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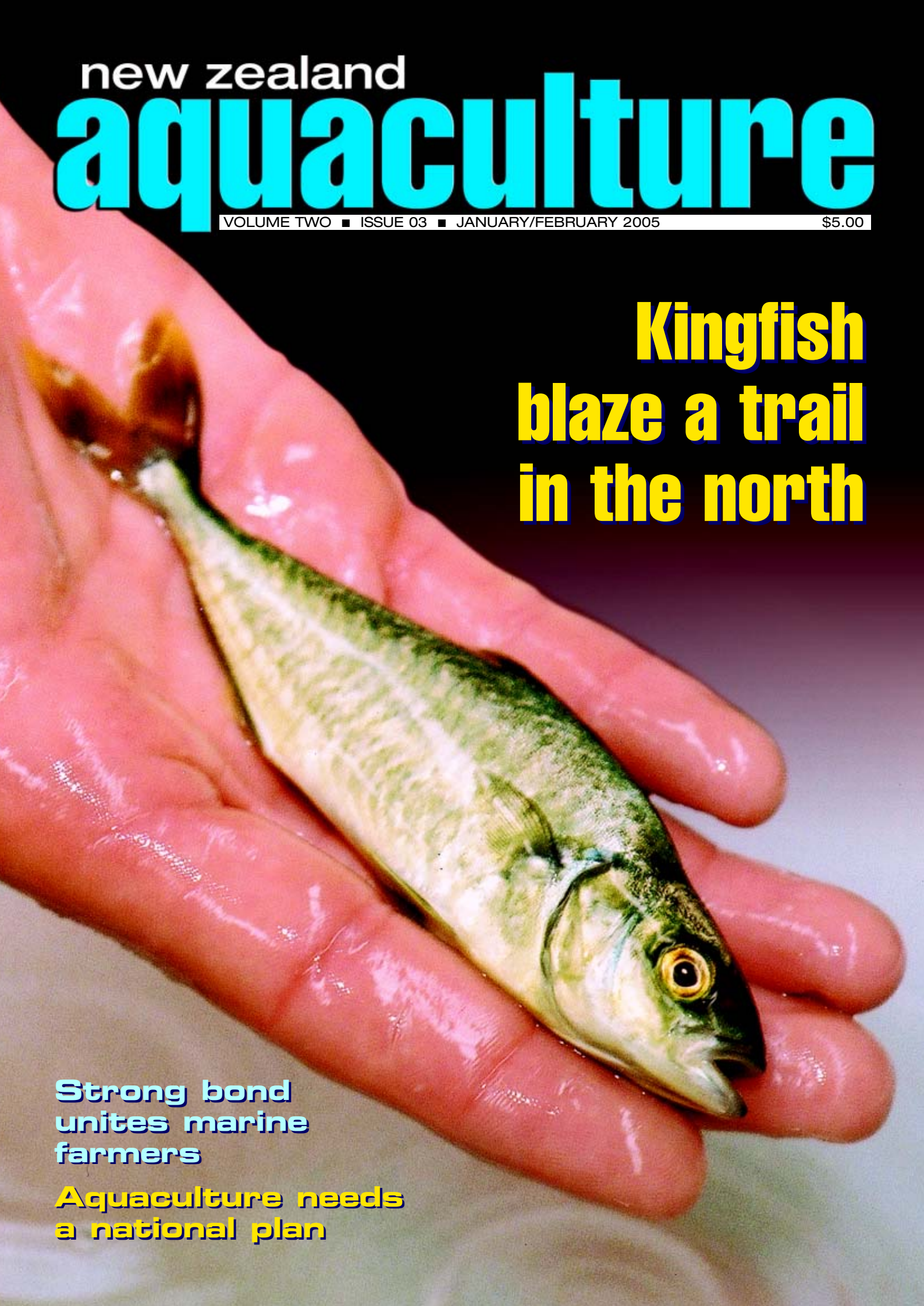

Kingfish blaze a trail in the north

Strong bond unites marine farmers

Aquaculture needs a national plan

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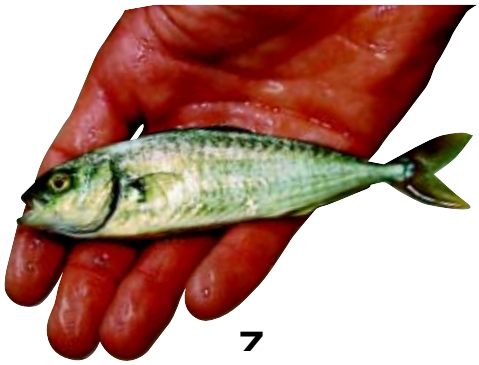

ON THE COVER:
Juvenile kingfish being raised at NIWA's Bream Bay facility, Northland
Photo by Alan Blacklock, NIWA

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BY KEITH INGRAM

REFORM BILL
is silent on key issues

Aquaculture industry leaders have been preoccupied with responding to the various segments contained within the Aquaculture Reform Bill.

In general, the bill redefines the interface between the Fisheries Act and the Resource Management Act 1991 so that regional councils will become the agencies that will consider all the environmental effects when providing for aquaculture in their regional coastal plans.

The bill gives regional councils greater power to manage the cumulative effects of aquaculture development, and they will be required to consider the effects of aquaculture on the use and sustainability of fisheries resources.

In future, aquaculture will be able to take place only in an aquaculture management area, (AMA), and it will be a prohibited activity outside of these areas.

Under the new legislation, the Ministry of Fisheries will assess whether an AMA proposed by a regional council will have an undue adverse effect on customary, recreational or commercial fishing.

If it has such an effect on customary or recreational fishing, the affected areas will be removed from the AMA. However, in the case of commercial fishing, the bill provides an opportunity for marine farmers to reach an agreement with affected commercial fishers.

Marine farmers will no longer require a marine farming permit under the Fisheries Act 1982. They will simply be required to be registered as a fish farmer under the Fisheries Act 1996.

Sounds good, you might say. Unfortunately, the devil is in the detail. The bill is silent on ocean ranching and makes no provision or willingness for the Crown to pay compensation to disadvantaged parties or existing rights owners. This fiscal dishonesty goes deeper in the AMA, where future investors are being asked to fund the 20 percent allocation to Maori by deception.

One has to ask, what the hell is wrong with our government leaders, where the Crown is bent on making it as difficult as possible for the aquaculture industry in New Zealand to progress and prosper. The New Zealand Greenlip mussel is the only native species currently farmed in New Zealand, be it on land or at sea.

Our mussel is only found in New Zealand, and it has already proven to be a preferred mussel by consumers around the world. With a bit of forethought, this industry alone could produce over $2 billion annually. All it needs is a bit of vision from the policy makers, and government support.

Here we are, looking down the barrel of a huge and costly old-age burden which the government is struggling to budget for. On the other side, we have a mussel industry that could quadruple its production and exports in a decade. The government's return from this industry in its tax take alone could be $1 billion, which would go a long way towards funding elderly care and pensions.

Ocean ranching is another aspect which could be a boon to the aquaculture industry. With some sound management controls on returning salmon, the salmon farming industry could move into ocean ranching as an economical, cost-effective way of ongrowing the fish.

The ability to ranch open spaces would also be a boon for the paua industry. We have large tracts of rocky coastline bordered by sand which is a natural barrier for paua. Much of this coastline is in isolated, productive areas plagued by poachers. If the government were to consider issuing permits for ocean ranching of paua, these farmers could release small, penny-sized cultivated paua in earthenware pipes along the rocky foreshore to allow them to grow cost-effectively in their natural environment. Because these tagged paua are genetically recognisable, the farmer could harvest these at a marketable size of 100mm. Recreational fishers would still be able to fish for paua in these areas as long as the shellfish were at least the minimum legal size of 125mm.

The farmer would be responsible and have the authority to effect compliance in his permitted area. He would be able to check amateur landings from divers working within the farm as part of the public's right of access.

If a cultivated paua grew to 125mm it would then be available for anyone to harvest. This farm monitoring would have the added bonus of removing poachers from the area. Simple, huh!

We hope you enjoy this latest issue, and we look forward to your support in the future. May 2005 be a productive and profitable year to you all.

COURSES TAKE TO THE ROAD

Darcy Ranger describes the course that he has been operating for the last two years as "A skipper's course that comes anywhere for any number of participants."

He is able to run courses for local launch operator, inshore launchmaster, restricted radiotelephone operator, facilitate restricted radar operator courses and a number of Coastguard courses.

He has been running courses since 1973, first for Taranaki Polytechnic and, since moving in 1995 to Coromandel, for the New Plymouth Charter Boat Company, which he owns with his wife, Jocelyn.

The couple ran a fishing charter business in New Plymouth from 1975 to 1990, and have been a member of the Marine Transport Association since 1975. Darcy is currently a safety inspector and systems auditor for a safe ship management company.

Darcy and Jocelyn can be contacted by phone or fax on 07 866 8276 or email dranger@wave.co.nz

NEW COMMERCIAL APPOINTMENT

The Cawthron Institute has appointed Mark Jarvis (pictured right) to the new role of commercial manager. He was previously at Cambridge in the United Kingdom, where he had wide-ranging experience in the commercial side of the science and technology industries.

Most recently he was commercial manager for the large European contract research organisation HFL, which specialises in pharmaceutical drug development, doping control, environmental monitoring and nutraceuticals.

He has also worked for the United States company Kodak Scientific Imaging Systems, where he was in charge of European sales and marketing for their scientific products.

In his new role, Jarvis will be responsible for developing and maintaining relationships with commercial clients, developing a commercial portfolio and liasing with non-government sponsors and clients.

"I'm impressed by the scope of work Cawthron is doing, and much of it is ground-breaking," Jarvis says.

The Chief Executive Officer of Cawthron, Graeme Robertson, says the role illustrated Cawthron's commitment to its commercial partners. "It strengthens our ability to give them even better service."

GOVERNMENT MAKES A MESS OF AQUACULTURE

The fisheries spokesman for the National Party, Phil Heatley, has questioned why the government has taken so long over its aquaculture legislation, only to get it so wrong. "It has taken the government two moratoriums and three years to make a mess of it."

Labour's proposed marine farming legislation faced Select Committee scrutiny for the first time on October 5, and received a lambasting from every submitter, including the New Zealand Aquaculture Council.

The submitters had made it clear that the government had taken too long and got it so wrong, he said.

"Even existing marine farmers, who have been good tenants face no certain right of renewal. They may be pushed out of their space by a competitor, especially if that competitor is Maori.

"The legislation applies the same Resource Management Act restrictions to marine farming outside specific areas as it does to dumping radioactive waste at sea. Its bureaucratic approach does nothing to develop this industry's potential," he said.

According to Heatley, the Aquaculture Council told the Select Committee that, "the aquaculture industry has languished during the three-year duration of the current moratorium, and this is set to continue if the bill is passed in its present form."

LIVE LONG-FINNED EELS TO ASIA

Australian Aquaculture Products now exports around 120 tonnes of live fish each year to Asia, of which 60 percent is long-finned eel. The company has been exporting to Hong Kong and China for six years and is now exploring the Korean market.

There's been a move to Murray cod in recent years, too. The eels are grown out to between 2kg and 7kg over 18 months in 15,000 litre tanks.

The exports meet an Asian tradition that live fish be examined before they are bought. The long-finned eel is popular because of its spotted markings. AAP, which says it is now the biggest exporter of long-finned eels in Australia, attributes its success to focussing on meeting customer demands.

ANGER BUILDING OVER DREDGING

The aquaculture sector is joining other organisations and industry groups in voicing its opposition to the deepening of Port Phillip Bay's shipping channels.

It is believed that the project could cost hundreds of jobs in the region. More than 40 million tonnes of silt, sand and rock would be moved to allow larger ships into the bay.

The president of the Victorian Aquaculture Council, Steve Rodis, said sediment plumes could affect the region's 20 mussel farms and three abalone farms, which employ 140 people. An independent commission is now hearing submissions on the A$500 million project.

HIJIKI IS HIGH IN ARSENIC

An imported seaweed, hijiki, has been added to New Zealand's high-risk list of food after being found to have high levels of naturally occurring arsenic. However, the New Zealand Food Safety Authority says it is very unlikely that anyone consumes enough each day to be at any risk. Very little hijiki (also known as hiziki or MeHijiki (Hizikia fusiforme), about 300kg, is imported into New Zealand each year.

The distinctive, almost black, shredded seaweed is sold in the specialist food sections of some supermarkets and department stores and in health food shops and specialist shops selling Asian and Far Eastern food.

It is mainly used as an appetiser or starter in some Japanese restaurants, or sold for use in soups and salads and some vegetarian and vegan dishes where seaweed is an ingredient.

A director of the authority, Tim Knox, said that tests carried out on 10 hijiki products available in New Zealand showed that all had arsenic levels above those allowed by New Zealand Food Standards.

All shipments of hijiki must now be tested and shown to have acceptable levels of arsenic before it can be sold in New Zealand.

Contact Tim Knox, phone 04 463 26512 or 021 403 9907

BLAZING A TRAIL in kingfish

"The fishermen have landed the fish without getting their feet wet."

This image, evoking the fishing tradition of generations of Far North Maori, was ironically employed at the official opening of Parengarenga Fishfarm on November 26. The so-called winterless north laid on a blustery wind and biting rain for more than a hundred guests and locals, who sheltered in a marquee.

The farm is the largest land-based finfish farm in the southern hemisphere and is New Zealand's only land-based kingfish farm. It is located just south of Cape Reinga, on the east coast 22km north of Te Kao. The opening was the first and probably the last occasion for the public to look inside.

FROM LEFT: The director of the Parengarenga Fishfarm, Peter Bevin, in discussion with NIWA scientists Steve Pether and Ian Cameron

The manager of the Parengarenga Fishfarm, Garth Foote, shows the kingfish diet to a local police officer, Chris Yarnton

The students of Te Kao School greet guests as they approach the fish farm

The Far North Mayor, Yvonne Sharp, unveiled the commemoration stone to officially open the fish farm. "It is an exciting and sustainable venture, and I am confident it will bring immense benefits to the Far North," she said.

Kaitaia and the entire Far North had already benefited economically from the construction work required, and she predicted further "knock-on benefits" as the farm became fully stocked and production grew.

The chairman of the Parengarenga Incorporation, Winiata Brown, paid tribute to the foresight of elders whom he said wished to develop the land on which the farm is situated. He said the old people knew it could be two generations before their hard work bore fruit. "Now we can catch fish all year round," he said.

One of the aims of the farm was to diversify the assets of the Parengarenga Incorporation and to provide employment in the Far North. Those jobs, he said, were environmentally friendly. The farm currently employs six full-time staff on a 24-hour roster.

Mayor Sharp commended Winiata Brown and the Parengarenga Incorporation for forging partnerships with marine science researchers, including the National Institute of Water & Atmospheric Research.

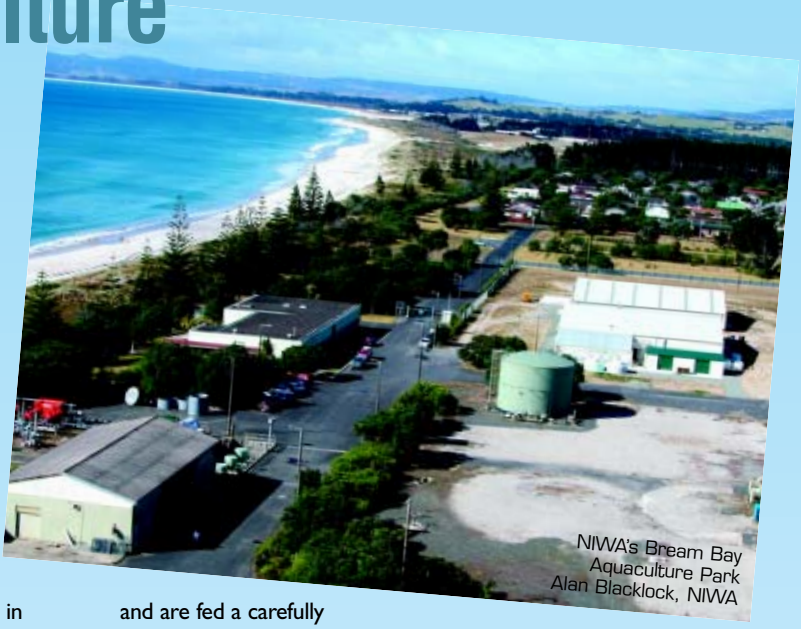
She described finfish farming as, "an example of where business and research synergies produce outcomes which will, in times to come, be significant contributors to the economy and to our diets. I know the government is watching this initiative closely and sees it as a great step forward."

RESEARCH IS THE KEY
to kingfish aquaculture

BY MICHELLE HOLLIS OF NIWA

WHY KINGFISH AQUACULTURE?

- Yellowtail kingfish are a valuable species, but commercial catches are small, seasonal and therefore inconsistent. Aquaculture, on the other hand, offers year-round availability and a uniform product.
- Kingfish grow fast, reaching a marketable size in 12 to 15 months, and are responsive to culture conditions.
- Kingfish have excellent flesh quality, are highly valued for sashimi in Japan, and can be processed into a wide range of products.
- Kingfish are a traditional food source for Maori. There are opportunities for coastal iwi to get involved in kingfish aquaculture, and so increase economic and employment opportunities for iwi.



NIWA's Bream Bay Aquaculture Park
Alan Blacklock, NIWA

Commercially focused research and development, combined with state-of-the-art facilities at NIWA's Bream Bay Aquaculture Park, are the keys to the supply of high quality kingfish fingerlings to Parengarenga Fishfarm.

The National Institute of Water and Atmospheric Research (NIWA) delivered the farm's first fingerlings in June. It is gearing up to supply tens of thousands more in coming years.

The fingerlings are bred at Bream Bay, south of Whangarei, from a broodstock of some two dozen prime kingfish. These beauties, caught in the wild, have been in captivity for about five years. They weigh up to 35kg and could be up to 10 years old, and are fed a carefully selected diet of fresh, high-quality fish and squid, as well as vitamin and oil supplements.

Kingfish fingerlings being poured into a bucket
Nelson Boustead, NIWA

In anticipation of Parengarenga Fishfarm's future requirements, NIWA is establishing a second broodstock to breed out of season, and so spread the production of fingerlings.

The spawning broodstock can produce up to two litres of eggs in total every third or fourth night. An egg collector skims the buoyant, fertilised eggs off the surface of the tank. The eggs are disinfected and put in incubators.

When kingfish eggs hatch, the next stage is yolk sac larvae - a curious but brief period where the young kingfish has no mouth and relies on its yolk sac for sustenance. They are transferred to prepared tanks containing algae, and from there, the juveniles progress through a variety of specially formulated diets to pellets. The light, temperature and water quality are carefully monitored throughout the process. It takes roughly 70 days for the fingerlings to reach about 5g, ready for transport to Parengarenga Fishfarm.

While the first delivery used NIWA's salmon transporter, the institute has just bought a dedicated marine fish transport system comprising four modular tanks which can be carried on the back of an ordinary flat-bed truck.

The modular system provides greater flexibility - and it will be easier for drivers to negotiate windy stretches of road, such as just north of Mangamuka, in a truck rather than in a tanker. If all four modules are used together, the system can transport at least 100,000 fingerlings in one trip. The system is German designed and built, but NIWA is modifying the oxygen system and carbon dioxide strippers on the tanks because kingfish are such a vigorous species.

It has taken seven years of intensive research and development to get to this point. In 1997, NIWA started recruiting a small kingfish team with scientific grunt and commercial sense. The following year, NIWA and Moana Pacific Fisheries began working together to assess the potential for commercial kingfish aquaculture in New Zealand.

A kingfish in the hand at Bream Bay Alan Blacklock, NIWA

Offloading the live transportation tanker at Parengarenga Nelson Boustead, NIWA

At that time, kingfish were not cultured in commercial quantities in this country or in many places offshore. South Australia was working on hatchery production. Japan, which has a long and successful history of farming species of Seriola, a relative of our yellowtail kingfish, still largely relies on catching fry in the wild and ongrowing them in sea cages.

NIWA and its industry partners have established a captive breeding population of kingfish. The researchers collected the eggs and reared them through the larval and juvenile stages, with the fish growing to 3kg in 12 to 15 months. Given the strong commercial focus of this research, it was important to identify and tackle the main bottlenecks limiting commercial-scale kingfish aquaculture. They were:

- variable egg quality
- larval abnormalities
- cannibalism during the larval phase
- parasite control, and
- the live transport of fingerlings.

The work programme included examining the reproductive and stress biology of kingfish, examining their egg production cycles, and assessing protein and fatty acid profiles during egg and larval development. To manage the risk of the spread of unknown diseases when developing a species to be cultured in high density, NIWA surveyed the pathogens in wild kingfish populations and developed methods for treating them. Ongoing vigilance is required, of course, to guard against the appearance of new pathogens.

Central to these achievements has been moving the kingfish research efforts to NIWA's Bream Bay Aquaculture Park. The country's largest aquaculture facility was opened in April 2002 to bridge the gap between small-scale research and commercial-scale production. The idea for NIWA is to conduct research and development which is scientifically rigorous yet commercially relevant, and focuses strongly on rapidly developing commercial culture technology.

Scientists work at Bream Bay in partnership with industry to provide the support and expertise required to commercialise new aquaculture species. Sealord and OceaNZ Blue currently operate on the site.

NIWA chose Bream Bay because it was close to its researchers and clients in Auckland, and had existing infrastructure, including electricity, roading and the large pipelines that had been built to draw cooling water from the sea for the Marsden Power Station. These same pipelines now supply high-quality seawater to the centre.

NIWA produced more than 30 000 kingfish fingerlings during the 2002-03 kingfish spawning season. This greatly exceeded the production target, and the success pushed forward the commercialisation of this exciting new species for New Zealand aquaculture.

The quality and survival of the fingerlings also surpassed expectation, particularly because NIWA reduced the incidence of jaw abnormalities to less than 10 percent. This success was achieved through a combination of small and large-scale experimental trials, based on a good understanding of kingfish physiology.

NIWA plans future kingfish research and development to capitalise on the efficiency gains made in rearing larvae and nursery technologies. Further developments could include using natural immune stimulants and probiotics, optimising feeding strategies, and manipulating environmental variables to achieve optimum growth and survival rates. Thanks to a Technology for Business Growth grant from the Foundation for Research, Science & Technology's business unit, Technology New Zealand, NIWA is continuing to work with Parengarenga Fishfarm on many of these issues.

REGULAR SUPPLY OF GAMETES
required for the aquaculture industry

BY DR ANDREW MORGAN

The aquaculture industry is experiencing a proliferation of hatchery technology to gain more control over commercial production for new and domesticated species.

Life cycles have been closed for species such as mussels, oysters and salmon, and similar protocols are under development for other species such as abalone and kingfish. Broodstock are bred and selected through F1 and F2 generations and onwards as breeders are crossed with various family lines to optimise production parameters such as growth, yield and reproduction.

Selecting animals that are good breeders depends on many factors. In the case of mussels, these factors are the focus of the Cawthron Institute's development of an EST genetic database. However, to increase production, access to gametes (sperm and eggs) on demand both in and out of season is also needed.

Even during the season, access to quality gametes is very important to selectively breed superior animals to continually achieve genetic gains in the quality of broodstock and the offspring they produce for nursery phase culture, growout and harvesting.

Techniques applied in developing better gamete-handling technologies are many and varied, but the key ones for increasing production cycles currently involve the development of cryopreservation storage protocols.

This technology includes the development of storage protocols for gametes, including sperm, eggs, embryos and larvae. The ability to minimise any handling impacts on the quality of gametes during processing, storage and subsequent use during production is becoming increasingly important for domesticated species.

Here the focus will be on handling and storing sperm, and its effect on fertility (the numbers of sperm capable of fertilising) for domesticated aquaculture species. Some of the issues and problems with the commercial use of this technology will be highlighted.

Storage problems are usually based around the use of diluents, cryoprotectants and the process of freezing and thawing sperm for use in the production cycle. Handling problems are usually related to sperm concentrations, the length of time kept as fresh sperm before use and/or storage, and the physiological problems and damage caused by these and other factors.

Sperm batch variation or differences in fertility between males over the reproductive season is also an issue. There are a number of potential solutions for minimising these effects to achieve better commercial outcomes together with the development of technology for high throughput, simple and cost-effective predictive screening and evaluation of sperm.

SIMILAR ISSUES

These issues are similar to the problems faced in the livestock industry with the commercial use of sperm cryopreservation. In the livestock industry the assessment of stud sires is in some ways qualitative.

Sperm fertility and thus sire fertility is currently usually assessed using a number of sperm/egg bioassay techniques and morphological criteria in combination with "non-returns" or the failure rate of pregnancy in females from artificial insemination (AI) using frozen-thawed sperm.

Over many years a profile of the sire is built up, and his fertility is assessed by using this database. Usually some relationship is drawn with morphological features of the sperm, sperm binding assays, the ability of sperm to fertilise and the condition of the sire.

What has been shown time and time again is that sperm physiology and/or morphology and sperm-egg binding does not consistently correlate with sperm fertility and the ability to fertilise, and is not always an accurate tool for assessing sire value and is rarely predictive.

It should be kept in mind, though, that in the case of developing commercial protocols in aquaculture, sperm viability is often measured in terms of fertilisation success using assays, whereas in livestock it is more often the inability of females to become pregnant or "non returns".

As stated previously, apart from sperm binding assays, most other measures of fertility rely on the assessment of morphological criteria, and result in weak or limited association as predictors of sperm fertility and superior male broodstock.

The aquaculture industry is, however, in the process of adapting cryopreservation technology developed in the livestock industry for our key species. Successes are leading to commercial protocols for gamete storage and a significant improvement in domesticated production criteria for our key industries.

However, as pointed out, similar problems exist in aquaculture as occurs in livestock with assessing the fertility of broodstock and the viability of sperm as a result of various handling and storage procedures.

Although commercial protocols can be developed without addressing these issues, if they were solved, the gains in fertility and handling for male broodstock and sperm could be commercially substantial at the production and harvesting end.

At the molecular level, damage to sperm effects DNA and the expression of proteins, and the functions they perform in producing enzymes that catalyse processes related to the ability of sperm to fertilise.

During the development of sperm, bundles of DNA condense as histones and are removed and replaced by protamines. Enzymes digest these somatic histones and stop transcription. Transitional proteins are replaced by protamines which stabilise and compact these bundles of DNA by forming disulphide bridges.

At this stage, the programming for transcription of proteins later in development is stored as tRNA in the cytoplasm. All transcription stops at chromatin condensation. Consequently, the reason that damage to sperm occurs from handling and procedures such as freezing, thawing and sperm age post-spawning is that they cannot repair themselves. In addition, sperm and the media they exist in have a limited capacity to produce antioxidants to protect against sperm damage, and handling easily disrupts this balance.

CHEMICAL EVENTS

Phosphorylation involves a cascade of chemical events involving proteins and enzymes that prepare sperm to fertilise. This process may be very sensitive to reactive oxygen species or free radicals that cause damage to sperm.

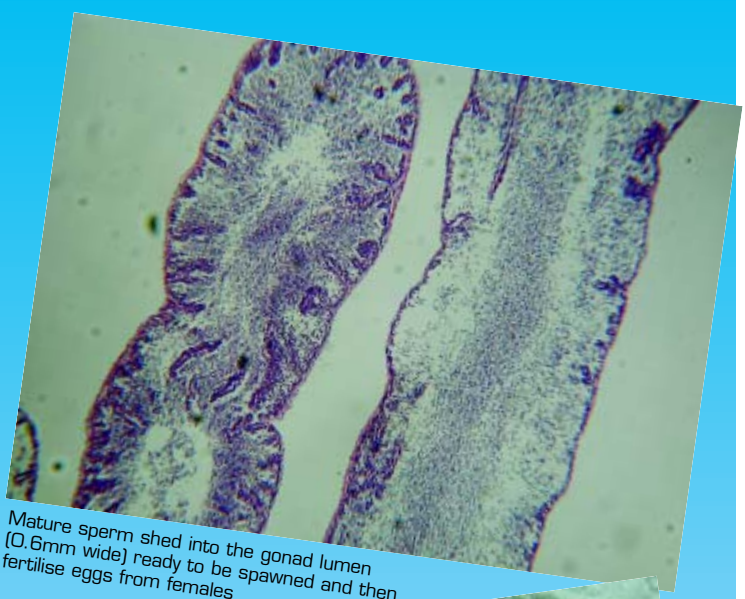
Reactive oxygen species such as hydrogen peroxide cause lipid peroxidation or the mobilisation of lipids in the cell membrane. This causes a breakdown of sperm membrane function and disruption of the ability of sperm to swim, capacitate and undergo the acrosome reaction and penetrate the egg membrane.

Antioxidants help prevent this process from occurring, and play an important roll in maintaining the integrity of the sperm membrane to ensure successful fertilisation.

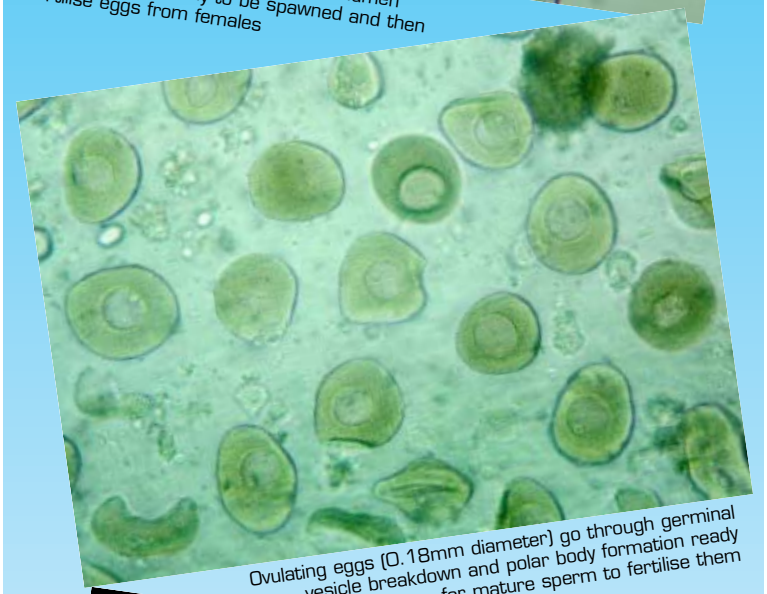
Batch variation of sperm during the reproductive season even prior to the use of fresh or frozen stored sperm for hatchery production may also be related to oxidative stress. Compromised sperm, whether from handling, age or some other factor associated with batch variation, may produce these reactive oxygen species that affect healthy neighbouring sperm even within the gonad before spawning.

In summary, there are a range of problems that need addressing to improve the numbers of viable sperm post-thaw from cyropreservation that will enable a better understanding of the handling and freezing process and its effect on sperm fertility (the numbers of viable sperm capable of fertilising) relative to the use of fresh sperm.

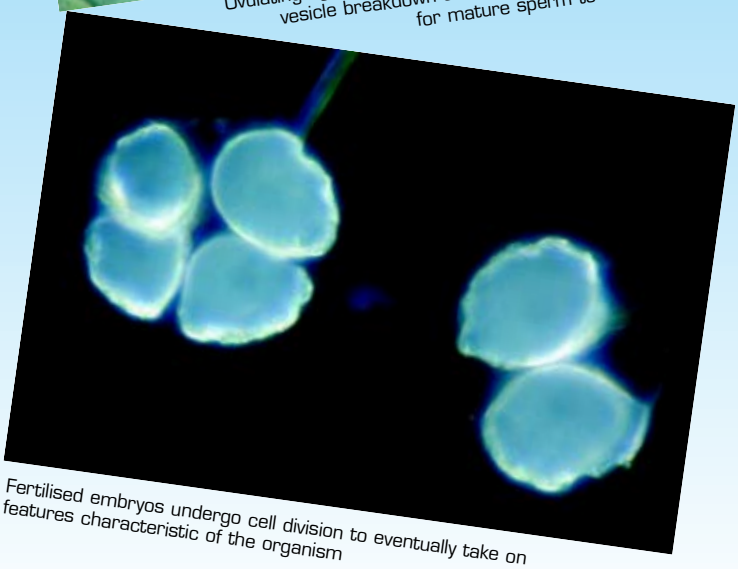
Understanding the relationship of these processes to the physiology and morphology of sperm will help develop better screening and diagnostic predictive tests of fertility that have commercial value.



Mature sperm shed into the gonad lumen (0.6mm wide) ready to be spawned and then fertilise eggs from females



Ovulating eggs (0.18mm diameter) go through germinal vesicle breakdown and polar body formation ready for mature sperm to fertilise them



Fertilised embryos undergo cell division to eventually take on features characteristic of the organism

This could be done by modifying existing storage protocols based on how sperm physiology responds to various handling procedures and reagents used in the freezing and thawing process, adding to the use of protocols that have previously been adapted from the livestock industry for freezing mammalian sperm.

Physiological changes in sperm can be assessed and evaluated using antioxidant assays in combination with quantifying changes in membrane ion exchange channels and the proteins and enzymes involved in this process. Proteomics or high throughput screening of protein interactions may solve this problem, and enable this technology to be applied in new commercial

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services for aquaculture selective breeding by developing simple, effective biosensor/biochip testing technology as a commercial endpoint for industry.

MUSSEL SPAT

In terms of revenue, fisheries exports were $1.22 billion for the year ending June 2000, of which molluscs accounted for 16.7 percent or $204 million. The main species exported were mussels and squid.

Exports of Greenshell mussels in 1990 were $25 million, and had increased to $132 million by June 2000. In the year to June 2000 the remaining $31 million consisted of other molluscs such as oysters and paua (Market NZ).

In addition to this, selective breeding and domestication of mussel spat production will increase substantially over the next decade, resulting in further increases in production and yield and export revenue, provided that markets expand and take up the extra production. Furthermore, cryostorage of sperm, eggs and embryos will allow the production of spat out of season for a range of commercial species and result in a further increase in potential revenue at the harvesting end, including mussels.

Therefore, a proportional increase in the percentage of available spat production as a result of better sperm cryopreservation technology and handling of sperm, and thus more available sperm, will result in increased revenue for the New Zealand economy.

More efficient use of sperm as a result of better handling techniques saves time and money while increasing production both within and between cycles.

For example, the Greenshell mussel industry is worth over $200 million per annum. The development of hatchery technology has allowed the domestication of this species.

Cryotechnology is being adapted from the livestock industry for gamete cryopreservation to increase production cycles and develop out-of-season breeding by having access to a readily available source of sperm, eggs and embryos.

This technology is also being used to select sperm from superior family lines and to increase production and yield within a production cycle. However, cryostorage can result in a limited increase in yield of seed stock, and although protocols can be considered commercially viable, even at the current rate there is certainly room for improvement and a measurable dollar value for the industry at the harvesting end.

The aquaculture industry needs a continuous commercial supply of frozen gametes. Furthermore, most aquaculture industries rely on the seasonal supply of gametes during natural spawning, limiting production. It is likely that an opportunity will develop to set up a commercial facility for the year-round supply of high-quality frozen gametes across a range of species to the aquaculture industry. Furthermore, access to a commercial facility that stores gametes long-term will benefit this industry by providing reliable storage for selected family lines and genomes used in breeding.

A lot of cryopreservation technology is either well into the research and development phase or is nearing commercialisation. Targeting a range of species using this technology in the aquaculture industry enables revenue to be generated across multiple species.

MARINE FARMERS HAVE STRONG BOND

The New Zealand Marine Farming Association Inc. (NZMFA) is a subscription-based organisation representing marine farmers in the top of the South Island.

Farmers in this area grow approximately 80 percent of the marine products farmed in New Zealand. The major species include Greenshell mussels and king salmon. Other species include seaweeds, Pacific oysters and paua (abalone). Sales from these farms exceed $200 million per year.

The association's objectives are to promote, foster, advance, encourage, aid and develop the rights and interests of its members and the marine farming industry in general.

The 2004 NZMFA membership stands at some 100 ordinary members and 70 associate members. Each ordinary member has one voting entitlement.

The association has management contracts to provide services to the Marlborough Shellfish Quality Programme Inc, (MSQP), the New Zealand Mussel Industry Council, the New Zealand Aquaculture Council and the Tasman Bay and Golden Bay Ring Road Spat Catching consortium.

The mussel farming industry in the Marlborough Sounds started in the 1960s. The early days of the industry were dominated by research and development, local sales and an extract used to help alleviate arthritis. By 1974, as the industry grew, there was a need for some formal organisation, and the Marlborough Sounds Marine Farming Association was formed. The name was changed to the NZMFA in 1986 to better reflect the growing importance of the industry.

In 2004 the NZMFA will be publishing a book on a history of mussel farming in New Zealand. This book will largely focus on the personalities and vessels involved in the first quarter century of the industry's growth.

The governance of the NZMFA is the responsibility of the executive committee, which is elected annually by ordinary members at the annual general meeting. The executive comprises a president, a vice president and up to 10 committee members.

The NZMFA has six full-time staff. The executive officer manages the day-to-day affairs of the association and is supported by three office staff. Two employees are devoted to providing services to MSQP. These include a sampling officer and an executive officer.

The NZMFA owns five spat catching and eight spat holding farms in the Marlborough Sounds. Spat catching and spat holding lines on these sites are leased to the industry on a contract basis. The NZMFA manages the lighting and permits relating to the farms and in return receives income from the leasee farmers.

The association is also an active participant in the Golden Bay and Tasman Bay Ring Road consortium, holding approximately eight percent of the water space in those areas.

Its other activities include an Adopt-a-Beach programme and the Marlborough Sounds lights monitoring programme. The NZMFA runs regular liaison committee meetings with the Marlborough District Council, Port Marlborough Ltd, the Ministry of Fisheries and the Tasman District Council. It also participates in the Marlborough District Council's sounds liaison committee.

CRANES REACH OUT
to mussel industry

To many New Zealanders the name Palfinger is synonymous with truck cranes from the days when they were made under licence in Waharoa during the seventies.

What many may not know is that the Austrian company has produced cranes for 70 years. It went public in 2000.

Now recognised internationally as the industry leader for foldable knuckle boom cranes, the company now produces some 15,000 truck and marine cranes, of which 80 percent are produced for the truck market.

The managing director of Palfinger, Heinz Kissel, recently visited New Zealand to to talk with customers and see how its marine cranes were being used. He said he was especially interested in building a crane specifically for the mussel industry. It was important for customers to have confidence in backup support and future development, he said.

Kissel's earlier experience as a marine engineer on SOLAS ships from tankers to reefers gave him the skills to enable him to marinise the truck cranes so they could withstand the rigorous marine environment. At the time, other crane manufacturers were struggling in this field because of the high cost of servicing and warranties.

Early production of marine cranes started on a separate line in the main truck crane factory in the Austrian Alps at Salzburg. High tensile steel components ensure an optimal power-to-weight ratio, and the cranes have an extremely low centre of gravity for a long outreach.

The cranes are made using the same steel structure as truck cranes, which is then specially treated to withstand the marine environment. The secret would appear to be in the preparation. The steel is grit blasted to 50 microns to give a uniformly rough surface for the primer to adhere to. The zinc-rich primer is applied immediately after the blasting while the steel is still warm to eliminate the chance of any moisture contamination. Intermediate and final coats are applied to a dry-film thickness of 210 microns. The final top coat colour may be ordered to suit the owner's choice. White is popular on superyachts, otherwise the standard colour is blue.

The hydraulic rams are nickel-chromium plated, although Palfinger can offer stainless steel piston rods for the main and outer boom cylinders as an option. All the hose couplings and fittings are stainless steel and the crane incorporates a specially developed marine winch.

Ross Walden, Transpecs' Palfinger sales manager, has been with Palfinger since the early days in Waharoa in 1978. Marine cranes have come a long way since then, with the aquaculture industry now being a key business sector for this type of folding knuckle boom crane. Palfinger needed to ensure the crane will meet the industry's future needs, as part of its commitment to the marine industry, he said.

Professional Skipper and *NZ Workboat Review* feature a Palfinger PK14080(M)B marine crane on the *Coromandel Harvester,* the latest addition to the Gulf Mussel Farms fleet. The company harvests its own mussels, which are sold locally and overseas. They also contract to other farms.

The fleet owner, Alan Bartrom, worked with Bos & Carr to develop the vessel.

"A shallow draft and a proper bow that didn't drag were two important features," he said. " The traditional rising transom and classical lines allow us to unload in the shallow."

The PK14080(M)B marine crane was supplied by Transpecs, and Ross Walden worked closely with Alan Bartrom and the team at Total Hydraulics to specify a suitable crane.

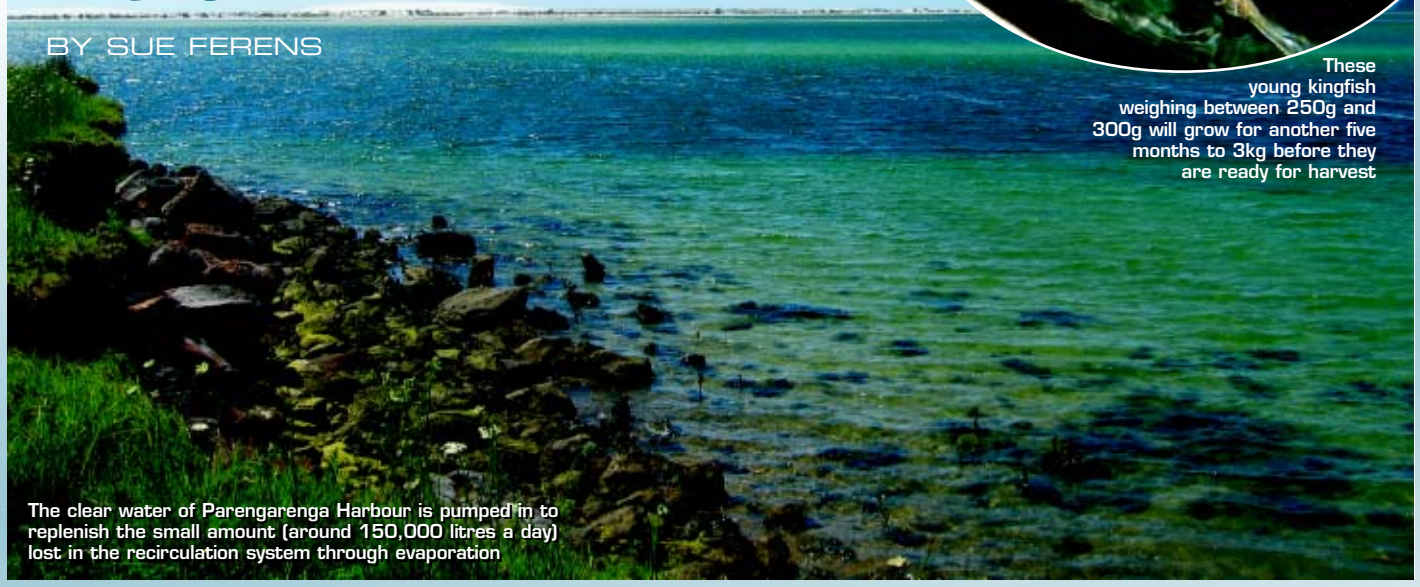
"We needed a light, conical base crane that could lift a tonne at 10m, and this one fitted the bill nicely," Alan said. "After all our effort, we are very happy with the new vessel. The hull shape and hydraulics are a major leap forward."

Contact Transpecs, phone 0292 970 707.
See www.transpecs.co.nz

FARMED KINGFISH enjoy warmth and food

BY SUE FERENS

These young kingfish weighing between 250g and 300g will grow for another five months to 3kg before they are ready for harvest



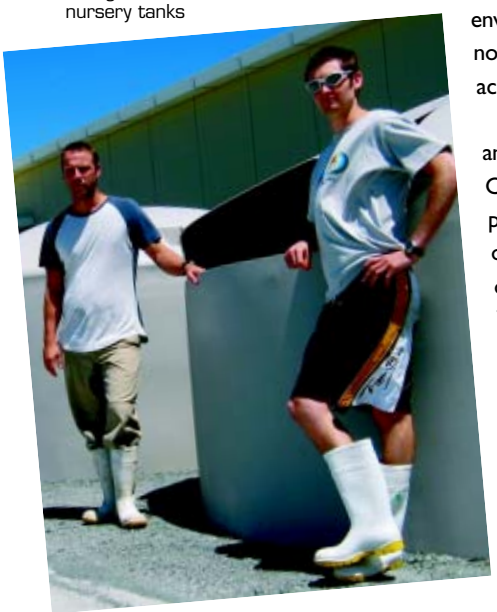
The clear water of Parengarenga Harbour is pumped in to replenish the small amount (around 150,000 litres a day) lost in the recirculation system through evaporation

While the aquaculture industry has been focused on the outcome of the government moratorium into marine farming, a Far North enterprise has quietly established the largest land-based finfish farm in the southern hemisphere to produce yellow-tailed kingfish (Seriola lalandi).

Construction of the $10 million Parengarenga Fishfarm Ltd, owned by the Parengarenga Incorporation, began in November 2003, and the first fingerlings were introduced in the following June.

Five months down the track, 30,000 kingfish weighing between 250g and 400g are being nurtured to an optimum weight of 3kg (achieved in around 12 months) before being harvested and processed for sale in New Zealand and overseas.

The project, which employs cutting-edge technology and a recirculation system designed for energy efficiency and environmental sustainability, is notable for the speed with which it achieved resource consent.



Consultant marine biologist Andrew Steele and fish farm supervisor Garth Foote alongside the nursery tanks

The Northern Regional Council and the Department of Conservation lauded the fish farm proposal as a model for this type of development, says the chairman of Parengarenga Incorporation, Winiata Brown.

He compared the application to a proposed marine farm further south around the same time, which cost $1 million and did not get approval. "Ours cost $30,000 and was through within three months.

"The project lends itself to environmental sustainability through the recirculation system," said Brown. The only discharge from the operation is into the sediment ponds, and from a resource consent perspective, the lack of discharge into the pristine Parengarenga Harbour was a key factor in gaining approval.

Brown said environmental sensitivity was very important, even from a visual perspective, and the low-impact, sand-coloured, 130m by 30m farm nestled on the flats by the harbour looks unobtrusive.

Parengarenga Incorporation's decision to explore land-based fish farming came through a need to diversify its business interests. "We needed to diversify more than anything else," he said. With over $30 million of assets in farm and forestry, the Northland Maori incorporation had no further land to develop.

An existing oyster farming operation and a seasonal processing plant, Aquaculture Ventures, in Awanui (a joint venture with Muriwhenua Incorporation), handled oysters and scallops. Options for developing marine farming on Parengarenga Harbour, had this been possible, were further restricted by the shallowness of the harbour and its narrow entrance, so attention turned to land-based fish farming.

After four years of research, the directors selected a Danish firm to provide the technology for the fish farm, and bought state-of-the-art machinery and equipment.

Its second notable coup was eliciting almost 100 percent support for the venture from its 2500 shareholders, achieved through transparency regarding the proposal.

Most of the start-up funds were on hand, and with some shareholders opting to contribute additional funds, together with borrowings, construction began and was completed on target six months later. This was a feat in itself in this remote part of New Zealand, and with over 200 workers being

employed on the project.

It is still early days, with only six of the 32 raceways stocked with fish as systems are fine-tuned and staff are trained. The first harvest of kingfish is scheduled for March or April, 2005. The current programme for the supply of fingerlings to the farm is 30,000 in year one, 150,000 in year two and 220,000 for year three, with a projected 600 tonne annual harvest once fully stocked.

The key to producing kingfish, which are prized for their flesh quality, is the ability to closely control conditions for optimum growth.

Keeping the fish at a constant temperature of 20 to 25 degrees Celsius, slightly higher than the natural open-sea temperature in the Parengarenga area in Northland, plus a tailored feeding regime, gives ideal, low-stress conditions for growth.

The fish themselves generate heat through their metabolic processes and create a natural heat within the system. A heat generator can also be switched on as required. "They don't have to fight overly hard for their food, and they can feed 24 hours a day," says consultant marine biologist Andrew Steele.

The water quality is also closely monitored. "Good water quality is absolutely imperative to us," says Steele. Water in the raceways is continually refreshed via a drum filtration system that extracts sludge and faeces, and sends the leftover water through bio-reactors that convert toxic ammonia and nitrites into non-toxic nitrates.

The circulation ratio in the system sees four to five exchanges of water in the raceways every hour. The extent of velocity in the 32-raceway system is impressive, and this is where the technology employed in the fish farm really comes into play.

Water enters denitrification towers, from where it passes through a substrate of molasses. It then undergoes pH monitoring before entering oxygen controllers for the injection of pure oxygen.

The water is further treated by ultra-violet sterilisation, and ozone injectors reduce the amount of protein in the recycled water before it is finally filtered back into the system.

"The less water we pull in from the harbour, the more efficient the system," says Steele. Submerged pumps in the harbour currently pump around 150,000 litres per day into the system, less than five percent of the total water, covering that lost through evaporation and filtration. The only discharge from the plant is into the adjacent settlement pond, where it will be used as fertiliser after de-salination.

The fish are regularly graded and separated to maintain a constant density in each raceway, and smaller fish are fed by hand to help them grow. The certified fingerlings, bred by the National Institute of Water and Atmospheric Research's Aquaculture base at Bream Bay, are transported by tanker to the fish farm, where they are checked and graded during a two-week quarantine period in nursery tanks before being introduced to the raceways.

NIWA and the fish farm have an intellectual property agreement relating to the facility and its operation, as well as joint involvement in breeding research. Brown says the government had not contributed to the set-up, but subsequent Technology Business Growth grant funds would be used with NIWA to develop intellectual property skills relating to future work.

The interior of the fish farm with its raceways where kingfish will be raised to 3kg for harvest. Water in the raceways is refreshed every 12 minutes at a rate of 10,800m³ per hour

CONTROLLED RISK

The risks inherent in this operation are minimised by the highly controlled system with its banks of computerised, alarm-controlled mechanisms and auto-diallers linking back to the software programme Fish Farm Supervisor on Garth Foote's computer. There's also an automated back-up generator with a 10 second kick in, should there be a power failure. The operation is manned 24 hours a day by a staff of six.

Steele says he is confident that the currently accepted mortality rate of 10 percent will be halved over time. "The beauty of this plant is in the control of conditions. Filtration through closing off to the environment gives the best growth rates and the best economic benefit over time.

The cost benefits far outweigh the initial capital cost, he says. "We have the opportunity here to produce a fish that has a far higher quality, due to our ability to control the environment."

The directors are investigating potential markets in New Zealand, Japan, China, Europe and possibly the United States for their high-end product, and are taking time to decide just who the best market partners will be.

"If we can get customers we can trust and rely on, we will be able to supply them year-round," says Brown.

Kingfish, processed into cutlets and fillets if required, will form the core product at the Aquaculture Venture's processing plant, giving the operation continuity and reducing the costs incurred in training seasonal staff.

Brown envisages potential additional business from local fishermen once Paua Wharf, alongside the fish farm, is developed, and he is not ruling out future growth for Parengarenga Incorporation through further land-based fish farms on the Northland coast.

TECHNICAL DETAILS

Building size	4400m³
Concrete	1300m³
Steel	132 tonnes
Raceways	32. 20m x 3m x 1.2m
Total water	3712m³
Water recirculation	10,800m³ per hour, raceway transfer every 12 minutes
Water circulation	7 pumps with a capacity of 1465m³/hour capacity each
Average stock	138 tonnes
Average stock density	64kg per m³
Maximum stock	220 tonnes
Maximum stock density	120kg per m³
Nursery tank capacity	5000 fingerlings per tank
Feed	pellet feeds 50 percent protein, 17 percent lipid (oil)
Feed capacity	1890kg per day

NATIONAL PLAN NEEDED
for aquaculture to thrive

BY KEITH INGRAM

At the recent conference on current trends in fisheries management and aquaculture, we had a chance to catch up with Graeme Coates, the executive officer of the New Zealand Marine Farming Association.

In response to our question as to how the mussel industry was at present, he responded, "There is nervous confidence within the industry at present. We have been through four years of reforms that have lacked leadership in a bureaucratic sense.

"As we move forward, the initiative on the development of aquaculture around our coastal waters will need to come from regional groups and not central government.

Graeme Coates

"In order to ensure that aquaculture grows in a controlled and logical manner, we need to have a national aquaculture plan, something along the lines of what they have done in Australia," said Coates.

Under the current proposals, the fear for the industry is that local authorities will bow to pressure from ginger groups or the NIMBY (not in my back yard) syndrome. Either no aquaculture management areas will be created, or some authority, through no structured process will create too many, and the markets may not be able to handle the excessive overflow of product. Either way, the outcome for New Zealand and the mussel industry is bad.

The biggest concern facing the aquaculture industry is the lack of leadership at senior level. "In other countries, leadership is provided at a multitude of levels. For example, they would have their own Minister of Aquaculture or, as in Canada, an aquaculture commissioner or government agencies such as Bord Iascaigh Mhara in Ireland, (the Irish Sea Fishery Board, the Irish state agency responsible for developing the Irish Sea fishing and aquaculture industry,) and in Scotland they have the Highlands and Islands Development Board, the HIDB. These agencies promote and encourage aquaculture development.

However, this should not be restricted to senior level. At the next level below ministerial government, leadership also needs to come from bureaucracy, the civil servants. The problem appears to be that everyone pays lip service to the aquaculture industry, but the bureaucrats are not committed to doing anything about it. We need dedicated civil servants. I must ask the question, " Is the Ministery of Fisheries, with its regulatory and ITQ focus, the right ministry to nurture the growth of aquaculture in New Zealand?"

With the current law reforms, we have the outrageous situation where the minister responsible for aquaculture, the Minister of Fisheries, David Benson-Pope, is not the minister responsible for the main aquaculture legislation, which is contained within the Resource Management Act.

"Short of having our own ministry, perhaps the most logical place for aquaculture to sit is with the Minister for Primary Production, the Ministry of Agriculture, Forest and Fibre," said Coates.

This ministry deals with the planned production of primary products, exactly what the participants within the aquaculture industry would like to focus on, he said.

At an industry level, the whole seafood industry needs to embrace the potential for job creation that will occur through the growth and development of aquaculture in New Zealand.

By January 2005, the outcome of the undue adverse affects debate will be known, and the aquaculture industry will need to live with that decision. To achieve the best outcome in the future, this industry will need to demonstrate leadership and cooperation with other stakeholders.

Independent representation of the aquaculture sector within the SEAFIC structure would be a useful start, said Coates. The regional structures that will be required to ensure the AMA creations is already in place through organisations such as the Coromandel Marine Farmers Association, representing farmers in the Coromandel region and north, and the New Zealand Marine Farmers Association, which represents growers in the top of the South Island.

Coates' plea to the Minister of Fisheries is that he recognise the urgent need for Cabinet-level leadership, and that he facilitate the creation of a national aquaculture management plan similar to that initiated by his counterpart in our closest competing neighbour.

The New Zealand mussel industry is unique in that it is the only industry that profitably farms a native species that has the potential to be marketed worldwide as a preferred mussel of choice.

The mussel industry, and in particular the New Zealand Greenshell mussel, has been afforded recognition as environmentally friendly organic farmers.

In talking with Coates, one quickly understands his frustration and desire for the industry to progress. He is a very passionate advocate on the industry's behalf, and one must ask that given that we have this huge natural resource that has minimal impact on the environment, why is there so much public adversary towards marine farming?

The visual impact is not huge, and if on the expiry of the

lease the farmer decides to shift his farm to another area, the impact on the marine environment is negligible. Granted, there is a growing access and navigation problem with other boat owners and the recreational fishing sector.

But with leadership from within the industry, these problems can be resolved by good farm husbandry, maintaining access to sheltered bays for small craft, and clear boundary lighting of the farms.

We should also recognise that recreational fishers see mussel farms, particularly harvesting, as a fishing opportunity, and this should be encouraged by education and access.

Clearly, it is the Mussel Industry Council's view to encourage boaties to treat mussel farms as a local asset. Recreational fishers and the public can take mussels from the top of the ropes, or by reaching down to arm's length to get a feed, as long as they stay within the allowed amateur bag limit. The public should see this as a privilege to be enjoyed and nurtured.

It should also be clearly pointed out that an offence is committed if an amateur fisher attempts to cut a rope or damage any of the mussel structure, as this is wilful damage, and could be seen as theft if they were to take a section of rope with mussels attached.

In essence, while the mussel industry has come a long way, it is still a teenager. As it matures, it must take responsibility for its place within the community and the marine environment.

But this cannot happen alone, as we believe that both national and local government agencies have a responsibility to show leadership and facilitate communication, education and future growth in this environmentally friendly industry.

LETTERS

DOUBLE STANDARDS

Dear Sir

I seriously like this publication. It includes articles that make very good points, like your editorial, where you refer to "double standards" regarding water quality degradation. We need more of these double standard attitude revelations.

The marine farming sector needs to be factual and conservative with its claims. We need to be seen as creditable and having integrity, therefore we must make every effort to be factually correct, and if wrong, be prepared to acknowledge we are wrong and make adjustments.

Peter Stevens' article, Regional Councils - some points to ponder, also makes many very good points that I am pleased to see written. But it includes a statement that I believe is not factually correct, the claim that, "it has been scientifically established that the mussels in a typical farm only filter about one percent of the water passing through the farm, meaning that they consume only one percent of the available phytoplankton."

This in my understanding is not factually correct, and we do not do ourselves any good by making claims that are not accurate.

I am very strongly objectively pro-marine farming. I believe marine farming managed correctly has a lot to offer New Zealand. I am a mussel farmer in Pelorus (Sound) with more than 22 years observational experience.

Andrew King, Marlborough

The one percent business came out of research done by Canterbury University. The research was used in court recently and the judge accepted the scientific validity. The research findings were unchallenged. I cannot name the title of the research paper, but Keith Heather, who works for the Marlborough Regional Council, certainly can. I'm sure that if Andrew King contacted Keith Heather he would be more than happy to give him all the details. Email khe@Marlborough.govt.nz

Peter Stevens

PROMOTIONAL FEATURE

PLASTIC MAKER HEAVILY INVOLVED IN AQUACULTURE

Indac is a plastics manufacturer with a history of manufacturing for more than 20 years, says marketing manager Cathy Adams. At the beginning, Indac was driven to supply its owner, Michael Hitchins, with mussel floats for his own mussel farm. "Being heavily involved in the aquaculture industry, Michael's expertise means he is constantly receiving requests for different products, and over the years the range has expanded to cater for various facets of the New Zealand aquaculture and fishing industries," she says.

The range of aquaculture and fishing products includes insulated bins, conical tanks, water monitoring buoys, filleting trays, magnetic coding tags, juvenile abalone growing trays and a unique nursery tray for oysters called the Rotoshell. The range also includes three models of heavy-duty toolboxes, which serve well as storage boxes in the marine environment.

Indac's most popular fishing industry product, the FT680 insulated bin, is an industry standard within the New Zealand market, and these bins are now available through various distributors in Australia, says Cathy. New Zealand users include Sealord, Moana Pacific, Ngai Tahu and New Zealand King Salmon.

Indac uses both rotational and injection moulding methods of plastics manufacturing, meaning a diverse range of products can be made at the Blenheim factory. Along with a large range of products in the aquaculture, fishing, marine, viticulture and materials handling sectors, Indac provides a design and contract manufacturing service, so custom designs can be easily provided.

Products manufactured under contract are as diverse as irrigation fittings, signage, playground equipment, composting toilets and portable spa pools.

Contact Indac phone 03 578 3034
or email cathy@indac.co.nz