reached more than 10 years ago. Australian scientists had been working on alternatives since then, he said.

The meeting noted that most farmers needed information on how to make best use of the available ingredients. Scientists at the meeting provided information on combining materials, pellet production and minimising waste during stock feeding.

It is hoped that the meeting will result in the development of a three-day programme that can be delivered to people in many Asian regions.

OYSTER GRADER WORKS FAST

An Adelaide industrial designer, Peter Johannsen, has developed an oyster grader which uses lasers and cameras to make accurate assessments.

Oysters can be graded according to their length, width, thickness and volume at the rate of 3.5 per second. The device can actually grade eight oysters per second at 98 percent accuracy.

Johannsen says he has sold more than 30 machines at A\$50,000 each, but needs capital to build a next-generation machine.

FOUL ORGANISMS MAY BE PUT TO GOOD USE

Sponges, seaweeds, sea squirts and other organisms that foul mussel farms may have a use after all, as bio-active products. The National Institute for Water and Atmospheric Research said it found 85 species growing on eight mussel farms in Pelorus Sound.

Seaweeds showed the most promise for product development, being abundant and relatively easy to collect. Products derived

MARINE FARM FOR JACKSON BAY

The Ministry of Fisheries has confirmed its preliminary decision to approve the first major marine farm development on the West Coast of the South Island. The 45.5ha farm is located about one kilometre offshore in Jackson Bay, south of Haast.

The decision to grant preliminary approval for the farm was announced on June 1, and the public had an opportunity to present submissions to MFish before a final decision was made.

MFish received two submissions, one from Jackson Bay Mussels Ltd supporting their application and the other from Runganga O Makaawhio, stating their interest in ensuring the farm would not affect the mussel beds at Neils Beach that are used by the runanga, said MFish's aquaculture manager, Dan Lees.

"These submissions were considered carefully, along with all earlier information received by the ministry, before the final decision was made," said Lees. "We believe the farm will not unduly affect the fishing in the area, or the marine environment and protected species in the area."

from seaweed include anti-inflammatory creams, flavour-enhancing salts, and extracts to reduce cholesterol, lower blood pressure and boost the body's immune system.

TINY METER MONITORS SPAT HEALTH

Two New Zealand organisations have developed a simple way to identify undernourished spat in the field as an alternative to complex laboratory tests.

Carina Sim-Smith, a scientist with the National Institute for Water and Atmospheric Research, is field-testing a small, battery-powered blood-glucose metre used by diabetics to determine the nutritional condition of mussel spat. The research was undertaken with Sealord Shellfish Ltd.

Previous research has shown that poor nutrition is a major cause of losses of wild-caught mussel spat from mussel ropes. Mussel farmers report that losses of 70 percent are common.

"We can test the spat in the field with the meter in just 15 minutes, reliably differentiating between well-fed spat and those that have been poorly fed for as little as four days.

"This technology will allow us to reduce financial losses associated with harvesting and re-seeding poor quality spat," said Lance Searle, science and research manager of the Sealord Group.

FATTY FISH MAY CUT KIDNEY CANCER RISK

Swedish women who eat fatty fish such as salmon, mackerel and herring at least once a week have a significantly lower risk of kidney cancer compared with consumers of lean fish, says a new study.

The 15-year study found that those who regularly eat fish containing lots of fish oil rich in omega-3 acids and vitamin D had a 74 percent lower risk of getting kidney cancer compared with those who ate no fish at all. Lean varieties such as tuna, cod and fresh-water fish did not confer the same benefit.

Compared with lean fish, fatty fish have up to 30 times the amount of certain acids and up to five times the amount of vitamin D. The fatty acids have been reported to slow

SEA LICE TRAVEL MILES TO INFECT SALMON

Sea lice, the most harmful parasite in salmon farming, can travel up to 50km to infect a host, according to research at the University of Auckland.

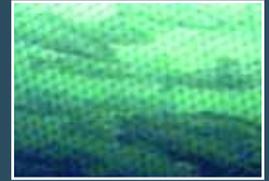
A paper published in September in Trends in Parasitology found that as few as five lice may result in the death of a salmonid (ie salmon, trout and char). The paper concluded that sea lice on salmon disperse over distances of 20km to 50km.

Sea lice skin parasites are the most harmful parasite in salmon farming, causing losses estimated at €170 to €270 million per year globally. The abundance of salmon in farms in coastal waters has increased the number of available hosts, and epidemics have occurred in farmed and wild fish in Ireland, Scotland, Norway and British Columbia, Canada.

"One of the most challenging research questions has been how lice find new hosts," says Dr Mark Costello of the university's Leigh Marine Laboratory. "Lice from farms may be infesting wild trout and salmon at fatal levels. As the growth and reproduction of both sea lice and their hosts are strongly temperature-dependent, sea temperature warming due to climate change is likely to upset natural balances, with consequences for fisheries, farms and coastal ecosystems. Patterns of infestation on wild hosts suggest that lice may already be more harmful than previously appreciated."

Sea lice were needed to infect a host, and each louse could travel up to 50km in open water, Dr Costello said. Research had enabled better farm management practices to control sea lice, including avoidance of infestations, use of parasiticides and biological control using local cleaner-fish.

Further research may provide opportunities to breed more lice-resistant salmon and aid the natural host defences against sea lice.



development of cancer, and people with kidney cancer often have low levels of vitamin D. The report was published in the September 20 issue of the Journal of the American Medical Association.

Another study published by the American Institute for Cancer Research found that nut and seed oils were no substitute for fish omega-3 fats. Omega-3 fats, the "good fat" found in fish, are turning out to be more complex than some may have expected. They may help protect people from heart disease, dementia and inflammation that can lead to rheumatoid arthritis, diabetes and cancer. Researchers are now finding that differences in the benefits seen in studies may reflect differences between omega-3 fats, as well as their interaction with other fats.

TROUT DELIBERATELY KILLED

Intruders who broke into a hatchery in the Adelaide Hills on August 8 deliberately killed

about 250,000 rainbow and brown trout. The fish at the South Australian Fly Fishing Association's hatchery in Millsbrook died when the pumps were turned off and the tanks drained. They also caused more than A\$25,000 of damage.

Many organisations are believed to oppose the release of trout into Australian waterways, on the basis that they are an introduced species which preys on native marine life.

EELS GIVEN A LIFT

Simple crane or winch-powered lifts at New Zealand dams are helping juvenile eels progress upstream from the sea to the creek beds where they hatched. The National Institute for Water and Atmospheric Research, which has monitored these operations, says it transferred 4.4 million elvers at 12 dams around New Zealand in 2005-06. About 920,000 were longfins, the largest number ever recorded, and the first increase since accurate records began 10 years ago.



KAIKOURA KOURA FARM

in conflict with Fonterra

BY VINCE SCULLY

Power has always required access to water, and I mean pristine water, and this is more significant now than ever before. Concerns of the impact of the dairy industry degrading water quality in streams and groundwater throughout Canterbury prompted Environment Canterbury to post large advertisements in The Press to create awareness.

To some this is just the greenies going on again and they don't take in the significance of the issue. But what if the issue was put like this: clean, green prosperity – pollution poverty! It means you can't grow high value, renewable, sustainable crops that are in harmony with the environment, because someone else is getting away with being selfish, and spoiling it for other end users, both now and in the future.

My wife and I are growing freshwater crayfish, or koura, in Kaikoura. Our farm has suddenly come under threat from Fonterra's proposed remedy to complaints from discharging its nearby cheese factory waste into the ocean by a crude outfall. Instead, Fonterra will irrigate it with almost 20 percent of the volume of water that the town uses, over land and into groundwater, and hence degrade it, and onto our farm, with an adverse and unknown effect on the health of our extremely sensitive koura. We would prefer Fonterra to discharge

their waste into the town's settling ponds.

Before we started farming we looked at two established koura farms, whose owners gave us helpful advice, but we have still made mistakes and are only surmising what we have done wrong. To stop us from having to reinvent the wheel, we decided to investigate an advanced industry where the mistakes have already been made - freshwater crayfish called marron in Western Australia.

Thanks to a week of heavy rain in Western Australia, our plan of approaching growers for an hour of their time worked. It was the best thing we could have done. The first grower we met we now consult with, as he had the experience, the scientific base and a top harvest of three tonnes per hectare to verify what he said.

"Yes, I will be happy to consult with you," he said, "But you have to do exactly as I say, otherwise it won't work. I have been learning lots of different ways to kill marron over the last 18 years."

He and others with a science base and the practical experience have written procedures for someone who is interested in farming a species that is sensitive to all kinds of things. I refer to a guidebook for another Australian freshwater crayfish, *The Australian Yabby Farmer*, by John Mosig. There is nothing in that enlightening 200 pages that is beyond a studious 16-year-old.

Another farmer we spoke to in the rain described himself as a retired plumber who got absorbed, as we have, in being a crayfish farmer. With four years experience he said he was improving his harvest each year, and this year was expecting two tonnes/ha. We came away feeling that if we followed procedures and eliminated predators completely, in our case eels, cormorants and dragonfly nymphs, we would be on our way to becoming koura farmers.

Interestingly, the industry-standard 25m by 40m ponds we saw were built around having an emergency response plan. They were designed around the advantages and disadvantages of the most efficient and most economical aerators: the paddle wheel. Mosig states the same commandment for crayfish farmers over and over: "If in doubt, aerate."

Water health was managed with aeration by paddlewheel and not by waterflow, as we were. I was intrigued by that, and that marron farmers could then grow something separate to marron.

They were building and monitoring an aquatic food chain for the marron to eat, with the addition of manure and fertiliser supplements.

I likened it to the world-class trout fishing at Deans Bank, near the outlet of Lake Wanaka, where flooding does not destroy the food in the river which the trout eat because the

Cheese factory wastage will degrade the natural ground water



flooding is absorbed, with the lake rising and buffering the flood threat.

Interestingly, the nearby Cardrona River, which is also susceptible to flooding, has little trout life. I was going to give this concept a go, and by monitoring the building food chain with the reduction in visibility with a ski pole converted to a depth gauge or sechi disk. Mosig's advice on this was, "If in doubt, aerate."

The marron were fed protein supplements as well, as we were doing, and for which I had started a worm farm. The problem was that protein not eaten decayed in the nitrogen cycle to toxic ammonia. That is: overfeeding is fatal, and underfeeding isn't going to grow the equivalent of the big fish that could once be caught near the discharges of the meatworks into Wellington Harbour.

To resolve this, Western Australia government fisheries provided the growers with tables on feeding ratios dependent on water temperature. The paddle wheel offered subtle signs too, such as uneaten feed washed to the surface, and I was warned to watch for the first en masse moult in spring with rising temperatures when crayfish don't eat.

We also received strong advice to read and understand the management of water quality. Pristine water is paramount to our industry.

I came home to New Zealand disappointed. I walked under a bright, government-sponsored banner in the immigration halls, prompting visitors before they even arrived that if they were interested in residing here, to go to a website.

Here was the government effectively poaching people to build a skills base to better New Zealand, and here was I, an unqualified grower, going overseas on my own funds to further a primary industry that is worth \$100,000 per hectare of water, and possibly \$200,000 per hectare in the future, in an industry billed in my aquaculture book as the growth industry in the next 30 years.

Or, in the words of the New Zealand Aquaculture Council: "to be on the same footing as the wine industry by 2025, and by 2030 to match the wild fisheries catch".

I see the potential of fresh water aquaculture as exciting. There are two developments in New Zealand research that we will learn to become proud of. Eels, for the first time in centuries, have been induced to spawn in captivity. If we can grow them from larvae to the elva stage, in captivity, we have a huge industry.

Secondly, a food-safe microchip means that for the first time crayfish, which because of their moulting process cannot be tagged, now effectively can, so that a genetically fast-growing strain can be developed.

We can now develop as agriculture, horticulture and viticulture have been doing for centuries. This, advises our Western Australian consultant, is the future of the industry. (The WA government fisheries has traced a genetic strain of faster-growing marron using the New Zealand microchip, and passed them over to the farmers.)

So here am I, one of a handful of passionate koura farmers growing a boutique product, oddly without any government assistance, and possibly to be affected by the degradation of ground water which the government is allowing to happen.



I say to the government that the future prosperity of this country is assisted not only by poaching screened visitors, but also by supporting and protecting our valuable fledging industry. Please, make discharges of effluent everywhere go through settling ponds - as they do in other first world countries - and stop allowing pristine groundwater to become a toilet. Our environment, health and prosperity depend on it.

Vince Scully is a master mariner and the author of Poles Apart with Northanger. Vince and his wife, Mary Shanahan, have taken over the dream of the late deep-sea diver Peter Johnson to develop Kaikoura's first koura farm. It is expected to be two years before the farm is in full production.



STRATEGIES, POLICIES and the law



BY
JUSTINE
INNS

The launch by the New Zealand aquaculture industry of its Aquaculture Strategy marked a shift away from the past few years, fixation on the legal regime for aquaculture to an emphasis on the policy environment within which the sector operates. However unsatisfactory the legal regime might be, it seems that it will be with us for the foreseeable future. Rather than a further beating of heads against that particular brick wall, the industry strategy seems to herald an era of just getting on with it.

Above all, the strategy emphasises the need for the industry to be more involved in aquaculture planning through the Resource Management Act. In particular, a key priority will be to “work with, and assist councils to identify areas for and establish environmentally sustainable new aquaculture management areas, or AMAs.”

Local body planning through the Local Government Act has also been flagged as important. The LGA provides the framework for developing long-term council community plans and annual plans. These outline activities to be undertaken by councils, and how those activities will be funded. Given the likelihood that councils will continue to seek to generate revenue from aquaculture activities, whether through rating, coastal occupation charges or increasing resource consent fees, LGA planning processes will require attention from the industry.

Another suite of activities covered by the strategy relate to increasing certainty of tenure for existing marine farmers, including identifying and promoting successful examples of ways councils have dealt with consent renewals.

Another innovative idea is to explore an “evergreen contracts” model, whereby consents might be renewed part way through their term, so that incumbents always have a “buffer” of a number of years of guaranteed tenure ahead of them.

The need to look at the “bankability” of marine farming consents is also highlighted. A common complaint of smaller marine farmers, in particular, is that banks won't accept marine farming consents as security for business loans, with the result that the family home often ends up being mortgaged to fund the business.

The problem lies in section 122 of the RMA, which provides that resource consents are not “real or personal property”, and that coastal permits do not give the holder “the same rights in relation to the use and occupation of the area (to which it relates), as if he or she were a tenant or licensee”.

There are some exceptions to those general rules, but the impression clearly remains that resource consents, particularly coastal permits, are inferior to leases, licences and other forms of bankable property right.

The strategy does not ignore the fact that the aquaculture

reforms left much to be desired. It flags the need to “work with the government to continually monitor and improve the aquaculture regulatory regime”. Implicit is a recognition that another major overhaul of the legal framework is unlikely in the foreseeable future and that any further improvements will have to be incremental.

Frameworks for experimental/educational aquaculture and for freshwater/land-based aquaculture are highlighted as requiring further work. There is little doubt that the post-reform framework presents huge hurdles to experimental aquaculture activities, due to the practical difficulty of demonstrating the environmental effects that will result from an activity that has never been undertaken before. “Tweaking” of the framework to provide greater flexibility in this respect would be a real boon to the whole industry.

GOVERNMENT RESPONSE

The ministerial response to the strategy has been positive. The government has accepted the invitation to develop a national statement or policy, “that looks to maximise the value we get from aquaculture”, and that states that “aquaculture is a legitimate and valued use of our coastal space,” the Hon Jim Anderton said on July 27.

This is not, however, to be the “national policy statement” provided for under the RMA. Such policy statements are prepared through a formal, public process and are binding on local authorities. The national policy on aquaculture is intended to be a more political statement, recording the government's commitment to the future of the industry, rather than having any formal, legal effect. At the same time, it has been mooted that the New Zealand Coastal Policy Statement - a key RMA document that is binding on councils - could include guidance for councils on aquaculture development.

In launching the industry strategy, the Minister of Economic Development, Hon Trevor Mallard, chose to emphasise the need for industry improvement: “Rather than undertaking business-as-usual activities on a greater scale, the growth of the industry will come through better use of existing space... the development of new value-added products and the diversification into new markets.”

While few would disagree with this sentiment, development will be limited, and the reforms will ultimately fail, if there is not also access to new aquaculture space.



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

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LEARNING CURVE at conference

BY DAVID COOPER, MAHURANGI TECHNICAL INSTITUTE

On August 23, a mob of happy aquaculturalists from the Mahurangi Technical Institute consisting of myself, Adrian Paarman, Kim Pierce and Garth Foote, jetted in to Adelaide to attend the Skretting Australasia Aquaculture conference and trade show.

During a brief stopover at Sydney we visited Majestic Aquariums, where the owner, Paul Talbot, kindly collected us from the airport. We were pleasantly surprised by the high quality and variety of livestock, and in particular the range and sheer number of yabbies on sale for aquarium use. New Zealand koura farmers take note!

Talbot has a very successful series of DVDs on the market relating to aquaria, and is currently filming a television series on aquaria and aquarists. A more "fish crazy" person would be hard to find!

After the obligatory wine tour of the Barossa Valley it was down to business. August 25 and 26 were taken up in attending the aquaculture recirculation technology short course at the University of South Australia, which was delivered by Dr Thomas Losordo and Dennis DeLong, both from the North Carolina State University. This workshop was presented by the Inland Aquaculture Association of South

PHOTOS: ADRIAN PAARMAN AND KIM PIERCE



FROM LEFT: Adrian Paarman, David Cooper and Kim Pierce at the conference

Australia. See www.iaasa.org.au

We had two days of intense and technical learning about all aspects of recirculating aquaculture systems, or RAD, from components to economics.

The excellent presentation was supplemented by complete notes and a CD with all sorts of helpful tools, including spreadsheets for working out the "mass balance", a particular crowd favourite!



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SECURING OUR FUTURE – educating the nation

BY DR ANDREW MORGAN

Securing our marine farming future involves investing in an integrated strategy incorporating all end users in the maritime sector. Although the maritime industry abounds with many goings on, it seems at times that many different groups of people, both large and small, often keep to themselves. The following article discusses marine farming as part of the wider issues facing the maritime sector.

Our exclusive economic zone has huge potential in terms of primary, value-added and energy production and mineral extraction. Furthermore, areas such as medicine, exploration and marine protection industries such as the Navy, customs and fisheries could be increasingly integrated in exploiting our EEZ. All this has flow-on effects across the entire maritime sector, including marine farming. As technology progresses, these resources will become more accessible. The opportunities for revenue and employment are enormous.

Jobs “up the food chain” cannot exist without a flourishing industry of primary producers with a guaranteed future. How can the industry possibly attract or employ quality people in a knowledge-based economy and invest in its future development when they are limited by short-term contracts, questionable remuneration, limited research and development funding on a renewable basis and little job security. As a united maritime sector there is a need to start investing more in our people.

A glut in highly skilled labour across a number of maritime industries also exists. Is it training, recruitment or a lack of awareness by people looking for work? Or is it pay parity, lifestyle, a lack of opportunities or a lack of job satisfaction.

Creating a diverse job environment comes from expansion and integration of an at-times disparate maritime sector.

A fine example is the proposal put forward for controlling bottom trawling in the fishing industry. The benefits of education self-management and taking responsibility by investing in an educated technology-based industry are evident. Public awareness of long-term sustainability is exemplified, and its wider implications for employment, lifestyle and job security are valued.

It is the public that effects change and a significant investment in human resources. This change comes through developing an awareness of opportunity for everyone in a wider socio-economic context. This is achieved by educating everyone at all levels, at all ages and in all industries, including defence and educational centres, about the opportunities that exist through changing attitudes about investing in and exploiting our maritime environment.

Eco-tourism provides a powerful link between people in the maritime industry and those who move through it, the public. From whale watching to fishing in marine farms, aquarium displays and education centres, this area in particular could further extol the value of marine farming in a wider context.

Issues such as the protection of whales, dolphins, penguins, bird life and seafloor habitat are prominent. Marine farming, like other industries, overlaps these areas, and a considerable amount of effort at a huge cost has gone into addressing this.

This is something that needs to be imparted to the public through teaching and education. How many people on the street, the voters, really know what goes into an assessment of environmental effects and the outcomes implemented from it.

Teaching and educational institutes and research and development centres are moving towards sharing more with the public to promote greater awareness of the marine environment, maritime industries and the work being carried out.

What may be lacking is an integrated view of the wider maritime picture. An integrated strategy at a national level across the maritime sector may change public perceptions.

Fundamental to this is educating the nation about the enormous opportunity there is at our doorstep, given our extensive coastline and EEZ relative to our land mass. New Zealand is a maritime nation, and marine farming is a significant part of that.

The Marine Education Centre at Portobello Marine Laboratory, Otago University



Farming is the only chance for **EUROPEAN EELS**

Dioxin-like contaminants are having a devastating effect on European eel embryos, according to a report in the May issue of *Fish Farming International*.

Arjan Palstra, a scientist at the University of Leiden in The Netherlands, says the only answer is to develop a complete cycle of eel-farming techniques.

When Palstra and his team examined deformed embryonic eggs from eels spawned at the university, they discovered that dioxin-like contaminants had a drastic effect on the development and survival of the embryos.

The European eel, *Anguilla anguilla*, is found virtually everywhere around inland Europe and along the Mediterranean coasts of Europe and Africa, and most eel farming takes place in The Netherlands and Denmark. Eels can live for 20 years or more.

Farmers in Europe and Asia buy wild-caught young eels called glass eels and grow them to maturity, and they are also popular with consumers, so demand is extremely high. But the number of glass eels caught in Europe has declined dramatically from the 1980s by 99 percent, and overfishing is the suspected cause.

The International Council for the Exploration of the Sea says there is no single cause for the crash. Over-exploitation, inland habitat loss, changes in the climate and ocean currents, disease and pollution are all suspected.

But around 2002, researchers began to suspect that contaminants were the most likely cause. Eels do not feed during their 5000km to 6000km journey from Europe to their spawning grounds, thought to be the Sargasso Sea, south of Bermuda, and live on their stored body fat. Internal concentrations of lipophilic pollutants rise with fat consumption, thus increasing the chance for toxic effects.

Almost all long-lived fish contain dioxin, and eels often spend most of their life in rivers and streams contaminated with high levels of polychlorinated biphenyls, or PCBs, and other residues that have an adverse affect on fertility.

Because nobody knows where eels spawn or lay their eggs, until recently it was impossible to examine their eggs or newly hatched eel larvae to determine if there was any contamination.

Palstra and his team caught 25 female and 50 male silver eels in the wild during the eels' seaward migration. After killing 12 females as controls, the remaining females were injected weekly with carp pituitary extract and not fed during the experiment.

They discovered that they could induce ovulation in the female eels by injecting a special solution, after which their eggs were stripped by hand. The males were injected weekly



with human chorionic gonadotropin for at least seven weeks, and their sperm used to fertilise the eggs.

According to Palstra, embryonic malformations observed in the study were typical for eggs exposed to PCB. Dioxin-like compounds were determined in

These New Zealand eels don't suffer the European problem. An opportunity awaits

the eel eggs using a reporter gene assay.

"Our study suggests that current gonadal levels of dioxin-like contaminants, including PCBs, in eels from most European locations impair normal embryonic development," said Palstra.

"The conclusion is further strengthened by the fact that the emission of PCBs in the environment coincides with the decline of eel populations. Therefore, we consider it likely that dioxin-like PCBs contributed to the current collapse of European eel populations."

Although PCBs are now banned in Europe and levels are falling, there is strong speculation that it may be too late for the European eel. Palstra says that only eels from less industrialised areas may still be capable of reproducing. "We think the only answer is farming."



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VIABILITY TESTING for mussel spat

BY STEVE WEBB AND KEVIN HEASMAN, CAWTHRON INSTITUTE

A quick and simple test indicates whether mussel spat are fit or weak. The test can give forewarning to allow remedial action and reversal of decline in spat condition.

Mussel spat are not cheap, yet the industry currently tolerates significant losses where only a few percent of spat seeded onto grow-out ropes remain at harvest. Clearly, any improvement in retention would be a worthwhile goal, and monitoring spat health is a good first step in that direction.

Wild spat can have a rough time - after washing ashore on seaweed, they need prompt collection, otherwise overheating and desiccation can take their toll.

On top of this, the journey to the grow-out site can stretch from a few hours to a day or more. Again, temperature and humidity may deviate from the optimum. Stress and consequent mortalities can be minimised by appropriate handling of the spat, and a test of fitness can help identify critical points in the process. Such a test needs to be quick, easy and inexpensive.

This test exploits a reflex of marine bivalves to seal themselves off from fresh water - if they don't, they die. Healthy spat are good at sealing, but dead spat don't seal at all, and spat

between these extremes have shown intermediate ability.

Movement of water into spat is difficult to track, but it becomes obvious if there is stain in the water. Not just any stain will do - it must be of low toxicity to the mussels (and the user), and must also effectively stain any exposed tissues.

Several stains were evaluated before Fast Green was selected. See Webb & Heasman [Aquaculture Vol. 252, pp305-316, 2006] for details of the test.

OTHER HEALTH CRITERIA

To be sure that staining actually indicated ill health, we compared staining results with spat activity that is a more fundamental indicator of health. Activities of healthy spat in seawater include extension and movement of the mantle, beating of cilia or heart, movement of the foot and shell valves, and normal orientation of the shell with the hinge plane being held vertically.

Experiments showed that highly active spat groups had few stainers (spat that take up the dye), whereas inactive spat had many stainers and intermediate groups stained pro rata.

Activity, in turn, varied with the prior treatment of the spat. Spat exposed to increasingly hostile conditions such as



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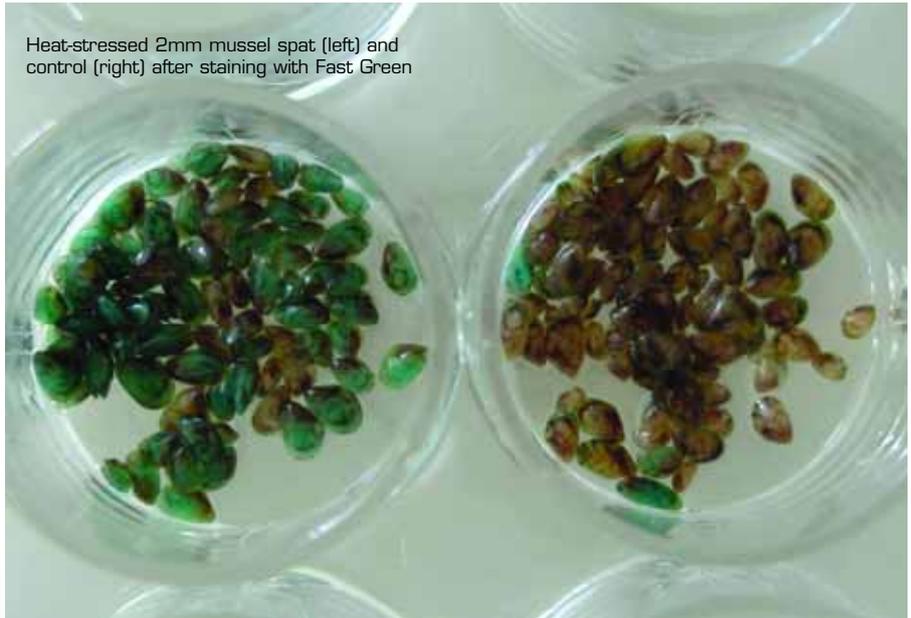
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Cawthron mollusc physiologist Dr Norman Ragg uses the stain test to assess the toxicity of ammonia to mussel spat



Heat-stressed 2mm mussel spat (left) and control (right) after staining with Fast Green

desiccation, poor quality water and noxious chemicals showed a proportionate decrease in activity that corresponded closely with an increase in staining.

Furthermore, staining and activity levels in a range of spat samples from controls to lethal exposures showed a significant relationship where one parameter was mirrored by the other. Thus, staining can be taken as a good surrogate for activity and, therefore, as an indicator of health.

Why not assess activity directly? Stain testing saves much time and effort. Spat sometimes require extended observation under the microscope to detect activity. This is time-consuming, especially when each of a sample of 50 spat require scrutiny until a decision can be made. With the Fast Green test, all you have to do is count the stained spat. Outcomes using the stain test are quicker and much more clearly defined.

TEST SIGNS

A range of spat conditions caused by exposure to air (emersion), ethanol and nutrient-loaded (hypoxic) water were detectable with normal health, sub-lethal and lethal conditions being statistically distinguishable.

Although staining increased significantly with more severe exposure to these agents, spat tested after return to normal seawater showed significant recovery (ie a lowering of staining proportions). The test thus gave warning while the spat condition was reversible - minimal mortalities during the test period confirmed this.

FURTHER DEVELOPMENTS

Although the validity of the test in laboratory and hatchery trials has been established, its usefulness during commercial transport remains to be confirmed. Once the test has been proved as informative, an on-site spat grading service will be made available to mussel farmers in the form of self-contained test kits for them to test spat as required.

Quality-based pricing of spat is possible. The spat fitness test can be used to optimise handling throughout the supply chain, thus extending the spat resource.

The stain test has also revealed a relationship between the

pre-seeding fitness level of spat and the proportion of spat remaining on ropes 48 hours after seeding. Further development is needed, but this relationship is being explored with the intention of producing a practical means of predicting spat retention on seeded ropes. Predictable retention rates will allow more accurate estimation of required spat seeding number, with savings in spat and labour.





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KOI CARP IN NZ - A NOXIOUS PEST

THE JULY/AUGUST ISSUE of *New Zealand Aquaculture* featured the article *Koi Ponds and Algae Don't Mix*. We also outlined some of the topics covered in a seminar for koi enthusiasts that took place in June in the North American state of Georgia. Note that this seminar was in the United States.

In a letter to the magazine from the Department of Conservation, the chief technical officer - conservation, Geoff Hicks, points out that koi carp, or *Cyprinus carpio*, are one of New Zealand's least desirable species. It was declared a noxious fish in 1983 and an unwanted organism in 1993.

The articles had caused significant concern, as the species was not at all desirable in waterways, said Hicks. "We have expended significant effort in educating the public with regard to the risk that this species poses to our freshwater environment."

Koi root up vegetation and stir up sediment when they feed. This makes the water murky, and increases nutrient levels and algal concentrations. Their feeding pattern also contributes to bank erosion in at-risk areas. They are opportunistic omnivores, preying on invertebrates, native fish and aquatic plants, he said.

Female koi lay up to 1.5 million eggs at a time, and since they were accidentally released into the wild in the 1960s they have caused significant detrimental impact on the environment, as they rapidly colonise new areas and expand their range.

They are nearly impossible to eradicate from bigger river systems and interconnected waterways, and DoC is continuing to eradicate koi carp from private ponds.

"The department has successfully eradicated all known koi

carp populations in the South Island, and hopes to maintain this area free of this pest."

It is illegal to possess, rear, raise or consign koi carp without the authorisation of the director-general of the Department of Conservation. It is also illegal to knowingly communicate (including transferring or moving), breed, sell or exhibit carp with an exemption from the chief technical officer - conservation. Penalties for persons convicted of these activities include fines of up to \$100,000 and/or five years' imprisonment for individuals, and much higher penalties for corporations. The prohibitions also include advertising or endorsements that could result in this illegal activity.

"I realise that the article is likely to have been sourced via an American syndication network and that its contents may be appropriate in its country of origin," says Hicks. "It is, however, not appropriate to promote koi carp as a desirable pond species in New Zealand." See www.doc.govt.nz



NOTE: We acknowledge that the article was based on American information, and are mindful that koi carp have established themselves within certain New Zealand waterways. So much so, that the only way to manage these invaders is to create a means of sustainable utilisation of this unwanted resource.

Clearly, DoC does not have the means or the resources to eradicate this pest. Therefore, the logical answer would be to encourage business initiatives that will harvest and control its future spread. ...Ed

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LINK FOUND BETWEEN FISH AND MAMMAL IMMUNE SYSTEMS

RESEARCHERS HAVE FOUND that a primitive version of B cells, the white blood cells of the immune system, known as killer B cells, are an evolutionary link between the immune systems of fish and mammals.

The researchers from the University of Pennsylvania School of Veterinary Medicine found that the study linked the evolution of the adaptive immune system in mammals to the more primitive innate immunity in fish. The finding, published in the October online version of *Nature Immunology*, represent a sizeable evolutionary step for the mammalian immune system, and offer a potential new strategy for developing fish vaccines.

"When examining fish B cells we see them actively attacking and eating foreign bodies, which is a behaviour that, according to the current dogma, just shouldn't happen in B cells," said Professor J Oriol Sunyer, of Penn Vet's Department of Pathobiology.

"I believe it is evidence for a very real connection between the most primitive forms of immunological defence which has survived in fish, and the more advanced, adaptive immune response seen in humans and other mammals."

Their findings also have an agricultural implication. The current vaccines given to farmed salmon, for example, appeal to the fish's adaptive immune response, which this research has now shown to be a smaller part of the overall fish immune system than previously thought.

Vaccines that encouraged phagocytic B cell to respond to

infection would play to the strengths of fish immunity, Sunyer said. "In the long term, farming is a better, more environmentally sound approach to fishing, so better vaccines may make the practice more financially attractive to fisherman and less destructive to fish populations.

"Here we have a clear picture of where one part of the immune system, primitive phagocytes, adapted over time to serve a more complex role as part of the immune system that humans enjoy today," Sunyer said.



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