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FISH



VOLUME 22 NUMBER 2
JUNE 2014

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Fisheries Research and
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FISH is published by the
FISHERIES RESEARCH AND DEVELOPMENT CORPORATION
(FRDC)

The FRDC plans, invests in and manages fisheries research
and development throughout Australia.

It is a statutory authority within the portfolio of the Federal
Minister for Agriculture, jointly funded by the Australian
Government and the fishing industry.

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FISH is written and produced for the FRDC by Coretext Pty Ltd.

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ISSN: 1833-4784 (Print) ISSN: 2202-7122 (Digital)

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JUNE 2014



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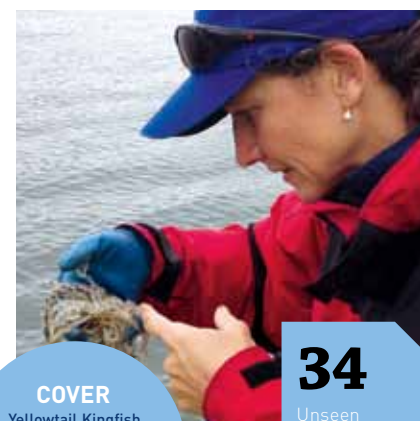
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Yellowtail Kingfish
(*Seriola lalandi*).

Photo by
Randy Larcombe

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Unseen
influence

NORTHERN FRONTIER

FIGURE 1 NORTHERN AUSTRALIA



AQUACULTURE Sustainable growth in aquaculture across Australia's north could help local industry meet increasing global demand for high-quality protein

By Melissa Marino

Increasing aquaculture production across northern Australia (Figure 1) would benefit local industry and help meet global food needs as demand for safe, high-quality protein grows, researchers and producers say.

Significant expansion has been identified across Australia's north, the area north of the Tropic of Capricorn, where the value of aquaculture production is estimated at about \$200 million. Aquaculture species in this region included oysters, prawns, Barramundi (*Lates calcarifer*), pearls and freshwater fish.

The Australian Government, as part of its vision for redeveloping northern Australia, says aquaculture could conceivably be increased to an industry generating two or three times the current figure by the end of this decade.

"Quality Australian seafood can play an increasing role in helping feed our Asian neighbours," the paper says. "Suitable sites for a large sustainable aquaculture industry

exist across northern Australia and businesses are pursuing large-scale opportunities."

The potential for growth is backed by CSIRO research that has identified half a million hectares in each of Western Australia, the Northern Territory and Queensland as suitable for pond-based saltwater aquaculture. These areas are at a safe distance from mangroves or other sensitive areas.

CSIRO Food Futures Flagship acting director Nigel Preston says sustainable aquaculture development will be important in meeting not only local food requirements but also burgeoning demand for high-quality seafood from Asia's growing middle class.

"Our neighbours are absolutely prepared to pay a premium for food they know is safe and sustainable – for the provenance of where it has been grown," he says.

Currently, Australia's contribution to the global seafood market is small. Australia imports about 72 per cent of the seafood it consumes

and in 2010 the contribution of the Oceania region, including Australia, to global aquaculture production was only 0.3 per cent (Figure 2). Asia accounts for nearly 90 per cent of global production (Figure 3). Meanwhile, food demand in Asia is expected to double by 2050 (Figure 4).

Nigel Preston says a growing global demand for seafood is reflected in trade figures that show China was a net exporter of farmed prawns and other seafood up to four years ago. Today it is a net importer, he says, which demonstrates its increasing appetite for seafood.

"There is a global challenge to provide healthy protein to feed more and more people and Australia needs to take a serious look at the expansion of sustainable saltwater aquaculture to take advantage of this opportunity," he says.

Quality and quantity

Nigel Preston says the Australian aquaculture industry adheres to the highest environmental standards in the world, which is one reason its produce is highly desirable. For example, the environmental management of prawn farming is world's best practice, as determined through a seven-year, multi-agency study by CSIRO, the FRDC and others into large prawn farms in Queensland and New South Wales.

Among the study's findings were that advances in treatment systems and practices had enabled



There is scope to expand northern Australia's farmed prawn industry – which embodies world best practice environmentally while producing record yields – and other aquaculture ventures.

PHOTO: NICK MOORE

some farms to increase production with no net increase in sediment or nutrient loads discharged into receiving waters. It found the industry had achieved an effective balance between economic gains and conserving ecosystems. And with operating practices and regulations in place, the study found that there was significant opportunity for expansion without compromising the economic and environmental sustainability of the industry.

“The industry has the strictest environmental practices and policies in place, so the licence to operate is based on the science that determines there is no adverse impact on receiving waters,” he says.

Nigel Preston says cooperation between industry and researchers has seen Australian farmed prawn enterprises innovate to embody world best practice environmentally, while also producing record yields.

In 2010, through a 10-year selective breeding program, CSIRO's Food Futures Flagship and prawn farmers developed an Australian Black Tiger Prawn (*Penaeus monodon*) labelled the ‘perfect prawn’. Delivering improved growth and survival rates resulting in record yields, it is also a sustainable and renewable resource grown in drought-proof saltwater ponds. This prawn has also won multiple awards for flavour.

Last year, to further the case for sustainability, CSIRO researchers produced a feed for farmed prawns, Novacq™, which contains no wild-harvest fishmeal or oil. This, Nigel Preston

says, is a game changer for prawn farming, potentially meaning it will no longer be reliant on wild-caught fishery products for feed, which is a legitimate concern regarding the industry.

“In Australia we’ve got some of the best elite prawn genetics, we’ve got a totally sustainable feed, we’ve got the strictest environmental management practices in the world and we’ve got a fantastic opportunity to produce high-quality, high-value protein at a scale that would allow Australia to not only become more self sufficient in seafood but to also respond to the huge demand for high-quality proteins from Asia,” he says.

Nigel Preston says aquaculture delivers a high-quality, cost-effective, sustainable protein. In 2013, the global production of seafood surpassed beef and demand is expected to continue to increase as the world's population grows.

“If you want to ramp up the production of high-quality protein, the most efficient method in terms of tonnes per hectare is production of fish or prawns in saltwater ponds or cages,” he says. “So we need to ensure that the new generation of Australian aquaculturalists have the means to operate sustainably and with certainty.”

Model for expansion

Global nutrition needs will be met not only through continued advances in the beef, dairy and grain sectors, but also through new

opportunities for innovation and expansion in aquaculture, Nigel Preston says. And such an opportunity is being harnessed by the team behind Project Sea Dragon, he says.

Project Sea Dragon is an ambitious plan for pond-based prawn aquaculture development across northern Australia that seeks to increase national prawn production dramatically over the next seven to eight years.

Farmed prawn production in Australia covers less than 1000 hectares, but Project Sea Dragon, a Seafarms Group Limited project, plans to increase that by at least 10 times by developing 10,000 hectares of land into ponds to produce 100,000 tonnes of Black Tiger Prawns a year.

In a departure from the industry standard, which is characterised by small farms supplying to the domestic market, Project Sea Dragon involves large-scale production with an eye to supplying the growing export market – a kind of ‘big agri’ for prawns.

“In other words, we are talking about what Australian agriculture has done for a long time with grain and livestock exports,” says Commodities Group economist Daniel Fels. “We’ve got a preference for large farms because, as Australians have known from very early days, they give you economies of scale.”

Daniel Fels says the plan is ambitious but realistic in a climate where demand is

strong and growing, and land is available.

Of the seven million tonnes of prawns eaten throughout the world every year, four million tonnes are farmed, he says. Twelve years ago, less than 1.5 million tonnes of prawns were farmed.

"There's been a massive ramp-up of supply but there has also been a massive ramp-up of demand and it appears to be a good, strong, sustainable demand," he says.

But through this period of growth in supply and demand, Australia's farmed prawn production has remained at about 4000 tonnes a year. "Australia hasn't joined that prawn boom, so while our project is ahead of the curve in the Australian context, in the global context we are possibly late adopters," he says. "We are catching up."

Daniel Fels says there is promising potential across Australia's north to develop the land required, particularly in WA and NT, where government agencies are helping guide investors through the regulatory processes involved in establishing an aquaculture venture.

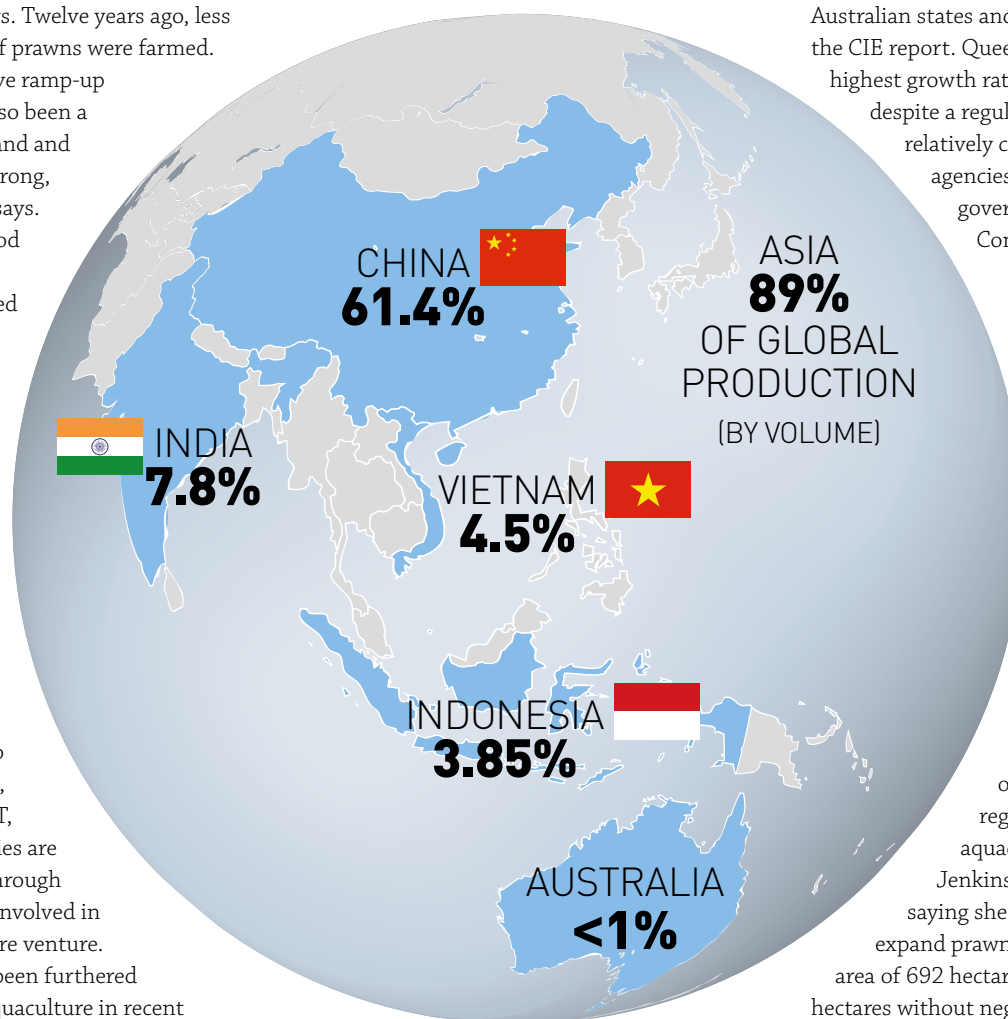
In NT, the cause has been furthered by the identification of aquaculture in recent legislation as a possible non-pastoral use of pastoral land. In WA, increased opportunities could also emerge for sea cage expansion after the government recently opened a larger aquaculture area in the state's north.

"In the north of Australia, there is land and there is water and there are under-utilised reserves of both," Daniel Fels says. "We looked at what we could do with land and water and an extremely efficient use of both is aquaculture – and when we see what has happened to aquaculture in the rest of the world (Figure 5) it starts to really resonate."

Case-by-case

Nigel Preston explains aquaculture development is still largely a state issue and therefore development of the industry has been variable across the country. In Tasmania and South Australia, relatively clear policy and zoning is

FIGURE 2 REGIONAL AQUACULTURE AS A PERCENTAGE OF GLOBAL PRODUCTION 2010



SOURCE: FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS (FAO), THE STATE OF WORLD FISHERIES AND AQUACULTURE 2012

in place for the sustainable development of aquaculture, but in other states industry has faced challenges involving complex legislation and an array of agencies to work through.

The success of Tasmania and SA's aquaculture zones for the high-value species salmon and tuna, respectively, is reflected by 2010–11 figures published by the Centre for International Economics (CIE). It shows Tasmania produced about 46 per cent of Australia's total aquaculture production followed by SA at about 24 per cent (Figure 6).

Marine Farming Development Plans in Tasmania cover more than 10,000 leasable

hectares and over the past decade growth in the Tasmanian aquaculture industry has averaged about 14 per cent – the highest of all Australian states and territories, according to the CIE report. Queensland has the second-highest growth rate (at four per cent),

despite a regulatory framework that is relatively complex, involving multiple agencies across all three levels of government – local, state and Commonwealth, the report says.

Australian Prawn Farmers Association executive officer Helen Jenkins cites the complex system compounded by environmental regulations regarding the Great Barrier Reef as a deterrent to development in Queensland. No new prawn farms have been approved in the state for more than a decade.

A Queensland Competition Authority (QCA) review is investigating options for reforming regulation of the state's aquaculture industry. Helen Jenkins has welcomed the review, saying she believes there is potential to expand prawn production from its current area of 692 hectares in Queensland to 5000 hectares without negative environmental impact.

"This industry sector has campaigned long and hard for a regulatory approach that facilitates expansion ... while balancing environmental protection," she says.

The Project Sea Dragon team has also put a submission to the QCA review and Daniel Fels says he is optimistic about prospects in Queensland.

The process for development in northern Australia is complex, but the company has been working carefully with state and federal governments, land owners and other stakeholders through a 'matrix' of issues involving Native Title, and the geophysical, employment, logistics and environmental sustainability, he says.

Meanwhile the Australian Government is producing a white paper on the development of northern Australia. Its terms of reference do not explicitly include aquaculture, but the secretary

FIGURE 3 AQUACULTURE PRODUCTION BY GLOBAL REGION

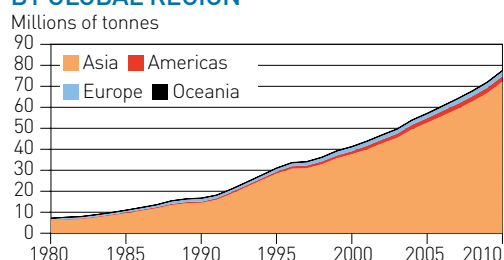


FIGURE 4 WORLD AGRIFOOD DEMAND

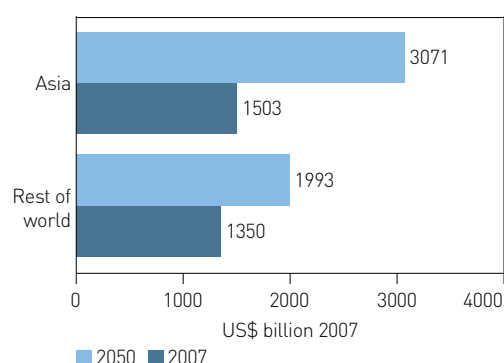


FIGURE 5 GLOBAL CAPTURE AND AQUACULTURE FISHERIES PRODUCTION

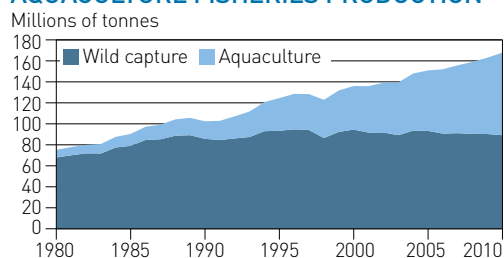
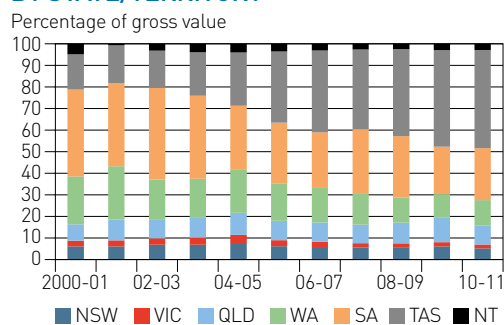


FIGURE 6 AQUACULTURE PRODUCTION BY STATE/TERRITORY



to the Minister for Agriculture, Senator Richard Colbeck, has aquaculture on his agenda. "Our policy is to create a national aquaculture strategy," he says.

The National Seafood Industry Alliance has made a submission to the process.

Chris Calogeras, chief executive officer of the Australian Barramundi Farmers Association, assisted the alliance with its submission and says aquaculture is implicit in agricultural development.

In its submission, the alliance says northern Australia has great potential for further aquaculture development but convoluted legislation emanating from overlapping agencies and state legislation lacking defined pathways for sustainable growth have been major obstacles.

Chris Calogeras says a national development strategy for aquaculture would benefit industry. "If we could get a national agreement around priorities or a policy it would make it easier, but each state has its own issues to deal with," he says.

There is the potential for expansion of

farmed Barramundi, but crucial to growth is that a solid underlying policy and legislative framework is established first, he says. This would relate not only to environmental issues but also to workable regulatory regimes involving logistics, workforce agreements and training. In addition, marketing strategies need to be developed to ensure that additional production can be absorbed into and grow the market.

Indigenous Australians must also be part of the conversation about expanding aquaculture in northern Australia where developments take in their land and waters, says Chris Calogeras, who also provides support to the FRDC's Indigenous Reference Group.

"Our focus on an industry level is to get the existing structure right so that people can operate effectively and efficiently, and that will drive development," he says. "There's massive potential but if we head off without getting the bones of it right, it could be fraught." **F**

APPLICATIONS OPEN FOR PRIMARY PRODUCTION STUDY SCHOLARSHIPS

The FRDC will again sponsor the Nuffield Australia Scholarship program, with applications closing for the 2015 scholarships on Monday 30 June 2014.

Nuffield Australia chair Andrew Johnson says a total of 25 scholarships are on offer, sponsored by a range of leading primary industry and business organisations.

Commercial fisher Wayne Dredge, from Lakes Entrance in Victoria, was awarded a 2014 Nuffield Scholarship, jointly sponsored by the FRDC and Woolworths. His study program will research methods of hook-based fishing compared to gill-net fishing for Gummy Shark (*Mustelus antarcticus*), taking into account environmental impacts of the different fishing techniques, with visits to Canada, New Zealand and Norway.

As owner and operator of the vessel *Opal Star*, Wayne Dredge spends up to eight months a year at sea, with an average annual harvest of 15 tonnes of Southern Rocklobster (*Jasus edwardsii*) and 25 tonnes of primarily Gummy Shark. Other catch includes octopus, some scale-fish and crabs.

Nuffield Scholarships provide a six-week global focus program for primary producers and managers, looking at the latest developments and trends in agriculture. It also includes up to 10 weeks of individual study that allows scholars to pursue a particular area of interest.

Writing from on the road, Wayne Dredge says the scholarship has taken him from shanty towns in South Africa, to a school run by a former Kenyan Army Major General and national hero. He has visited one of the last great cattle ranches of east Africa and dined with a Russian oligarch who was agriculture minister during the Chechen War in 1999. He has travelled through the old Eastern Bloc of Europe to the last of the major European manufacturing powerhouses in Germany, to the corridors of power in Washington, DC, and to the very centre of US agriculture, in Nebraska.

"Having finished the global focus program, I'm now studying the seafood markets of the city that never sleeps. What does this have to do with commercial fishing in Australia? The answer is everything. Lessons learned from other production sectors are invaluable and it is this that Nuffield offers better than anyone."



FRDC-sponsored Nuffield scholar Wayne Dredge

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Engagement to underpin marketing development

CONSULTATION TIME

The FRDC is also revising two major strategic documents over the next 12 months – the National Fisheries and Aquaculture Research, Development and Extension Strategy and the FRDC's Research, Development and Extension Plan – for release in 2015. The FRDC is conscious of the need not to burden stakeholders with multiple requests for input or participation in planning meetings. To minimise this, the FRDC will aim to align planning activities where possible. This will allow for cost savings in meetings and ensure that discussions are linked, providing a holistic discussion around the FRDC's RD&E investment strategy.

ILLUSTRATION: KEN UCHIDA

MARKETING With diverse stakeholders, creating the right links between research and marketing will be a challenge for the fishing and seafood industry

How will the FRDC develop a marketing function? This may seem like a simple question but to do it right and to meet the needs of a diverse range of stakeholders – including commercial, recreational and Indigenous fishers who all have different views and business needs – means it is not an easy task.

The *Rural Research and Development Legislation Amendment Bill 2013* was passed by Federal Parliament on 12 December 2013. It extends the scope and range of activities the FRDC can undertake by amending its enabling legislation, the *Primary Industries Research and Development Act 1989* (PIRD Act). The legislative changes now allow the FRDC to connect and activate research, development and extension with marketing, as part of a natural progression to improve outcomes for the industry.

The FRDC sees its initial role in marketing as around consulting, engaging and communicating with the industry to gain understanding of what end users want from a collective and stakeholder-specific marketing function.

Through stakeholder engagement, by the end of 2014 the FRDC hopes to have a good idea of the initiatives that the industry as a whole is willing to support – for example,

increasing recreational participation rates or seafood consumption and addressing sustainability questions, says Peter Horvat, FRDC communications, marketing and trade manager.

Peter Horvat says a critical outcome of the engagement process is to develop a business case that clearly demonstrates 'What's in it for me?' – showing individuals within the industry the potential and likely benefits of marketing. The Australian seafood industry is diverse and complex and, while many in the industry face similar issues and drivers, it is unlikely that one generic business model will be sufficient to meet all stakeholder needs.

Information is the key

"A key activity for the FRDC in the coming year is to identify gaps in industry data and knowledge to inform industry end users. Information and data should be the foundation for all marketing activities. Without it stakeholders are flying blind when it comes to their investment," Peter Horvat says.

"There are several different areas we are looking at, to build up our knowledge in. For example, at present, many sectors within the commercial seafood industry do not have a good baseline set of trade or production figures."

Peter Horvat says the key areas the FRDC is trying to understand better are:

- industry production volumes – by sector, fishery and region, and pathways to market;
- real-time supply-chain data – volumes,

venues and prices along the chain, from the producer, processor, wholesaler and retailer;

- export countries; and
- consumption or participation data.

Getting access to and understanding basic production figures is just as important as understanding what a consumer wants. This basic data can show how often a consumer is buying a product, when they are purchasing and the price. This information alone provides some real insight into opportunities for marketing.

Just as the data provides a base from which to develop a marketing activity, it also provides a way to evaluate it. For example, if a sector undertakes an activity designed to increase the price or rate of consumption without knowing the current rates, it will be difficult to know whether the activity has been successful.

The FRDC is now assessing how much information and data is available, what information could potentially be collected and how to do it in an efficient and cost-effective way.

Thanks for the thoughts

"Several stakeholders have contacted me with ideas and suggestions about marketing, which has been really valuable," Peter Horvat says. "Their comments and specific issues raised have been added to the list of areas the FRDC needs to follow up on." **F**

If you have any comments, thoughts or questions about seafood marketing, please contact Peter Horvat (peter.horvat@frdc.com.au).



Sunrise over Lakes Entrance,
Victoria.

PHOTO: www.123RF.com

Strategy to set common vision

POLICY Stakeholders are being asked to have their say in setting priorities for investment in fishing industry research

Over the next 12 months the FRDC will be coordinating the development of two different but equally important documents. These are the National Fishing and Aquaculture Research, Development and Extension (RD&E) Strategy and the FRDC's RD&E Plan.

The National Fishing and Aquaculture RD&E Strategy is nationally focused and builds on the first strategy, which was developed in 2010. The next iteration will build on this platform and provide a nationally agreed, common vision for the industry over the next five years, guiding the investment of millions of dollars of state and national research funding.

Underpinning the national strategy is the desire to expand the fishing and aquaculture industries while maintaining high standards for management and sustainability. The strategy will seek to improve the focus, efficiency and effectiveness of fisheries and aquaculture RD&E across all Australian jurisdictions and funding sources.

Potential performance measures could include targets for increased production

volumes of value of Australian seafood, and increased participation in recreational fishing.

Changes to the research environment during the life of the current strategy that may influence the new national strategy include a significant reduction in the number of fisheries research facilities, particularly in eastern Australia, which places collaborative research higher on the agenda.

Globally, aquaculture has been expanding rapidly in recent years, particularly in Asia, and production volumes now exceed those from wild-catch fisheries. However, growth of the industry in Australia has been comparatively limited.

A specialist Strategy Governance Committee, run by the FRDC, will help oversee the development of the National Fishing and Aquaculture RD&E Strategy. Membership of this committee comprises fisheries managers and peak industry bodies from across all Australian jurisdictions. This committee met in Canberra in May.

At the same time, the FRDC is also coordinating the development of the FRDC RD&E Plan, which is focused on FRDC business and future investment.

Joshua Fielding has joined the FRDC as a project manager and is responsible for coordinating stakeholder engagement for both documents.

"We are conscious that there is a lot of consultation going on this year, with the national strategy, the FRDC's strategy and also the FRDC's marketing engagement strategy," he says.

The formal consultation for the FRDC RD&E Plan began with a workshop in April 2014 involving the FRDC's representative stakeholder groups and members of the Fisheries Research Advisory Boards.

Industry consultation on the development of both the national strategy and FRDC RD&E will occur over the next six months.

"Even though there are some formal consultation points, such as organised meetings, it is important for ongoing consultation, with multiple opportunities to ensure our stakeholders have input," Joshua Fielding says.

The FRDC's executive director Patrick Hone says the new FRDC RD&E Plan should be "deeper, not wider" than the current strategy. "We need more targeted investment in research and some clear indications about the success of the strategy, more specific outcomes and performance measures," he says.

As part of industry input into the national strategy and FRDC plan, graduates of the 2013 National Seafood Industry Leadership Program are also organising online discussion forums and will hold a 'think tank' in July. The contribution of young industry leaders is expected to include both practical considerations and 'blue-sky' thinking about the future of Australian fisheries.

Other information to assist the development includes an update of the sector-by-sector overview of the fishing industry that was completed in the lead up to the 2010–15 strategy. The update will be completed by Ewan Colquhoun, director of Ridge Partners. It will detail where the Australian fishing industry is based, the demographics of the people involved, who is catching what and where, and the industry's direct and indirect employment.

The updated overview will also provide information on some of the aspirations of the industry, which should help in forming RD&E priorities for the next five years. This project will rely heavily on input from industry representatives and experts and will work across all sectors (Indigenous, recreational, aquaculture and commercial fishing).

Peter Chudleigh from Agrtrans Research and Consulting will also provide a cost-benefit analysis of the 14 themes of the current FRDC RD&E Plan, which will help assess the success of the FRDC RD&E Plan. **F**

TOURISM PROVES A TASTY SIDE DISH

AQUACULTURE The tourist dollar is helping to keep this Queensland fish farm buoyant as it works towards expanding production of its award-winning Barramundi

By Rebecca Thyer

The opportunity to catch an iconic Barramundi (*Lates calcarifer*), weighing anything up to 10 kilograms, has proven a drawcard for enthusiastic tourists and fishers alike at this Far North Queensland aquaculture farm.

For the past two years, Daintree Saltwater Barramundi (DSB) has been operating a special grow-out pond as a recreational fishing experience.

Manager Mark Hober says it has provided an opportunity to promote Barramundi and aquaculture in general, plus an important second revenue stream, supplementing the company's main fish-farming operation.

The farm is in a popular tourist spot. On its doorstep it has the Daintree Rainforest, Australia's largest continuous tropical rainforest, and the Great Barrier Reef World Heritage Area.

"We're in a busy tourist area and had people pulling in and wanting to catch a fish. So we listened to that, looked at the flow of traffic going past and decided to give the tourists what they wanted," Mark Hober says.

DSB's 'Hook-A-Barra' tourism venture opens every day. In a designated pond in

front of the new reception area, the biggest Barramundi, including some rare albinos, can be found tempting tourists as they swim with Mangrove Jacks (*Lutjanus argentimaculatus*).

Tourists are supplied with rods and reels and a guide talks them through the species, aquaculture and the art of fishing. "Many tourists have already unsuccessfully attempted to catch Barramundi in the Daintree River so they're keen to give the pond a go," Mark Hober says.

As everyone wants to catch a fish, Hook-A-Barra will often take those struggling with the big Barramundi to another pond where smaller fish can be caught. On peak days, during school holidays, Hook-a-Barra attracts 30 to 40 visitors. During non-peak times, the tourism venture attracts about 10 to 15 visitors daily. Most tourists catch and release the fish, although they can take home their catch for a per-kilogram fee.

DSB has also started building an aquarium to show tourists other fish and explain the Barramundi life cycle. "It looks fantastic and we do get repeat visitors," he says. With its own Facebook page (search 'Hook-A-Barra'), the team is also reaching people via social media.

Rain, hail or shine, Barramundi harvesting goes on.

PHOTOS: FRDC



PHOTOS: FRDC



Marty Phillips, president of the Australian Barramundi Farmers Association, oversees the harvest at his farm, PEJO Enterprises.

Award-winning flavour

As an aquaculture business, last year DSB produced 90 tonnes of Barramundi: two-thirds whole fish and one-third plate-sized fish.

Fingerlings are purchased from local hatcheries and raised in salt water sourced from the Daintree River. They are grown-out in large earthen ponds from 100 millimetres to commercial size over 12 to 18 months.

Its plate-sized fish (400 to 800 grams) and whole fish (two to four kilograms) both won gold and champion exhibit awards at the Sydney Royal Fine Food Show in 2013, for the fourth consecutive year.

Mark Hober credits the local environment for the prize-winning Barramundi. "Our location, the soil and the dynamics of the pond make it ideal for growing Barramundi. The weather never gets that cool – we only ever get as low as 20°C overnight.

"We use the same fish feed as other producers and minimise fish stress when they are being handled, which other producers do too. I might drive the operation but it's the farm that produces such high-quality fish."

It is an achievement the business is keen to capitalise on, by expanding production. And there is plenty of room to expand. Operating from a 49-hectare site, DSB has only three hectares of ponds.

Expansion plans

Mark Hober, who has run the farm, at Wonga Beach, 17 kilometres north of Mossman, Queensland, for more than a decade, has spent the past few years consulting with various regulatory bodies to expand the farm's pondage and increase production.

"We have engaged a consultant about increasing productivity and we need to increase the size of the farm to be viable and profitable, but it is something we have found difficult. There is a lot of red tape," Mark Hober says.

Ironically, the farm's surroundings – which help it produce award-winning fish and also bring in tourists – are also the key point of contention in development plans: aquaculture producers bordering the Great Barrier Reef Marine Park are subject to strict regulations, especially in relation to wastewater discharge.

As a local, Mark Hober grew up fishing in the Daintree River, and recognises the value of the farm's surroundings; it is a point he is keen to share with the many tourists who visit Hook-a-Barra.



Mark Hober

He previously worked as a diesel mechanic in the region's sugar mills, before turning his engineering skills to rebuild production at DSB 10 years ago, when he stepped into the manager's role.

"We had 13 ponds, an aquaculture licence and approvals, and I learnt how to keep the Barramundi alive. About 75 per cent of it is engineering – with all the pumps, electric motors, electricity supply, water supply," he says.

Following a change in ownership in 2010 infrastructure has again been upgraded: "We have improved roads, installed more efficient drainage, more energy-efficient pumping systems and built new facilities – in particular tourist facilities."

However, increasing production remains the major focus of efforts to grow the business, and Mark Hober says he will continue to work through the red tape to expand operations at the current site. **F**

Hook-A-Barra Facebook page: www.facebook.com/pages/Hook-A-Barra/324223257642003

THE ICONIC BARRA

Barramundi (*Lates calcarifer*) farming is the second largest aquaculture activity in Queensland after marine prawn farming. Barramundi are grown in a variety of culture systems across Australia. Pond-based systems are used in the Northern Territory and Queensland to produce a range of fish sizes. In Western Australia, there is one sea-cage operation producing larger fish. Southern states use recirculating or flow through tank-based systems to produce plate-sized live and chilled fish. Most of the product is marketed to domestic wholesalers and supermarket chains as whole fish or fillets, but export markets are becoming more important. The main market is for larger fish (two to three kilograms), which require a second grow-out season. Plate-sized fish (400 to 800 grams live or chilled) still account for a significant portion of sales and can be produced within a year.

SOURCES: CHRIS CALOGERAS, EXECUTIVE OFFICER, AUSTRALIAN BARRAMUNDI FARMERS ASSOCIATION; www.business.qld.gov.au





Economics vital to fisheries health checks

ILLUSTRATION: PAUL DICKENSON

ECONOMICS With the health and wellbeing of fisheries, fishers and entire communities at stake, fisheries economists argue that more than a 'gut feeling' is needed when considering the financial and social implications of policy decisions

By Bianca Nogrady

How do you judge the health of a fishery? Many people immediately think of the health of the fish and whether they are being harvested in a sustainable fashion, or the impact of harvesting on the environment.

But for fisheries economist Caleb Gardner from the University of Tasmania (UTAS) Institute for Marine and Antarctic Studies there is much more to fisheries than their ecological health and wellbeing.

"If the only objective of fisheries management were to concentrate on sustainability, then we

could just halve catches across all the fisheries and solve that," he says. "But that would be a really poor outcome economically, so clearly there's more to the game than just sustainability."

This is where fisheries economics comes in, he says. While it may be viewed as the poorer cousin of biological research, he argues that fisheries economics is just as essential for good fisheries management.

"Before I had economic training I participated in a lot of fishery management committees dealing with issues such as setting quotas where my role was to provide biological advice, but we tended to face decisions that were not just about biology but also about economics," he says.

"I was finding that we tended to have pretty good information about biology based on good research, yet most of the economics decisions just got made off the cuff or by people's gut feelings around the table. It didn't match the level of detail that we'd put into the biology."

Caleb Gardner has mainly worked with Southern Rocklobsters (*Jasus edwardsii*),

where he sees considerable opportunity for the application of fisheries economics.

Economically, rocklobsters sit in a middle ground between fisheries such as abalone – which are cheap to catch but fetch a high beach price – and prawns – which generally cost a lot more to catch but have a relatively low beach price. Caleb Gardner says this allows plenty of room for informed adjustments to the fishery such as improved quota setting or setting rocklobster size limits in some areas.

"There's quite a large performance gap in current management of rocklobsters," he says. "Most of the rules in place for rocklobsters were set up historically, based on biology, without formal economic input and so if you start applying some economic analysis then it's pretty easy to find some big improvements."

He says analysis generally involves trying to quantify the economic yield from the fishery, then looking at the impact of different ways of managing the fishery.

"That might involve asking simple questions about the existing rules – what would happen

if you had a different quota, or a different season or a different size limit? What happens to the economic yield from the fishery? Can we improve economic benefits from the fishery and also make improvements in other aspects of the fishery, such as higher egg production?”

Making trade-offs

Having the input of fisheries economics to decisions about the management of fisheries is particularly important today, when there are many competing interests jostling for a piece of the resource pie.

Sarah Jennings, of the Tasmanian School of Business and Economics at UTAS, says the question of resource allocation among competing uses is central to fisheries management and that this is where economics really shines.

“Economics is all about how people make choices when decision-making involves trade-offs, and about how people’s decisions change when we change the costs and benefits they face,” Sarah Jennings says.

“The trade-offs are just going to get more intense as we recognise that the marine environment underpins a multiplicity of values to a wide range of people.”

While marine resources are the basis of valuable commercial and recreational fisheries, they also hold significant cultural, ecological and environmental value.

Sarah Jennings believes that while, in general, the calibres of fisheries management and governance in Australia is good by world standards, we need to think more broadly about what the notion of a sustainable fishery really means.

Ecological sustainability is only one part of the puzzle. Sarah Jennings maintains that we also need to consider the economic and social sustainability of fisheries right from the fish-capture stage to markets.

“Add to this the fact that marine resources will come under growing pressure from increasing demand for seafood as the population grows, and from changes in the abundance and distribution of fish due to climate change, and it’s clear that we find ourselves working in a dynamic environment characterised by complexity and uncertainty.”

Research opportunities

Sarah Jennings believes this makes fisheries economics an exciting area for students and young researchers to be working in. There are research opportunities in areas as diverse as how moving to a fisheries target of maximum

economic yield affects the environment, how oyster farmers can adapt to climate change, identifying the drivers of overcapacity in open access fisheries and what qualitative models can tell us about the stability of marine systems.

A forum (www.fishecon.org) has been created to strengthen research in the area of fisheries economics. The forum allows fisheries managers and PhD students to share research ideas and results, identify research opportunities and plan for events.

Sean Pascoe, a marine resource economist at CSIRO, has been working in fisheries economics for more than 25 years.

Much of this work has involved developing models for different fisheries to look at how many boats should be in the fleet, what they should be catching, how they should be catching it and when they should be catching it.

He has recently been working with the Queensland Government and industry to look at the economic, social and environmental outcomes of a range of potential management scenarios for the east coast prawn trawl fisheries with the aim of identifying the best approaches for the long term.

This is particularly important in prawn fisheries, where the prices for prawns have been falling substantially over the past few decades while fuel prices have kept rising.

“Fishers respond to the incentive that managers create, and different management structures create different incentives, some of which can be very beneficial in economics and some of which can be very bad,” Sean Pascoe says.

“Failing to take into account these incentives has resulted in quite a few fisheries in Australia being very biologically sustainable but economically very unviable and that’s particularly the case in Queensland – biologically they’re fantastic, economically many fishers are desperate to get out as they’re not doing very well.”

Economic reference points

Another challenge for fisheries is knowing what the goal posts are in terms of fisheries management – working out the target fishery biomass to achieve the best economic performance for the fishery.

Sean Pascoe has just finished a two-year FRDC-funded project (2011/200) using modelling to help develop some proxy economic reference points for both single and multi-species fisheries.

“We wanted some sort of way of estimating what the relationship is between the biomass at maximum sustainable yield and the biomass

at the maximum economic yield to put in as a management target so we know to what extent we need to pull back effort or increase it,” he says.

“Many fisheries don’t have sufficient data to build the models you really need to come up with these estimates for, say, optimal catches, optimal biomass levels, with any great precision. For some of the really small fisheries, the actual cost of building those models would probably exceed their value.”

One of the key challenges for the field of fisheries economics is securing funding, Sean Pascoe says. “Research funds are tight, competition with more traditional biologically focused research is high, and often we find ourselves with fewer resources than we need to do the work properly.”

International conference

Sarah Jennings says that thanks to investment from organisations such as the FRDC, capacity in fisheries economics is growing in Australia. One indication of this is the selection of Australia as host for the biennial International Institute of Fisheries Economics and Trade (IIFET) Conference 2014 in Brisbane in July (<http://iifet2014.org>). It is being jointly organised by CSIRO, the Queensland University of Technology, UTAS and the University of Adelaide.

This is the premier international fisheries economics conference, and will bring together more than 300 of the world’s best fisheries economists to both learn what has been happening here and to relate research findings in their own countries.

However, despite increasing numbers of practitioners, Sarah Jennings says that there are still many challenges ahead to make sure that fisheries economics becomes as routinely used as fisheries biology in fisheries management.

One challenge is for fisheries economists to better understand the interface between science and policy so they can provide answers tailored to the needs of policymakers. Another is to learn to work in a multidisciplinary environment.

“Fisheries are part of really complex and vital linked biophysical and human systems and if we are going to be able to provide strong scientific input into decision-making then we are going to have to find ways of integrating data and models across the social and physical sciences,” Sarah Jennings says.

“Bringing these disciplines together with the more traditional areas of fisheries science to make sure that when decisions are made that they take into account that whole spectrum of biophysical and human considerations is something that will keep us striving.” **F**

New approach heads off fish deformities

AQUACULTURE Granite-patterned tanks have become the latest 'must have' in hatchery equipment, where the decor is proving critical in addressing fish behaviour that has inhibited production

By Rose Yeoman

Australia's annual production of farmed Yellowtail Kingfish (*Seriola lalandi*) from sea net pens is on the rise and is expected to soon exceed 1500 tonnes, with a potential value of about \$24 million a year.

It is anticipated that further development in South Australia, Western Australia and New South Wales will bring production capacity to about 8000 tonnes a year within the next decade.

Based on SA's Eyre Peninsula, Clean Seas Tuna is one of Australia's leading producers of farmed Yellowtail Kingfish, but has been challenged by pervasive and persistent fish-health and deformity issues that have hindered viability.

In 2005, Canadian fisheries veterinarian Mark Shepphard, Sakana Veterinary Services, published an FRDC-funded report (2003/216) that focused on the detection and management of health issues in Yellowtail Kingfish. He stressed that the ability to control the natural environment and stressors inherent in raising fish in captivity is critical to success. Among the 'moderate risk' issues were head and jaw deformities and swim bladder deformity.

The cost and inconvenience of these issues has been high in terms of post-handling mortality, lost growth and performance and the elevated labour cost of counting, culling and disposing of dead or compromised fish.

For Clean Seas Tuna, 2013 was a landmark year. A research breakthrough that led to altered hatchery practices significantly improved the deformity and survival rates of Yellowtail Kingfish larvae. For the first time in nearly a decade, no additional staff was needed to hand cull deformed Yellowtail Kingfish fingerlings at the company's commercial hatchery at Arno Bay, SA.

Clean Seas Tuna CEO Craig Foster describes the new knowledge as a "game changer".

"Prior to 2013, on average 30 per cent of Yellowtail Kingfish were culled by hand sorting at 50 to 60 days post-hatching to eliminate fingerlings with severe jaw malformation," he says.

"Between 2008 and 2013, with more than \$2.5 million support from the Australian Seafood Cooperative Research Centre (Seafood CRC) and the FRDC, our hatchery manager Bennan Chen and his R&D team conducted a series of experiments to investigate the causes of the high levels of variability in the survival, growth and malformation rates of Yellowtail Kingfish larvae that caused 'bottleneck' issues in larval rearing."

Critical to this research was the development of a strategic research plan for Yellowtail Kingfish in 2003. This plan integrated results from past research conducted by Wayne Hutchinson from the South Australian Research and Development Institute (who early on determined that deformities could be affected by addressing tank colour) and Jenny Cobcroft from the University of Tasmania, who had worked on the causes of deformity in Striped Trumpeter (*Latris lineata*) and other species. Research has shown that tank design, management and colour were critical in resolving the jaw-deformity problem.

Jenny Cobcroft worked closely with the research team at Clean Seas Tuna to transfer the knowledge from the previous research and to develop the strategic plan, which included the construction of a dedicated larval-rearing research facility funded by the Seafood CRC within the Clean Seas Tuna hatchery at Arno Bay.

Jaw malformation

Bennan Chen explains that studies of other fish also showed 'walling' behaviour, where larvae congregated around the outer walls of the tank, indicating that it was not a disease or breeding health issue

causing deformities but rather a physical issue caused by larvae banging into tank walls.

"So we set out to determine if we could moderate the walling behaviour of Yellowtail Kingfish larvae by changing the colour or pattern on the wall of the larval rearing tank," he says.

In December 2012, preliminary trials were set up to assess a range of different coloured tank walls and tank wall patterns, as well as different light conditions. Walling behaviour was qualitatively assessed by visual observation throughout the day.

Bennan Chen says walling behaviours were more apparent at the beginning and end of each day but the most interesting discovery was that tank colours and patterns that reflected high levels of light reduced the incidence of walling behaviour.

Clean Seas Tuna then moved into the next research phase and began a full replicated trial to investigate links between reduced walling and growth, survival and incidence of jaw deformity during Yellowtail Kingfish larval rearing.

Four hatchery tank wall treatments were investigated: glossy green, non-glossy green, yellow and 'granite' – a motif created from an adhesive plastic film or by painting the tank wall.

No significant difference in larval growth rate was observed between any of the tank wall

colour or pattern treatments over the 23-day trial, but Bennan Chen says there was a significant difference in survival (Figure 1) and jaw malformation of larvae (Figure 2), with jaw deformity reduced from 30 per cent to about three per cent in granite-patterned tanks.

It has been suggested that the granite pattern, made up of random light and dark brown, black and grey irregular shapes may reflect light of different wavelengths and is thus perceived by the larvae as a structure to be avoided.

Bennan Chen notes that improved larval survival may be the result of larvae spending

"So we set out to determine if we could moderate the walling behaviour of Yellowtail Kingfish larvae by changing the colour or pattern on the wall of the larval rearing tank."

– Bennan Chen

PHOTOS: CLEAN SEAS TUNA



Tank colours and patterns used to test frequency of nose-walling behaviour in Yellowtail Kingfish larvae: (from left) glossy green, granite film and painted granite.

less time in futile walling behaviours – as they are able to perceive the water and wall boundary – and more time in the water column searching for food and feeding.

The reductions in the incidence and severity of jaw deformity (Figure 2) in granite-patterned tanks compared with the original glossy-green tanks was maintained in different sized tanks, including 8000-litre commercial Yellowtail Kingfish larval rearing tanks.

Craig Foster explains that larval jaw elements in bony fish remain soft from first feeding until metamorphosis at 15 days post-hatching. “We now think physical damage to oral membranes caused by walling in the two weeks post-hatching is a dominant factor in jaw malformation.”

Research outcome

Craig Foster says a jaw deformity rate of less than three per cent can be managed by Clean Seas Tuna grow-out production without hand-sorting individual fish, as had previously occurred.

“Manipulating tank wall colour and lighting conditions to reduce walling behaviour has resulted in more high-quality fingerlings being produced more cost-effectively. The key outcome of Clean Seas Tuna research has been the doubling of hatchery productivity, which has laid the foundation for a further doubling of overall productivity,” he says.

Bennan Chen and Craig Foster will present their research results at the World Aquaculture Adelaide Conference, in June. **F**

HATCHERY MANAGER BENNAN CHEN

As a graduating PhD student from the Aquafin Cooperative Research Centre (CRC), Bennan Chen has been conducting postdoctoral research through the Australian Seafood CRC. His work has already provided significant productivity improvements for the industry.

Both CRCs have been committed to creating ‘industry-ready graduates’. Bennan Chen is an excellent example of the initiatives undertaken by the CRCs to ensure graduates obtain pertinent knowledge about the seafood industry through student training, mentoring and opportunities for students to link with industry through internships and on-site training.

FIGURE 1 SURVIVAL OF YELLOWTAIL KINGFISH LARVAE CULTURED IN TANKS WITH DIFFERENT WALL COLOUR AND PATTERN TREATMENTS AT 23 DAYS POST HATCHING

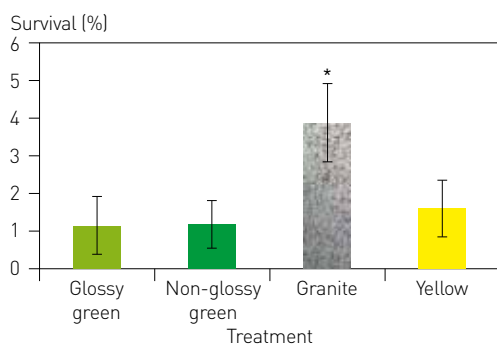
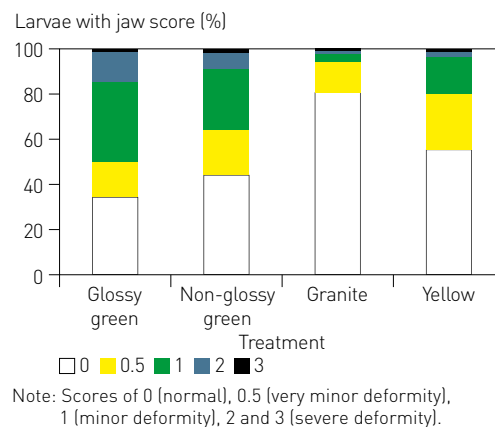
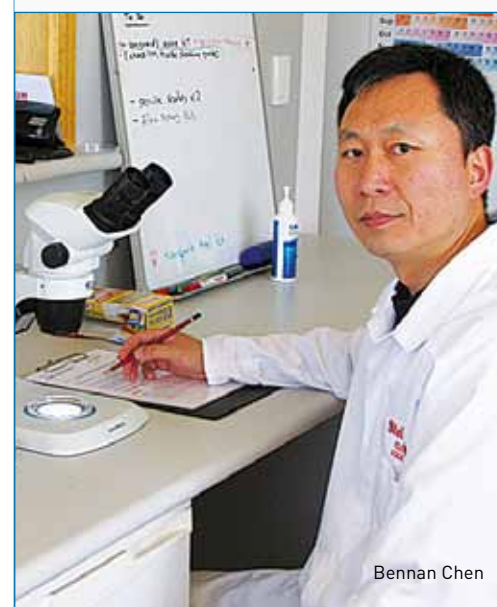


FIGURE 2 PROPORTION OF YELLOWTAIL KINGFISH LARVAE WITH JAW MALFORMATION IN TANKS WITH DIFFERENT WALL COLOURS AND PATTERNS AT 23 DAYS POST HATCHING



SOURCE: CLEAN SEAS TUNA



Bennan Chen

WESTERN CONVERGENCE

RESEARCH Research agencies join forces to lift the veil on the influences of the Indian Ocean

By Emily Weekes

Stretching from Australia to Africa, and north towards Asia, the Indian Ocean is the third largest of the world's five oceans. It is also one of the least explored.

Four of Australia's leading research organisations have united to help redress this knowledge gap, creating the Indian Ocean Marine Research Centre: the Australian Institute of Marine Science (AIMS), CSIRO, the University of Western Australia (UWA) Oceans Institute and the WA Department of Fisheries.

WA has already recognised 21,000 kilometres of its Indian Ocean coastline as a 'biodiversity hotspot'. At least 80 per cent of marine life in this region is found nowhere else. At the same time, the Indian Ocean is providing an increasing proportion of non-living resources such as gas and oil. Maintaining the health of these complex marine environments, in conjunction with industry development, is essential to the economic growth of Australia and neighbouring countries.

The new collaborative research centre has been bolstered by a \$34 million grant from the Australian Government's Education Investment Fund, along with sizeable contributions from each of the centre's partners. More than 240 researchers from across the four organisations will work in residence together. They will collaborate

on a range of subjects from oceanography and fisheries to marine technologies and governance.

The centre will include a \$62 million purpose-built marine research centre at UWA's Crawley Campus, designed to meet a five-star Green Star environmental rating, and an \$11 million upgrade to the Department of Fisheries' Watermans Bay marine research facility. This upgrade will feature flow-through seawater aquaria in which experiments can be conducted.

Collectively, both sites will be known as the Indian Ocean Marine Research Centre. It will be the largest collaborative marine research partnership in the Southern Hemisphere and provide the largest marine research capability in the Indian Ocean rim.

Collaborative approach

Peter Davies, pro vice-chancellor (research) at UWA, is the chair of the Indian Ocean Marine Research Centre steering committee. He says as a collaborative research centre it will provide a stronger base from which to address the kinds of issues facing marine and fishing industries.

"The questions now are big and cross-disciplinary. We're not asking simple questions about where our fish live, it's how will climate change impact the distribution of that fish and how will it change its production? We thought that by collaborating we could do more than each organisation could do alone," Peter Davies says.

Research funding has also begun to favour multidisciplinary-focused projects, which has prompted the need for better structures for collaborations.

Stuart Smith, director-general of the WA Department of Fisheries, sees the centre as integral to building the state's marine research capability. "We're obviously interested in the fisheries side, but we're also interested in broader issues which are impacting the marine environment," he says.

He says identifying the cause of the recent decline in Western Rocklobster (*Panulirus cygnus*) recruitment is one area of fisheries management that has already benefited from a broader collaborative research approach.

Rocklobster response

In 2008, WA's Western Rocklobster puerulus monitoring program predicted a reduction in the rocklobster population. This was based on recruitment data gathered annually for more than five decades, which was known to be highly accurate in predicting the number of rocklobsters that would enter the fishery for harvest in three to four years.

"If we hadn't had the baseline data, combined with research capability and external collaborations to deal with the issue at the time, we probably wouldn't have been able to act," Stuart Smith says. "We weren't going to have any stock unless we did something about it."

In response, fisheries management nearly halved the total allowable catch to a record low, to protect the breeding stock and spread the catch of available rocklobster over the next three years. The fishery also changed from input control to a quota system, which enabled fishers to focus more on maximising their margins than their volume.

Today, the fishery is more profitable than it has ever been and breeding stocks are at record levels,



An AIMS scientist conducts a baseline survey of Scott Reef.

PHOTO: AIMS

far above the long-term average, Stuart Smith says. Research collaborations established in 2008 to address the predicted resource decline confirmed that it was not caused by fishing pressure, but by changes in environmental and climatic conditions that were influencing fish stocks at the time.

“We’ve seen an enormous change in fisher behaviour coming out of a potential collapse of the fishery, along with outstanding results. We have strong capability in many marine research fields, and other players such as CSIRO and UWA provide substantial additional capabilities and resources, which makes working in collaboration really important for these initiatives.” He says the new centre will offer scope to expand these kinds of collaborative relationships.

CSIRO is also looking to expand its research partnerships and horizons in what is one of the world’s least explored marine environments.

The deputy chief of marine and atmospheric research at CSIRO, Tony Worby, says evidence shows that the Indian Ocean contains a large proportion of the world’s biodiversity and significant non-living resources.

While the region itself might be relatively unexplored, AIMS has been undertaking marine-focused research in WA for 20 years. Steve Rogers, AIMS science and business leader in WA, is confident that collaboration is the way forward and that the centre will provide practical opportunities to build on existing relationships and forge new partnerships to meet future challenges.

Shared space

“We’ve had joint research projects for many years, but there’s an increasing realisation that all of the different research agencies and

universities have to work together to be able to address the major issues,” Steve Rogers says.

“To physically locate all of those people in a single, purpose-built, state-of-the-art facility means we’ll have a focal point: a centre for the majority of the marine research undertaken here in WA.”

Stuart Smith agrees. He hopes that the centre will position Australia as a hub of expertise in marine research in the region and he foresees that the Watermans Bay facility, with the seawater flow-through, will be a distinctive drawcard for out-of-state researchers. “It’s a unique facility. While it’s in the city, it’s also located on the coast in an A-class marine reserve. It offers very high water quality in a metropolitan area, which isn’t possible in many other places.”

Researchers at the centre’s facilities will be asked to focus on the questions they’re trying

to answer, rather than on projects within their specific organisations. Common areas in each building have been designed to facilitate discussions; each floor is assigned by subject area, not organisation. “And it’s not just the collaboration in specific research projects we’re after, it’s that informal collaboration that is just as important,” Stuart Smith says.

With plans to expand AIMS research in WA, particularly in partnership with the offshore oil and gas industry, the institute recently entered into a five-year project with Shell and INPEX to help protect the marine environment from potential oil spills. CSIRO and UWA are also involved in the project. Steve Rogers sees the centre as having a critical role in facilitating this kind of research.

“At AIMS, we underpin and assist the industry and regulators in terms of the sustainable management of the marine environment, to minimise the impact of offshore development in what is now a major industry,” Steve Rogers says.

Career support

It is not just industry partners who will benefit from co-locating. Plans to engage AIMS and CSIRO specialists in PhD supervision are in place to help students develop different ways of thinking about their research questions and become better equipped for a career in the industry.

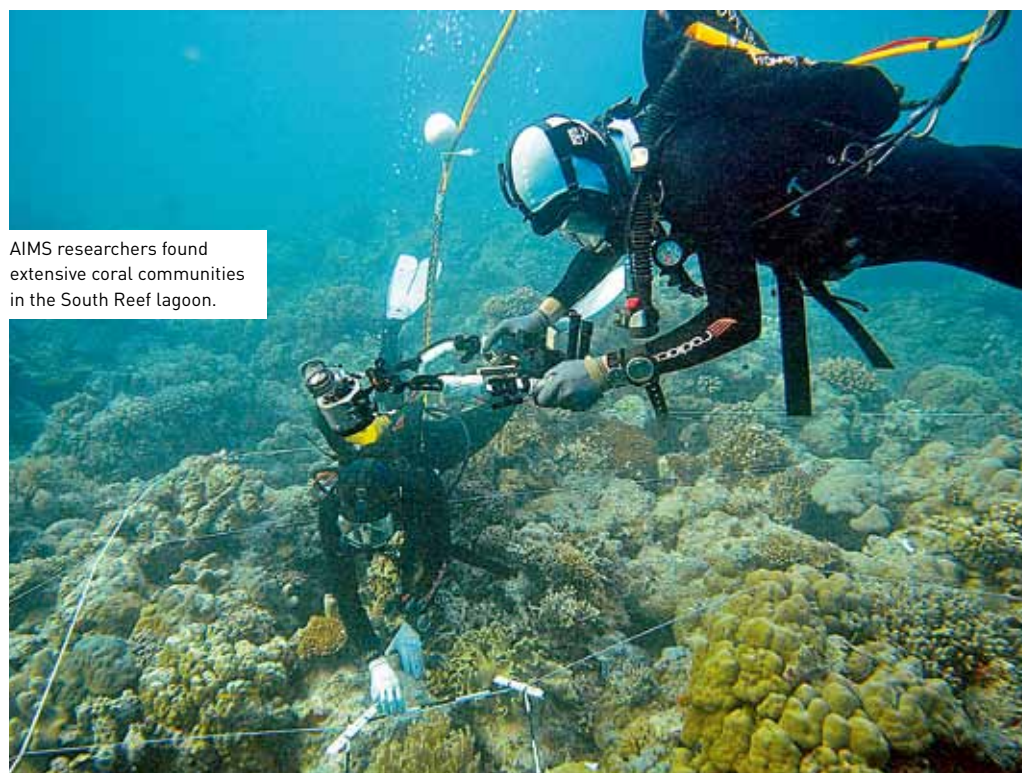
In his role as pro vice-chancellor of research at UWA, Peter Davies sees great value in having scientists who have not traditionally been involved in teaching located in the building and engaged in the teaching program.

“The more we can engage people in discipline areas, rather than institutions, the more chance we have of making some real inroads,” Peter Davies says. “When there’s competition, you have people hanging onto data and trying not to share. This is a very different way of operating. Gone are the days where a single researcher works alone and produces a paper.”

Peter Davies admits there may be challenges as each partner organisation will have its own goals and ways of measuring success, but is nonetheless excited about the potential for sharing expertise.

“The willingness to work together has been really encouraging. Each partner sees the value of being in a collaborative arrangement, rather than doing it alone, and I think we’ll see more co-location of agencies and universities in the future.” **F**

AIMS researchers found extensive coral communities in the South Reef lagoon.



PHOTOS: AIMS



SCIENCE FOR REEF MANAGEMENT

Initially established with a focus on the Great Barrier Reef in Queensland, for the past 20 years the Australian Institute of Marine Science (AIMS) has also undertaken research in Western Australia.

Today AIMS’s WA research is primarily in partnership with the offshore oil and gas industry, including projects on Scott Reef in northern WA with oil and gas company Woodside. “It’s work that both organisations are very proud of,” says Steve Rogers, science and business leader for AIMS in WA.

Scott Reef is made up of several oceanic reefs, which lie 200 nautical miles offshore. These occur where the ocean is 400 or 500 metres deep, sitting on top of a chimney of rock that comes up from the seabed to break the surface. As the reefs are so far offshore, they are not impacted by human activities such as river run-off or agriculture, which are some of the major pressures facing the Great Barrier Reef. This makes Scott Reef quite rare.

“These reefs are unique geological features,” Steve Rogers says. “We’re not quite sure what they are, but they’re ecologically very important because they make up some of the most pristine reef systems on the planet.” These reefs are considered global coral refugia, meaning that they offer the potential for reseeding damaged coastal fringing reefs from this pristine habitat.

The main focus of AIMS research at Scott Reef relates to its location, at the centre of major offshore liquid natural gas developments. AIMS helped oil and gas companies operating in the area to undertake habitat and baseline assessments, and establish long-term monitoring programs. This helps to ensure that the reefs can be sustainably managed as part of the companies’ operations.

“It’s not just environmental sustainability,” Steve Rogers says. “Economic and social sustainability around the use of our marine environment is important too.”



Small-scale fisheries focus for management workshop

FISHERIES MANAGEMENT Costs, resources and impacts: fisheries managers take on the challenge of finding the balance

Thirty-nine fisheries managers from all Australian jurisdictions met recently in Adelaide for a two-day workshop, with the management of small-scale fisheries as the main focus for discussion.

While the executive directors of the country's fisheries management agencies meet regularly, as the Australian Fisheries Management Forum (AFMF), there have been no regular meetings for operational managers and policymakers to discuss issues. The last national meeting of the country's fisheries managers was held in 1996.

Both the FRDC and the AFMF recognised the need for managers to be more aware of what was going on in other jurisdictions and at a national level. The FRDC sponsored the workshop through its Tactical Research Fund.

As well as awareness raising and networking opportunities, the workshop also provided a forum for the AFMF to consider the issue of cost-effective and efficient management of Australia's small-scale fisheries. This is a topic that the Fisheries Management Subcommittee of AFMF (composed of a senior fisheries manager from each jurisdiction) is working on.

The workshop brought together the collective knowledge and experience of a large group of managers, to help advise the AFMF on the issue of consistent, affordable and effective management methodologies for small-scale fisheries in Australia.

The workshop was facilitated by Ian Cartwright, and keynote speakers were Ian Curnow (chair of the AFMF), Richard Stevens (Australian Fisheries Management Authority commissioner) and Robert Stephenson (of the Canadian Fisheries Research Network).

The keynote addresses were followed by presentations on various national issues such as resource sharing, social objectives and indicators, National Harvest Strategy Guidelines, the National Fisheries Management Standard and the National Indigenous Fishing Strategy.

The afternoon of the first day provided an opportunity for several fisheries managers from various jurisdictions to present case studies on small-scale fisheries in their jurisdiction. Presentations highlighted both best-practice approaches and the challenges of small-scale fisheries.

On the second day, participants worked in groups on issues identified during the previous day's discussions. These included matching fishery capacity to the size of the resource, cost-effective monitoring and assessment, social licence and communications, Indigenous engagement in small-scale fisheries, resource sharing and stakeholder capacity building.

The Fisheries Management Subcommittee will draw on the outcomes of these workshop groups as it continues its consideration of small-scale fisheries management for the AFMF.

Following the workshop groups, fisheries managers from various jurisdictions gave presentations on innovative approaches to managing small-scale fisheries and how these innovations have assisted in the cost-effective and efficient management of the fisheries.

A steering committee has been formed to consider the establishment of a national association of fisheries managers, to build on the networking and awareness-raising resulting from the workshop.

The ideas and approaches considered at the workshop will be drawn together into a 'guideline' document for use by fisheries managers in implementing cost-effective and efficient management of small-scale fisheries. The diversity of small-scale fisheries is such that there is no 'one-size-fits-all' management solution. However,

SOCIAL FRAMEWORK DISCUSSIONS

A national workshop, also held in South Australia, in March, considered the practical implementation of social and economic elements in ecosystem-based fisheries management and integrated fisheries management frameworks.

This recognises the growing need to include social and economic objectives in fisheries management and to address public trust and confidence (to secure a 'social licence') in fisheries management processes.

More than 40 participants attended, including fisheries managers from around Australia, fishing industry representatives, and researchers with both national and international perspectives. Visiting expert Robert Stephenson from the Canadian Fisheries Research Network discussed the Canadian experiences related to ecosystem approaches to management, incorporating social and economic considerations, and arrangements for co-management and integrated management.

The workshop also reviewed what Australian jurisdictions are doing to integrate social and economic dimensions into fisheries management decision-making (including the commercial, recreational and Indigenous sectors). Participants reviewed recent experiences, with a focus on social and economic objectives and initiatives that generate broader community benefits. Key findings of the meeting will be released in June.

the guideline is expected to outline a broad range of policy and management options to help find solutions appropriate to jurisdictions. **F**



A national gathering of fisheries operational managers has helped to share ideas about best-practice approaches.

Ancient traditions carry on



Spear fishing north of Carnarvon, Western Australia.

PHOTOS: GUY WRIGHT

INDIGENOUS FISHERIES Preserving customary fishing practices is more complex than simply providing an allocation for Aboriginal fishers

By Rose Yeoman

That's the fish we go for in the river 'Yirrigana' – the bony bream, that's our feed. Whitefellas use them for bait – they're our main tucker," says an elder of the Ngarla people, whose Native Title land is just to the east of Port Hedland on Western Australia's north Pilbara coast.

This comment was one of the many responses recorded from 150 Aboriginal people interviewed for an FRDC-funded study of customary fishing practices, economic development of fisheries and participation in fisheries management in WA. The aim is to document Aboriginal

fishing practices and to optimise access-rights allocation and opportunities as part of WA's integrated fisheries management program.

Guy Wright, a Fremantle-based anthropologist from Big Island Research, was principal investigator for the project. Supported by projects manager Teri O'Neill and field officer Brad Rowe, he has spent seven years collecting material about customary practices, summarised in the 2014 report *Culture, Food, Flavour, Fun*. The title is based on a comment from an Aboriginal man who described his motivations to go fishing in that order.

According to Guy Wright, customary fishing is the extension of an ancient food tradition brought forward into modern times. "Fish are eaten fresh and shared with family and friends, forming part of the web of reciprocities. People generally fish in order to eat it that day as they do not freeze or otherwise preserve large quantities. There is an ethic of 'no waste', which is a positive

and powerful aspect of Aboriginal stewardship."

The 'no waste' concept is demonstrated by a woman's complaint that the public took too many crabs from her father's country: "We've got that special place where all the [mud] crabs are ... but we'd like to get that place more protected because the whole town knows where it is and they just go there ... and we've seen photos where they've got crab piled up – so much! And I don't know what for ... We only go there and get a feed. We don't catch for parties and such. There may be 10 to 12 crabs that are good enough and that's enough for us."

Teri O'Neill says seafood may often support large cultural meetings and is used during "sorry time" when funerals occur and red meat may not be consumed but seafood is permitted. She also describes how the mix of species preferred often differs significantly from that sought by other fishing sectors. The tools used may be scoop nets, spears and handlines, and also rods and reels.

The study's final report outlines how Aboriginal people fish; that is, opportunistically, in areas that they know and preferably on their own traditional lands. As boat ownership is rare, most fishing is done on the coast, in rivers, river mouths and tidal shallows.

Guy Wright says he believes Aboriginal people should have a right to not feel anxious about the myriad 'rules', such as for catch and bag size, developed for the recreational sector. "The population of Aboriginal people relative to recreational fishers is very small and much Aboriginal fishing is for species that are not keenly sought by recreational fishers," he says.

Access issues

"This means there should be room for the relaxation of rules for customary fishers. They are fishing to feed themselves and their families, usually on their own traditional land, but access is becoming a major issue for them.

"The pace of development in WA, especially in the north-west, is phenomenal. Although the coastline is very long, much of it is difficult to access without boats or the four-wheel-drive gear that many non-Aboriginal people have," he says. "Ports and mining operations are locking people out. Some pastoralists are willing to allow access through their property to the coast, but when stations are bought by mining companies, the old local courtesies can become more difficult."

Guy Wright believes almost all Aboriginal people in WA benefit in some way from customary fishing. There is an active barter system and people often trade fish for kangaroo tails as well as the exchange of other goods and services.

Customary fishing is now recognised within WA legislation as a sector, along with the recreational and commercial fishing sectors. "Other sectoral representatives in WA, for example the Western Australian Fishing Industry Council and Recfishwest, are aware of the importance of a well-recognised customary sector. Aboriginal people are less aware of fisheries policy development but this is changing," Guy Wright says.

The report recommends that Regional Customary Marine Authorities be established to deal with the range of marine and coastal issues confronting Aboriginal people. Fisheries would be an integral part of this. "We need to create a situation where people can be informed and there is a solid, representative way of making decisions, although funding capacity may be an issue."

A shared resource

The development of Native Title in Australia has paralleled the development of a rights-based fisheries agenda: "Any discussion about how to share the resources of this land should include fish," Guy Wright says.

He notes that a national set of principles was developed by the National Indigenous Fishing Technical Working Group in 2004 and endorsed by the FRDC, most Australian state governments including WA, and by industry, recreational and peak Indigenous bodies after Aboriginal people agreed that they would accept definitions for customary fishing that excluded commercial activity. In return, they were to be helped into fisheries-related businesses and have better participation in management. "Now the definitional bit

has been done, but the promised assistance has, unfortunately, not yet materialised."

In 2003, a substantial Aboriginal Fishing Strategy document was developed and published with support from the FRDC. The document remains in draft form and Guy Wright says while it is now somewhat outdated it contains many good proposals. The strategy outlines consultative structures to engage with the other sectors and makes detailed recommendations for better fisheries engagement with Aboriginal people.

Culture, Food, Flavour, Fun identifies that people struggling with fundamental issues of poverty and access may not have the energy required to represent themselves on fishing issues. "Senior Aboriginal people have more than enough on their plates," Teri O'Neill says. "They are often on multiple boards or reference groups, they need to look after Native Title issues, and they often also have to balance their employment and look after their families like the rest of us. It is important for them not to waste their time and energies."

One of the main issues in the WA Integrated Fisheries Management Program is the lack of quantitative and qualitative information to support the fisheries allocation process. The Western Rocklobster (*Panulirus cygnus*), Abalone and demersal scalefish are being assessed for integrated allocation; however, there is little data for customary fishing of these species. *Culture, Food, Flavour, Fun* reports that almost all Aboriginal fishing is customary fishing and Guy Wright suggests the relevant quantitative data could be obtained by basing it on a simple projection of regional Aboriginal populations. **F**



Yellowtail Grunter (*Amniataba caudavittata*), a favoured species of the project's participants.



Netting baitfish north of Broome, Western Australia.

Seafood in the tourism spotlight

The opportunity to taste-test different prawn species proved popular as part of an Aussie Wine Month event in April.

PHOTO: TOURISM AUSTRALIA

MARKETING Australian seafood is set to shine in the light of increased national promotion of food and wine as part of the travel experience for international visitors

By Peter Horvat

Recent research conducted across 15 of Australia's key international tourism markets shows that "great food, wine and local cuisine" is now a major factor in holiday decision-making (nominated by 38 per cent of survey respondents), ranking third, ahead of world-class beauty and natural environments (at 37 per cent).

For those who have visited, Australia ranks second for its food and wine experiences (60

per cent), after culinary giant France and ahead of Italy. Australia also ranks as the number-one destination for food and wine for people who have visited from China, the US, France, India, Indonesia, Malaysia, the UK and South Korea.

Tourism Australia is already evolving its successful global campaign – "There's nothing like Australia" – shining a light on Australia's food and wine experiences. The idea is to reframe Australia as 'Restaurant Australia' – a place where, every second of every day, we are serving up unique and brilliant food and wine experiences in awe-inspiring locations.

The Restaurant Australia concept will focus on seven themes:

- seafood;
- restaurants;
- produce;

- people;
- food events;
- experiences and food trails; and
- "the wine story".

Seafood stories

There are so many seafood stories to tell and this is an excellent opportunity to showcase the Australian seafood industry. This is not limited to just the commercial industry; the recreational sector also has some great stories to tell. The key is for industry to share their exceptional food and wine stories at the Restaurant Australia hub.

The Restaurant Australia online hub (<http://restaurant.australia.com>) was launched in April 2014 and allows the industry to share its stories. This can be done via completing an online form available on the website and by joining the



PHOTOS: TOURISM AUSTRALIA

conversation by using '#restaurantaustralia' on Tourism Australia's social media platforms.

Pinot, prawns and people

It is not hard to find opportunities to showcase Australian seafood. But it is even better when you get the opportunity to showcase it with some iconic Australian wines. Combining the two gives you a very powerful event.

This was the case with the pre-launch event for Aussie Wine Month 2014, held at the base of Australia Square in Sydney. Wines from 55 regions were on show, including d'Arenberg d'Arry's Original 2010, De Bortoli's Noble One 2009 and Pizzini's Nebbiolo 2010.

The FRDC has continued to build its relationship with Wine Australia, working with industry to provide seafood for the

pre-launch event for Australian Wine Month. To get seafood to the event, the FRDC put the call out to select industry sectors based on what was possible to do at the event – minimal preparation space and no cooking.

The 'Love Australian Prawns' committee grabbed the opportunity, providing financial support and prawns for the event. Likewise, Petuna, from the Atlantic Salmon industry, took up the opportunity. Four different prawns were on show – Northern Prawn Fishery Banana Prawns, Spencer Gulf Western King Prawns, North Queensland Endeavour Prawns and farmed Australian Black Tiger Prawns. In addition, Petuna showcased its smoked Atlantic Salmon (*Salmo salar*) for the tastings.

During the eight-hour pre-launch event, more than 1500 people are estimated to have visited

Australia Square to try the wine and seafood. There was a high level of engagement from people attending, and many were interested in comparing the four types of prawns on show.

The event also provided some interesting insights into the consumers who attended – such as taste preferences and misheld beliefs (for example, only red prawns taste good).

Wine Australia was pleased with the event and full of praise for the participation and professionalism of the seafood team.

The FRDC coordinated the seafood participation, engaging Fishtales to undertake the preparation and to help with the display. Miles Toomey from the Australian Seafood Cooperative Research Centre was on hand to assist with organisation and transport of the product. **F**

Island delights

WILD CATCH Midway between Victoria and Tasmania, King Island is a major trading centre for some of Australia's highest-value wild-catch fisheries

By Catherine Norwood

King Island punches above its weight when it comes to an international reputation for gourmet food production. The island is hardly more than 1000 square kilometres, midway between Victoria and Tasmania, on the western edge of Bass Strait.

From this tiny base it produces a range of renowned beef and dairy products. Added to that are some of the nation's most succulent and sought-after seafoods: primarily Southern Rocklobsters (*Jasus edwardsii*), Greenlip Abalone (*Haliotis laevis*), Blacklip Abalone (*Haliotis rubra*) and Giant Crabs (*Pseudocarcinus gigas*). Although it may seem a logical step to

add such premium foods to the King Island brand, it is a more complex matter for fish than it is for land-based produce. Where do King Island's waters begin and end?

Politically, King Island is part of Tasmania, although boats from both Victoria and Tasmania are licensed to fish in Tasmanian waters. And the island is a convenient landing point for rocklobster fishers, midway between the two states. It is also a highly-efficient trading point for rocklobsters, which constitute by far the island's largest seafood harvest.

King Island is, nominally, Tasmania's rocklobster capital. In both 2012-13 and 2013-14 the total volume of rocklobsters landed at the island's ports of Currie and Grassy represented 19 per cent of Tasmania's total harvest. In 2012-13, Currie topped the rocklobster volume for a single port, with more than 160 tonnes, or 10 per cent of the total catch that year.

King Island Seafoods handles almost all of the island's seafood trading. Boats deliver their

harvest according to pre-arranged schedules at either Currie or Grassy. The rocklobsters are sorted into 40-kilogram bins from the wells or tanks on the boats, and each checked to make sure they appear healthy and whole. The rocklobsters are then transferred to the agent's live holding tanks at Currie, where they will be further sorted and packed for air freight to Victorian buyers, most of whom export the product, with some local sales.

But even on King Island, it can be difficult to know whether what you are buying is actually local product. Donna Summers, who runs King Island Seafoods with her husband, Max, points out that rocklobsters landed could come from almost anywhere along the Tasmanian coastline, including King Island.

Brand challenge

Donna Summers says she believes there is potential to build on the King Island brand, but guaranteeing provenance, to protect the brand, would be a significant issue. The King



Grassy Harbour, King Island, is one of Tasmania's top landing ports for Southern Rocklobsters (*Jasus edwardsii*).

PHOTOS: CATHERINE NORWOOD





Donna Summers checks the health and condition of rocklobsters as they are unloaded from a vessel and packed into crates.

Island Dairy, and local beef producers have been leaders in developing and promoting the King Island brand as representing the quality and simplicity of island production and life.

As a member of the King Island Brand Project, Donna Summers says maintaining the integrity of the brand is an issue locals take very seriously. "There have been cases of people selling products as coming from King Island, when in fact, those products don't come from here. We follow it up, and ask them to remove our name from their product, if it's not accurate, and most of the time they're happy to do that.

"There have been reports of King Island flathead or garfish being offered for sale in other parts of Australia. But those fish aren't caught from King Island. Also, King Island rabbits – there aren't any rabbits at all on King Island."

She says while some of her Victorian customers comment that rocklobsters from King Island taste better, that is as far as the local identification goes. Rather than regional branding, the King Island rocklobster fishers contribute levies through their industry organisations to state or national promotions of their product, such as the award-winning 'Australian Southern Rocklobster Clean Green' campaign.

Local supply

In terms of the commercial rocklobster fishery, Donna Summers says the whole supply chain is tightly controlled and managed. One consequence of this has been to make it difficult

for visitors to the island to experience seafood fresh from the boat.

For the commercial fishers, selling direct to consumers requires providing tags for each lobster sold, with corresponding forms to fill out and submit by the end of the business day to ensure that every single rocklobster is accounted for against the total allowable commercial catch (TACC).

Assuming a visitor is at the wharf as a boat is unloading, fishers say the paperwork involved is onerous, and a disincentive to ad hoc customer

sales. As a visitor, if your heart is really set on fresh rocklobster, with 24-hours notice you can place an order at the Currie supermarket.

Donna Summers says the difficulties in providing the direct-to-consumer fresh fish experience is disappointing for the local tourism industry. "For the kind of people who come to King Island for a holiday, this back-to-basics experience is exactly the type of thing they appreciate – highest-quality, fresh food direct from the source," she says.

The tight monitoring of the supply chain is part of efforts to ensure the sustainability of the fishery resources. Donna Summers says during her 20 years working with fishers, she has seen the level of professionalism and efficiency increase significantly.

A changing environment

Since the quota system was first introduced in 1998, the fleet of more than 30 boats has halved, and the quota also changed over this time. It has dropped from over 140 kilograms to 100 kilograms per quota unit for the 2014-15 year.

"It was a lifestyle choice, now it is much more a business decision, and we see that in the quality of the catch and the way the fishers treat their animals. Fishers recognise that they are providing a premium product for a premium market." The industry is also highly focused on improving efficiencies wherever possible, she says, which comes down to even simple things such as ensuring pots are in good repair.

Lease options

The shortfall between the allowable catch and the actual catch is generally small in Tasmania's rocklobster fishery. According to figures from the Tasmanian Rock Lobster Fisherman's Association in 2012-13, 99.86 per cent of TACC was harvested.

The leasing of quota has allowed for the active take-up of as much of the TACC as possible, although the lease prices can fluctuate wildly from year to year. One of the patriarchs of the rocklobster industry on King Island, Jon Munn, says he has only ventured into leasing in the past few years, to supplement his own quota. "When we did, we realised how hard it was for those who were dependent on leasing to make a living."

In years with good conditions for harvesting, such as 2013-14, lease costs can average \$18 to \$22 per kilogram, with a beach price of \$51 to \$53 per kilogram across the season. In years when harvest fall behind, the lease price of quota can drop to as little as \$3 a unit.

However, Jon Munn says overall, business margins are being squeezed once operating and crew costs come out. In 2013-14, he leased more than three tonnes of quota to supplement the units he owns. But he was reluctant to actually buy more quota because of recent reductions in the yield per unit.

Technological edge

For some local fishers, technology is providing the key to improved efficiency and catch per unit of effort. Robert and Dawn Jordan are also long-time rocklobster fishers on King Island. Robert Jordan only ventures out occasionally now that his son Paul skippers their vessel, the 55-foot *Kingfisher 5*. But Robert is the one responsible for the major upgrade in technology onboard, which is helping to more precisely target their catch.

With a combination of new hardware and software he is able to map the sea floor in swathes 20 metres wide, as he lays out his pots. It helps to identify geological formations on the sea floor that may provide better rocklobster habitat. He is also able to cross-reference this mapping with decades of his own catch

data. After a few initial technical glitches, he says the system is now paying for itself.

It has allowed the Jordans to catch their allocated quota ahead of schedule and to maximise prices for their catch, which peaked at more than \$70 per kilogram earlier this year.

Most of the rocklobster boats operating from King Island are well boats. Flushed regularly with fresh ocean flows, the rocklobsters can be held alive in wells for more than a month without losing condition, depending on the season – longer during the colder months. This allows fishers to wait for peaks in the market, or to wait out gluts.

Abalone and crabs

Brothers Paul and Grant Jordan also harvest Giant Crab and abalone off King Island and further south along the Tasmanian coast. The state's Giant Crab quota is relatively small and the annual harvest at King Island is generally only about 20 tonnes a year.

Grant Jordan is one of two licensed abalone divers on King Island, and he will harvest between 30 and 40 tonnes of Greenlip Abalone and Blacklip Abalone a year.

The market suffered a setback three years ago when abalone viral ganglioneuritis (AVG) was identified as endemic in wild Tasmanian abalone stocks. While animals only become symptomatic when stressed, the finding has led to a ban on importing live Tasmanian abalone into Australia's largest and most lucrative abalone market, in Sydney, where prices range up to \$60 per kilogram. The abalone are now largely sold for processing in Tasmania, at \$24 to \$34 a kilogram, although they can also be sold live to Victoria. **F**



Most rocklobster vessels operating from King Island carry 50 cray pots.

CATCH BENCHMARK GUIDES RESOURCE MANAGEMENT

In the Tasmanian Southern Rocklobster fishery a benchmark for the catch per unit of effort (CPUE) has been set to help assess the economic sustainability of the fishery, along with the sustainability of the fishery resource.

Catch information supplements recruitment data. For some in the fishery, there are concerns about the effects of inefficient fishers on the overall CPUE benchmark. If fishers are unable to catch their full quota, perhaps that means the fish are not there to be caught.

However, there are many factors that can influence lower-than-anticipated harvests, including low demand and poor beach prices for rocklobsters, or fisheries closures in response to conditions such as algal blooms.

While the systems used to calculate CPUE across the state's fishery take into account many of these variables, fishers remain focused on efforts to improve the efficiency of the industry overall.

ADJUSTING THE CPUE

In 2008-09, the total allowable commercial catch (TACC) was 1523 tonnes. But it was clear at that time, that the CPUE was dropping, says fisheries scientist Klaas Hartmann at the University of Tasmania. There were fewer rocklobsters in pots and they were smaller. Monitoring also identified low settlement of rocklobster puerulus.

"The fall in recruitment was unprecedented, with record lows for several years," Klaas Hartmann says. Considerable effort has been invested in research to identify the correlation between spawning and rocklobster recruitment, but the links have not proven as clear-cut for Southern Rocklobsters as



PHOTOS: CATHERINE NORWOOD

they have for Western Rocklobsters (*Panulirus cygnus*). In response to the combined scientific and commercial data that indicated a decline in the resource, the TACC has been gradually reduced over several years, to 1050 tonnes for the 2014-15 season, or 100 kilograms per unit of quota. Klaas Hartmann says the changes are designed to both protect the resource and the long-term viability of the fishery.

There has been a gradual increase to the CPUE, which scientists expect will accelerate in response to TACC reductions over the past five years. Recent puerulus sampling also indicates that recruitment in the past year is back to normal levels after a long period of poor recruitment.

"Things are looking positive on the recruitment front and with the current TACC we should be seeing some substantial CPUE increases over coming years," Klaas Hartmann says.



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STORM-CAST HARVEST

There is nothing John Hiscock likes more than a good south-westerly gale, raising swells to three or four metres to pound the King Island shoreline. It is the kind of weather that guarantees a plentiful harvest of Bull Kelp (*Durvillaea potatorum*) for Kelp Industries, of which he is general manager.

The business is based at Currie on the western side of King Island, and it produces more than 2000 dry tonnes of kelp a year, from 10,000 tonnes of wet kelp. Most of this is exported to Norway for use in a wide range of food, pharmaceutical and personal-care products. The company's largest customer is the biopolymer division of the global manufacturing company FMC.

The kelp is also processed and sold domestically for use in garden and agricultural products including liquid fertiliser and stock-feed supplements.

Kelp Industries has been operating at its current site at Currie since 1975, after more basic beginnings a few years earlier at the Currie harbour. Although now owned by international interests, John Hiscock says the business was a local initiative, designed in part to address the problem of huge quantities of seaweed rotting on the King Island shoreline.

When an analysis of the kelp revealed it was high in alginate content, markets were originally developed with processors in Scotland.

The development of Grassy Harbour on the eastern side of King Island to cater for larger vessels and containerised shipping to and from the island provided the opportunity for larger-scale processing and export.

John Hiscock says the quantities of kelp washed up are significant because of the extensive reefs and rocks around the island.

"Kelp only grows from low tide down to about 10 metres, and we have a lot of shallow water here. We are not taking any living resources from the ocean, it is all storm-cast kelp, and the harvest varies from year to year with the weather."

For the past decade, the harvest has averaged about 2500 dry tonnes, but in the 1980s, this was closer to 3000 tonnes a year, with one record harvest of 4000 tonnes.

"We're just not getting the frequency of south-westerly gales coming through," John Hiscock says. "We need the mechanical action of the sea to bring in the kelp."

He has almost 50 harvesters on his books, with about 10 of those making a full-time living from collecting the kelp. They are paid on a per-kilo-dry-weight basis.

Most use winches to haul the seaweed off the rocks into trailers or trucks, for delivery to the factory at Currie, where it is hung to dry for one to two weeks, depending on the weather. It is then cut into smaller pieces before being fed into a wood-fired drying system. There are two main products: one to five millimetres, most of which is exported for alginates, and less than one millimetre, used for garden and agricultural products.

John Hiscock says in some years there is demand for more than they can produce. "But we're entirely dependent on the weather."

MORE INFORMATION: John Hiscock, Kelp Industries, 03 6462 1340, john@kelpindu.com.au, www.kelpind.com.au

PHOTOS: CATHERINE NORWOOD



- 1 Kelp is hung on racks outdoors to dry for up to two weeks before processing.
- 2 Dried kelp is milled to two different sizes for sale domestically and for export.
- 3 Storms wash Bull Kelp ashore, where it is harvested for processing.
- 4 General manager of Kelp Industries John Hiscock with chopped kelp, ready for further drying and milling.

NEW CENTRE TO SPEED VACCINES TO MARKET

FISH HEALTH Additional research and testing facilities will improve the responsiveness of disease-management efforts for Tasmania's expanding salmonid aquaculture industry

By Sarah Clarry

Among the successes that Tasmania's fish health researchers can already claim are vaccines to treat four of the leading diseases that threaten the state's \$500 million salmonid aquaculture industry.

But with plans to double aquaculture production to \$1 billion by 2030, the salmonid industry is investing with government to increase research capacity to produce new vaccines as an essential part of its prevention strategy to secure a viable and healthy industry.

The establishment of the new Australian Aquatic Animal Health and Vaccine Centre this year is expected to further enhance existing capabilities for protecting salmonids and other fish and animal industries from new disease threats.

The centre will be part of the Tasmanian Department of Primary Industries, Parks, Water and Environment (DPIPWE) and based at the Fish Health Unit in Launceston.

Jeremy Carson, principal research microbiologist at the Fish Health Unit, will lead the new vaccine centre. He has been with the Fish Health Unit for almost 30 years – since the early days of intensive Atlantic Salmon (*Salmo salar*) and Rainbow Trout (*Oncorhynchus mykiss*) farming in Tasmania.

He says when salmonid farming first began in about 1985, the unit initially provided diagnostic services as part of the Tasmanian Salmonid Health Surveillance Program, but its role was quickly expanded to include research into disease control and prevention.

Diseases the unit have already addressed include vibriosis, yersiniosis, marine *Aeromonas* disease and Tasmanian *Rickettsia*-like organism



Atlantic Salmon (*Salmo salar*) being vaccinated with Corrovac in a field trial run by Huon Aquaculture Company.

(RLO). Each has different symptoms, but all ultimately result in septicaemia and fish death.

While vaccine development to date has kept ahead of disease development, limited tank space to run efficacy trials for new vaccines has restricted development.

Expanded facilities

To overcome this, the Tasmanian salmonid industry, the Tasmanian Government and the FRDC have funded a fourfold expansion of fish-holding capacity at the existing research facilities, establishing the Australian Aquatic Animal Health and Vaccine Centre.

"We can already handle organisms safely under biosecure conditions; however, our capacity to do lots of tank trials is limited," Jeremy Carson says.

"There is a demand for several other vaccines that are in development, but space is the bottleneck."

The fish-holding capacity will expand from one room to four. "The biosecure facility is a quarantine facility in its own right, able to handle infectious agents for both terrestrial and aquatic animals. We will be able to handle both bacterial and viral disease agents."

Jeremy Carson says all the targeted diseases are naturally occurring organisms, and are sometimes a variant of an organism that occurs elsewhere.

"With the increased intensity and length of aquaculture production, the likelihood of encountering new disease agents increases," he says. "The diseases were not unexpected – salmonid production worldwide had encountered

PHOTO: RICHARD MORRISON

these types of organisms – but once an organism appears you have to learn about it.”

“We ask: ‘Is it the same as what occurs worldwide or a variant of what occurs in the Northern Hemisphere?’ The diseases here have distinct differences and appear to be unique to Tasmania.”

As Tasmania’s salmonid industry has grown, diseases that were minor issues are starting to have a greater impact, so the demand for vaccines has increased. Vaccines can reduce the cost of production, and also allow the industry to avoid using chemicals to treat disease by preventing the initial infection.

Once a candidate vaccine is ready, it is tested by vaccinating a small group of fish, exposing them to the disease agent and measuring how effective the vaccine is at protecting the fish against the disease.

The Tasmanian DPIPWE laboratory in Launceston has 28 staff, about half of whom contribute to providing diagnostic services to Tasmania’s aquatic animal industry. Three of these staff also undertake research, with a further six providing support to research projects as required.

The overall role of the new centre is to consolidate the expertise that already exists in aquatic animal health diagnosis and research. It will continue to be a centre of expertise for aquatic animal health and diseases and the development of vaccines.

The primary focus of the new vaccine centre will be salmonids, but it is expected to provide expertise for other species such as abalone and Pacific Oyster (*Crassostrea gigas*). Construction is scheduled to begin in June, with the new facilities planned to be operational by the end of 2014.

Disease surveillance

The Tasmanian Salmonid Health Surveillance Program is the first line of defence in identifying potential threats. It operates as a partnership between the Tasmanian DPIPWE and industry to monitor the health of farmed stocks.

“Using active and passive surveillance, it allows us to assess disease trends and monitor for the emergence of new pathogens. The industry uses this information to decide the priority areas and commission research,” Jeremy Carson says.

The first disease agent the industry encountered was one that the European salmonid industry had warned it against – vibriosis – first discovered soon after commercial Atlantic Salmon aquaculture began. The vaccine Anguillvac was released in 1988.

Almost a decade later, in 1997, Yersinivac was released, to treat yersiniosis, which affects fish in the hatchery of about one gram upwards.

By 2005, the size of the salmonid aquaculture industry had expanded to such an extent that the Fish Health Unit was unable to meet the demand for Anguillvac and Yersinivac vaccines, and production was taken on by the pharmaceutical company Merck Sharp and Dohme.

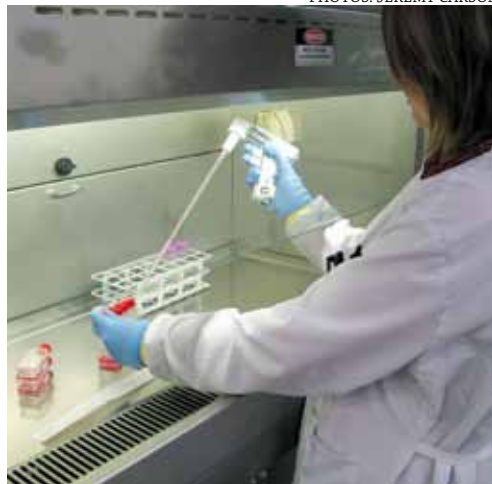
Working with Merck, Sharp and Dohme, the Fish Health Unit developed AnguiMonas – a single injection that provided protection against a new disease threat, marine *Aeromonas* disease and also against vibriosis. This was released in 2006.

The unit’s senior research microbiologist Richard Morrison has led development of the latest vaccine, Corrovac, currently in the field-trial phase, which protects against Tasmanian RLO.

The FRDC has funded development of Corrovac, and is also funding development of two new virus vaccines for the Tasmanian *Aquabirnavirus* and the Tasmanian *Aquareovirus*. This work is also led by Richard Morrison.

Both new vaccine projects are collaborations with Mark Crane and Nick Moody from CSIRO’s Australian Animal Health Laboratory in Geelong, Victoria. **F**

PHOTOS: JEREMY CARSON



Martine Cornish, research assistant at DPIPWE, prepares fish cell lines for the culture of Tasmanian Aquabirnavirus.

HOW TO VACCINATE A FISH

The first method of vaccination, now rarely used, is the **bath**. The water level in the tank is reduced and once it reaches the correct amount of fish and water, the vaccine is poured in. The fish swim around in the dilute vaccine for an hour until enough is absorbed into their system.

Dip vaccination is a very concentrated bath of the vaccine. A certain weight of fish is put into a basket and they are lowered into the bath for about 30 seconds. Dip is used in hatcheries where there is a risk of disease at a very young age; a fish of one gram cannot be injected so dip vaccination is used. The downside is that protection only lasts for a couple of months.

With **injection** vaccination, the fish are first sedated and then the vaccine is injected into the abdomen before the fish are put into a recovery bath. Injection gives very long-lasting protection. Fish are injected at the hatchery (depending on the disease against which they are being vaccinated) at between 40 and 100 grams. The injection method protects the fish for the entire life (production) cycle, about 18 months to two years.



Pilot-scale production of Corrovac vaccine at the Fish Health Unit, Tasmanian DPIPWE, Launceston. The fermenter is used for mass culture of the Tasmanian *Rickettsia*-like organism.

PHOTO: NORTHERN AUSTRALIA HUB, NATIONAL ENVIRONMENTAL RESEARCH PROGRAM

There are more than 20 known species of catfish comprising a significant proportion of the fish biomass in northern Australian rivers.

On the move

REC-FISHING From river to floodplain and back again, new research is tracking where, when and why fish are on the move in the Northern Territory's river systems

By Amy Kimber

A variety of techniques are being used to detect the movements of big fish in Kakadu National Park and the Daly River region in the Northern Territory, to better understand the importance of connectivity between the floodplain, river and ocean.

Charles Darwin University researcher David Crook and his team are using a combination of tracking tagged fish and ear-bone chemistry to monitor the movements of key species.

To date there has been little scientific research on the movements of fish in the NT. Previous research showed that the floodplains are an important habitat for Barramundi (*Lates calcarifer*) at particular stages in their life cycle, such as when they are growing and reproducing.

While it is clear that certain species use floodplain habitats at times, there are many

unknowns; for example, how long individual fish stay in the floodplain, how far they move, if there are particular habitats fish prefer, and what fish do as the water recedes and the floodplains begin to dry out.

David Crook's research is being funded through the Australian Government's National Environmental Research Program, which aims to improve the capacity to understand, manage and conserve Australia's unique biodiversity and ecosystems.

Since October 2013, his team has been investigating the movements of 65 Barramundi and 55 catfish throughout the wet season. The Barramundi were caught by electrofishing in October 2013 and January 2014, while the catfish were collected by hook and line in October.

"We are investigating these species because they are important to recreational and commercial fishers and for traditional harvest," David Crook says.

"They are also important species in the food web because they make up a large part of the biomass in Kakadu's river systems and, because larger species such as crocodiles prey on them, they transport a lot of energy around the ecosystem."

The fish were caught from the Yellow Waters area of Kakadu National Park, a wetland system that is part of the South Alligator River floodplain. This river system, which is the largest in Kakadu, contains extensive wetlands that include river channels, floodplains and backwater swamps.

Acoustic and radio-transmitters were surgically implanted into the fish. The acoustic tags are being detected using an extensive array of fixed receivers, while the movements of the radio-tagged fish have been tracked by boat and helicopter every two weeks since the fish were released.

Since beginning the tracking, the research team has seen a range of fascinating behaviours. Preliminary results show that the Barramundi moved up to 50 kilometres from where they were released, while the catfish moved up to 20 kilometres.

Following the first major rainfall in early December last year, there was a spike in fish movement, with some fish moving several kilometres out onto the floodplains and even disappearing altogether from the 3000-square-kilometre area being surveyed by helicopter.

Individual stories

Each fish has its own story. Among the fish tagged in October 2013 was a 450-millimetre Barramundi, collected by electrofishing in Mardugal Billabong, and a 410-millimetre catfish collected by hook and line.

The Barramundi made regular movements of up to two kilometres between Mardugal Billabong and Home Billabong during October and November, before moving downstream to Yellow Waters in early December after the first significant flows of the wet season.

It was detected back upstream in Home Billabong on 18 December and stayed in that area using the main channel and flooded side-channels throughout January. Following heavy rains in late January, the fish left the billabongs and moved approximately 30 kilometres downstream, where it was recorded in a side-channel near the South Alligator River on 4 February.

The catfish was detected within a restricted area (approximately 30 metres) around the same five-metre-deep hole throughout October and early November. Following the first minor flow increase in mid-November, the fish moved out of the hole and was detected 100 metres upstream in Mardugal Billabong.

As the water levels rose in early December, the catfish moved eight kilometres downstream and was detected on the inundated floodplain downstream of Yellow Waters on 4 December. It then moved back upstream and was detected near its original location in Mardugal Billabong on 18 December.

In early January the catfish was detected four kilometres downstream on the floodplain near Yellow Waters, and had moved a further eight kilometres downstream by the end of the month. It continued to move downstream and was detected in early February more than 20 kilometres from its original tagging location.

According to David Crook, anecdotal information suggests that a lot of the species in the NT may be diadromous, meaning they migrate between the ocean and freshwater during their lives.

“However, while our findings show that at least some tagged fish move between fresh and saline water, the movement patterns are much more complex than we had expected and there is a lot of individual variation in movement behaviour.

“These observations are really starting to change the way we think about fish migration,” he says.

PHOTOS: NORTHERN AUSTRALIA HUB, NATIONAL ENVIRONMENTAL RESEARCH PROGRAM



A directional antenna is used in boat surveys to detect where the tagged fish are within one metre, and an aerial is used in helicopter surveys to log the GPS coordinates of the fish.

Ear bones tell all

The research team is also using ear-bone (otolith) chemistry to determine whole-of-lifetime movements of ecologically important fish species in the Daly River, such as catfish and Mullet.

Otoliths are the ear bones of fish, functioning for hearing and balance in much the same way that they do in humans. Otoliths are made of calcium carbonate and start developing in the fertilised egg even before the fish has hatched. As fish grow, growth rings, similar to those found in tree trunks, are deposited and chemicals from the surrounding water become locked into the otolith structure.

The chemicals that accumulate in the otolith reflect the water chemistry that the fish has been living in, meaning researchers are able to determine the age of the fish and where it has been at various stages in its life.

“For example, we know that certain strontium isotopes are in much higher abundance in the ocean than freshwater, and so we can tell when a fish has moved between marine and freshwater environments by measuring the strontium isotopes in the otoliths,” David Crook says.

“Back in the lab, we extract the otoliths from the fish collected then use a saw and very fine sandpaper to expose the core of the otolith. Using a tiny laser trace from the core to the edge, we can work out where a fish has been living throughout its entire life.



Chemical analysis of the otolith (ear bone) of fish can be used to determine the age of the fish and which aquatic environments it has lived in at various stages of its life.



Radio-transmitters have been surgically implanted into 70 Barramundi and catfish. Researchers are tracking their movements every two weeks.

“Tracking and otolith chemistry are complementary techniques. Although tracking provides very fine-scale detail of fish movements, we can only monitor the movements of fish large enough to be tagged.

“The great thing about otolith chemistry is that you can go right back to the early life history of a fish to work out where it was living as a larva and as a juvenile.

“In southern Australia, a lot of the connectivity between river channels and nearby habitats was cut off by human activities before we had any of these tools to measure the impact. Up here, we’ve still got relatively pristine systems to study the importance of connected catchments and coasts.

“We hope that this research will help us to better understand the role of fish and ecological connectivity in supporting the remarkable productivity of northern Australia’s floodplain rivers.”

The full results from this research, which are expected in the second half of 2014, will ensure that policy and management decisions regarding our fisheries and their habitats can be made using sound scientific evidence. **F**

COD CAPACITY

AQUACULTURE From its origins in the Murray–Darling Basin rivers and streams, the Murray Cod is finding its way onto more urban menus through Marianvale Blue’s successful aquaculture operations

By Julie Haldane

Murray Cod (*Maccullochella peelii*) is one of Australia’s most iconic species, and a highly sought-after catch for recreational fishers. But if you are looking to put one on the table for dinner, the most reliable source of supply is likely to be farmed fish, sold live at local Asian markets and restaurants in Melbourne and Sydney.

This is where most of the 200 tonnes of Murray Cod John Breen produces goes. As general manager of Marianvale Blue, based near Goulburn in New South Wales, he runs the largest indoor commercial Murray Cod farm in Australia. The business was launched less than three years ago and is already close to full capacity.

Murray Cod only spawn once a year, so stocking is limited to an annual event, normally in December. Fingerlings are introduced to nursery tanks from ponds where they have been feeding on live feeds. “Our process begins with the arrival of fingerlings at about one gram and then we wean them onto pelleted feed over a couple of weeks,” John Breen says.

After the nursery, fish are grown out in 31 tanks, each with a capacity of 25,000 litres. The

PAN-SEARED MURRAY COD

Murray Cod (*Maccullochella peelii*) is a moist, white fish that flakes easily and has a delicate flavour. It can be steamed, pan-fried (similarly to Atlantic Salmon) or baked. The skin crisps easily due to its fat content. Chefs speak highly of the fish, acknowledging its flavour, texture and attractive appearance as a whole, filleted or banquet fish.

Ingredients

- 640 grams Murray Cod (skin on)
- 200 grams Desiree potatoes (peeled)
- 1/2 bunch flat-leaf parsley (chopped)
- 100 grams baby spinach
- 100 millilitres extra-virgin olive oil
- 1 carton cherry tomatoes
- 2 shallots (finely chopped)
- 50 millilitres sherry vinegar
- 20 grams brown sugar
- 2 bunches basil



Instructions

Potatoes: Peel and quarter potatoes and boil in water until tender. Strain, crush, stir through parsley, 50mL of olive oil and season with salt.

Tomato compote: Place tomatoes, shallots, vinegar, sugar, basil and 50mL olive oil in an ovenproof dish. Season, cover and cook at 180°C for 15 minutes.

To serve: Seal cod skin-side down in a hot pan with a little oil until crisp and golden brown. Finish in 180°C oven for about four minutes. Place potato in centre of plate, top with wilted spinach. Place fish on top and spoon compote over fish.

SOURCE: MARIANVALE BLUE, www.marianvaleblue.com.au



John Breen, general manager of Marianvale Blue, with a young Murray Cod (*Maccullochella peelii*).

PHOTO: JULIE HALDANE

fish are moved into the grow-out tanks when they are between 50 and 100 grams. The Murray Cod are constantly graded to ensure the fish in each tank are all of a similar size, which helps to keep the species' cannibalistic tendencies in check. John and his team grade a tank every day. Typically the fish grow fast enough to require grading every six to eight weeks.

Water quality is critical to the operation. The daily morning checks include water, oxygen, temperature and quality parameters. For its fish farming operations Marianvale Blue relies on bore water, which is treated to remove iron and carbon dioxide.

John Breen says that while the water does not have high levels of iron, it is removed as a precautionary measure, as iron is believed to contribute to hexamita (hole in the head disease) in the fish. "I don't think it has been validated yet, but we remove it just in case – the technology is there. Removing the iron also helps to keep the equipment in good condition."

The business is very conscious of water quality and consumption, and uses filters and other technology to ensure as much water as possible is recycled. The water temperature is

maintained at 23°C, and is heated with energy-efficient, state-of-the-art heaters. "We were worried that the power consumption would be high, trying to heat the water in the tanks, but once you get 100 tonnes of stock feeding, swimming and being active, it just about maintains its own heat. We only have to put in a little amount of power," John Breen says.

Murray Cod normally take 10 to 18 months to reach a saleable size, but growth rates are proving variable. "We can have a fish ready at 800 grams in 10 months and at the same time have a 300-gram fish from the same batch."

On the upside, having fish reaching saleable size at different times means he can supply the market all year round, even though he only receives fingerlings once a year. "For the Murray Cod market at the moment we need the variability in growth rate to be able to dispatch over a longer period. This way, the farm is able to reliably supply

"We are getting great feedback from chefs. They are taking the 500-gram plate size and are really happy with the fish – especially the fat content as there is a bit more margin for error in the cooking, so if they overcook it for a minute it is not dry. Its special quality is that it is a really moist fish with firm, white flesh."

– John Breen

four tonnes of Murray Cod week in, week out," he says.

Situated between Sydney and Melbourne, on the Hume Highway, Marianvale Blue is well positioned to access these two major markets.

Most of the fingerlings are grown to 800 grams. However, there is also a 500-gram, plate-size market. Most fish are sold live into Asian markets, with some chilled fish going to wholesalers. "Most of the

800-gram live fish are going into tanks in places like Chinatown, whose clientele like the fat content of the fish," John Breen says. All fish are purged before they are sent to market; live fish are purged for three days and those sold chilled are purged for a week.

"We are getting great feedback from chefs. They are taking the 500-gram plate size and are really happy with the fish – especially the fat content as there is a bit more margin for error in the cooking, so if they overcook it for a minute it is not dry. Its special quality is that it is a really moist fish with firm, white flesh," John Breen says. **F**

Vale Henry Jones, seafood industry icon

The fishing industry and the Murray–Darling Basin community will miss the passionate advocacy of South Australia's Henry Jones, following his death in April 2014.

Henry Jones was a fourth-generation fisher who began fishing at Clayton Bay on Lake Alexandrina in 1961, at the age of 19, and became a visionary leader for the Lower Lakes and Coorong Fishery, and for the Murray–Darling Basin.

He was president of the Southern Fishermen's Association (SFA) from 1988 to 2000, and was also the delegate to the state's peak industry body, the South Australian Fishing Industry Council (SAFIC) from 1988 to 2006. This included 10 years as president of SAFIC, and he was awarded life membership of the peak body in 2001.

As president of the SFA, Henry Jones and other Lakes and Coorong fishers developed the world's first Environmental Management Plan for a commercial fishery, and he was instrumental in initiating the process that

that resulted in the fishery's prestigious Marine Stewardship Council certification.

His extraordinary vision over many years has given commercial fishers in the Lakes and Coorong Fishery significantly more political certainty for their fishing businesses.

Over the past 30 years, Henry Jones devoted and volunteered extraordinary amounts of time to addressing the issues of habitat degradation of the Lower Lakes and Coorong, recognising that "a healthy environment underpins healthy regional communities".

The closing of the mouth of the Murray River in 1981 as a result of low river flows was the catalyst for Henry Jones's commitment to securing the future of the river, the lakes, the Coorong and the fishing industry. He became involved at a national level, advocating for better water management and more environmental freshwater releases specifically to the Lower Lakes and Coorong. Henry Jones was awarded the River Murray Medal by the



Henry Jones

Murray–Darling Basin Authority in 2013 in recognition of his instrumental role in developing the Murray–Darling Basin Plan.

He has also been awarded life membership of the SFA, and was inducted into the National Seafood Industry Hall of Fame in 2013. **F**

UNSEEN INFLUENCE



PHOTO: TOM ROSCHI

Tracy Hill is committed to supporting and raising the profile of women in the fishing industry.

PEOPLE DEVELOPMENT Women in the seafood industry are significant powerbrokers and influencers, a fact that often goes unnoticed

By Ilaria Catizone

While Coorong fisher Glen Hill starred in front of the camera and ultimately on the front cover of the FRDC's own *FISH* magazine, hauling in the nets, his business partner and wife, Tracy, was holding the light for the photographer. The situation was, Tracy Hill says, a reflection of the low profile that women in the seafood industry have, despite the vital role they often play in keeping the industry afloat.

But she says more women are stepping into the spotlight to take on the political and promotional challenges, and ensure the future of their industry.

Her own entree into the fishing industry began when, as a bank manager in the Coorong region of South Australia, she approved a

credit card for a customer who was looking to upgrade the fishing equipment he had just bought along with his fishing licence, little realising that he would become her husband.

She has since traded the banking business for fishing full time, as their fishing business took off.

And to help ensure the longevity and the social licence to fish in the region she was actively involved in efforts to secure the prestigious Marine Stewardship Council accreditation for the Lakes and Coorong Fishery in 2008.

"As well as the administration side of the business, I still fillet and wash the fish, pack and despatch the orders, and deliver fish to Adelaide twice a week. We have a farmers' market stall and also attend food and wine festivals, where we cook our fish and promote the industry. Plus there are management meetings and various committees. I particularly love the variety of the work," she says.

Tracy Hill was the first woman on the Southern Fishermen's Association committee and has also initiated some changes to the constitution to make it easier for more women to participate.

Her commitment to supporting women in the industry, and to raising their profile, also led her to join the Women's Industry Network Seafood Community (WINSC), which was established in the late 1990s. She says one of the important roles of WINSC is to provide a professional community where women can exchange knowledge and experiences and alleviate the isolation they may sometimes feel.

This was the case for Karen Holder, who has worked with her husband in their Adelaide-based fishing business for 27 years. She provides the administration for the business and takes care of

ABOUT THE WOMEN'S INDUSTRY NETWORK SEAFOOD COMMUNITY

The Women's Industry Network (WIN) was formed in 1996 by a group of women fishing in South Australia. In 1998, the Women's Industry Network Seafood Community (WINSC) developed into a national body, with organisations in each state. WINSC is the only national organisation in Australia representing women in the seafood industry. It is a unique network covering the tough, high-tech world of commercial fishing, cutting-edge aquaculture, research and processing sectors, and policy and resource management.

The objectives of WINSC are to:

- recognise and enhance the skills of seafood women;
- develop effective partnerships with government agencies and other industry stakeholders;
- take a professional approach to all activities and relationships with other stakeholders;
- create a supportive environment to ensure women of the fishing industry reach their potential;
- actively encourage the involvement of seafood women; and
- provide community education on all aspects of the seafood industry.

Wherever it works, WINSC builds the capacity of its seafood women to contribute to their industry.

SOURCE: <http://winsc.org.au/about-us>

their children while he fishes for Blue Swimmer Crab (*Portunus armatus*). “The flexibility of the work is the best part of the job: the worst part is keeping up with changing regulations,” she says.

But until she became involved with the WINSC, Karen Holder says she often felt quite isolated in her work, as there were few fishing families in the Adelaide region. Karen Holder is now the SA director for the network’s national committee.

For Leonie Noble, the desire to influence government decisions encouraged her to form the group Friends of Abrolhos in Western Australia and provided her first steps into the arena of fisheries management and politics.

When she moved to the Abrolhos Islands with her fisher husband and their three children in the early 1980s, she quickly realised that the industry needed a stronger voice in the fisheries management decisions.

“It all started with six women around my kitchen table,” Leonie Noble recalls. They wanted the government to consider the social implications of its decisions, as well as the latest research. “So we started to make a noise about it.”

Eventually the Friends of Abrolhos became the go-to group for the local community on issues such as environmental closures and codes of conduct for stakeholder industries of the Abrolhos Islands. This level of involvement resulted in Leonie Noble being appointed to the Ministerial Advisory Committee for the Abrolhos.

At high-level departmental and Ministerial board meetings, Leonie Noble says she was often the only woman in the room. Initially, other attendees would assume she was there to make coffee or take the minutes. She had



Ana Rubio inspecting some fouling from oyster baskets.



Working for the sustainable future of the Abrolhos Islands, (from left) Leonie Noble, marine scientist Jen Shaw, and Western Australian fisheries officer Rebecca Thomas.

to work hard to gain the respect of her peers, she says, but the effort has been worthwhile because it has allowed her to make a difference to government policies that affect the viability and sustainability of her community and industry.

As the vice-president of WINSC, Leonie

Holder says the network can help young women starting out in the seafood industry to find a mentor who can support them through some of the industry’s challenges, and encourage their enthusiasm and passion.

Passion and commitment are exactly what has helped oyster researcher Ana Rubio gain acceptance among New South Wales oyster farmers when she first arrived from Europe more than a decade ago. At that time she was one of only a few women actively out on the water in the oyster leases. She says it took about six months for growers to start taking her seriously.

“I think it happened after a few days of heavy rain,” Ana Rubio says. “It was pouring and I was still there taking my samples. After that, they started asking for my opinion and assistance.”

She says that while the oyster industry appears, to the outsider, to be heavily male-dominated, things are changing. She sees a greater involvement of women, especially in the new businesses that are taken up by young couples, where both partners work together in all aspects of the farm. **F**

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Skilled-up for seafood

TRAINING A new online training initiative helps time-pressed apprentice chefs – and others – upgrade their seafood skills

By Catherine Norwood

It can take four years to become a qualified chef, and during that time an apprentice may spend as little as four days learning how to select, handle and prepare seafood.

When compared with meat, seafood forms a small part of the formal training, but to counteract this a series of videos have been developed as a new national online training resource to make it easier for apprentices to improve their seafood skills.

The project brings together the expertise of the Australian Seafood Cooperative Research Centre (Seafood CRC), the West Coast Institute, Curtin University's Centre of Excellence for Science, Seafood and Health, the FRDC and leaders of the seafood and hospitality trades in Western Australia.

Emily Mantilla, communication, education, training and extension program manager for the Seafood CRC, says the idea came from discussions during a training project for CRC-sponsored PhD and master's students in 2012.

"We brought the students together with leading chefs such as Adriano Zumbo and Jared Ingersoll to create a mock restaurant. The aim was to help students understand how seafood is used in a commercial setting and the end-use requirements of chefs."

She says conversations with chefs during the event identified a lack of confidence among apprentices when it came to handling and preparing seafood.

In a busy commercial kitchen it can be difficult for qualified chefs to find the time to provide the necessary training for apprentices on the job.

"We felt that creating an online learning resource would be useful not just for apprentices, but also for front-of-house staff who may be discussing menu choices with diners. It could also be used as a refresher for qualified chefs, and even by customers and the home cook," Emily Mantilla says.

Fishfiles

The FRDC has also created the Fishfiles website (www.fishfiles.com.au), an online seafood-preparation resource based on the *Australian Seafood Users Manual*. It provides a logical and easy-to-use format that explains handling and preparing seafood. In addition to the manual, it also includes recipes, videos and research on storage, quality, cooking and safety.

Fishfiles is now being used as a resource for students by hospitality training providers including the West Coast Institute. Linking the two projects was an obvious step.

Curtin University researcher Janet Howieson has been leading the development of the training materials, assisted by staff from the West Coast Institute.

"We selected six species to focus on for the training videos, following the food chain from harvest to the restaurant door," Janet Howieson



Josh Catalano focused on seafood processing and supply.

PHOTOS: FRDC



Janet Howieson with chef Don Hancey.



says. “These are Australian oysters, rocklobster, farmed Barramundi, snapper, sardines and prawns.

Local industry leaders have delivered the presentations, which will be trialled as part of the training undertaken by apprentice chefs at the West Coast Institute. The students will be assessed against the video content, which is linked to the relevant curriculum.

Josh Catalano, from Catalano Seafood, explains processing and supply, and what happens up to the point when seafood arrives at the restaurant door.

Peter Manifis, executive chef at the Incontro Restaurant in South Perth, talks about the process for receiving and checking the condition of seafood.

FISH FEATURE IN CULINARY CHAMPIONSHIPS

International cooking competitions provide a way to both challenge and showcase the talents of Australia’s leading junior and senior chefs, and also to showcase Australian food products, including fish. From state competitions to national events and international regional events, participants rise to compete in the IKA, or International Culinary Olympics, held in Germany every four years. In 2012, the Australian senior team placed ninth out of 35 teams, and the junior team placed seventh of 25 teams. Sweden and Norway took first and second place in both events. In 2014, the leading international event will be the World Culinary Championships, in Luxembourg in November. In most events the competitors – teams of five chefs – have to prepare a total of 18 dishes, and serve dinner to 100 to 120 people. Peter Tischhauser, who provides the logistical support for the Australian junior culinary team, says leading international chefs provide judging for these competitions and have been known to incorporate products they particularly liked in the competitions into the menus at their own high-end establishments. In 2013, the Australian junior team featured the popular Western Australian Dhufish (*Glaucosoma hebraicum*) in its menu at the International Young Chef Challenge in South Korea, as well as Glacier 51 Patagonian Toothfish (*Dissostichus eleginoides*),

Marron (*Cherax cainii*), prawns and Atlantic Salmon (*Salmo salar*). Competing against 23 countries, they returned home with a silver medal in the hot kitchen competition and bronze in the cold table.

Peter Tischhauser says Australian seafood is always well received, particularly in Asia, where fast-grown aquaculture species dominate availability and often lack depth of flavour.



(From left) Peter Tischhauser (logistics manager), James Cole-Bowan, Phil Grice, Christopher Malone (captain), Patrick O'Brien (manager), Nick Gillan, Cherise Minas and Jade Hugi-Ferguson.



Salmon three ways: (from left) salmon tartare, pickled cucumber, apple gel, salmon skin soil, salmon caviar and dill; smoked loin of salmon, horseradish cream and baby capers; and olive-oil-poached salmon belly, fennel and apple salad, yuzu and elderflower dressing, apple air.



Josh Catalano

Catering consultant and WA food ambassador Don Hancey demonstrates how to apply to seafood the standard cooking techniques that all apprentices are expected to master, such as steaming, grilling and baking.

Janet Howieson says the findings of research conducted in collaboration with Meredith Lawley at the University of the Sunshine Coast have been incorporated into the training video. That work involved interviews with 60 chefs in South Australia to identify ‘What chefs want when buying Australian seafood’.

“Talking with chefs, Meredith Lawley found that what they really want is information, and this resource is a really accessible and simple way of providing it.”

The training videos have been developed with the assistance of the FRDC’s digital communications specialist Rachelle Etienne-

Breidenbach who has been coordinating the filming and collection of digital content for the FRDC.

The videos will be added to the FRDC’s Fishfiles website and are also available for industry sectors to use and to add to their own websites. Other industry sectors interested in developing something similar for their own products should contact the FRDC.

After a trial period at West Coast Institute, the training resources will be rolled out nationally to other TAFEs and registered training organisations. **F**

The videos were officially launched in May 2014, and can be viewed at www.youtube.com/user/FRDCFishfiles

Seafood and the food-safety GOLDEN RULES

FOOD SAFETY There are risks and benefits to eating any class of foods but when it comes to seafood, Australian regulatory safety standards help keep risks from food poisoning to a minimum

By Gio Braidotti

Few people in Australia had ever heard of scombroid fish poisoning prior to the tragic death of Queenslander Noeline Bischoff, 54, and her daughter Yvana, 14, while holidaying in Bali, Indonesia, in January 2014.

Public surprise over the deaths – along with the difficulty initially identifying the cause of death – is understandable in retrospect. Scombroid poisoning is rare; however, the chances can be almost eliminated entirely with good cooling and refrigeration of fish catches.

More typically, scombroid poisoning causes symptoms that resemble an allergic reaction, including skin flushing, a throbbing headache, oral burning, abdominal cramps, nausea, diarrhoea and palpitations. Symptoms usually occur within 10 to 30 minutes of eating affected fish.

Australian food safety researcher Alison Turnbull says she too was initially perplexed by the reported deaths, despite chairing SafeFish. SafeFish is a partnership of seafood stakeholders (including funding agencies the FRDC and the Australian Seafood Cooperative Research Centre), regulators and researchers that advise on food safety and hygiene issues, particularly their effects on Australian seafood trade and marketing.

Based at the South Australian Research and Development Institute, where she is leader of the seafood sub-program, Food Safety and Innovation, Alison Turnbull explains that there are two basic types of agents that cause fish poisoning but it is extremely rare for either to cause sudden death.

The first type are biological agents such as bacteria, parasites and viruses that are present in a fish's growing area or contaminate the fish during processing and packaging. These are well controlled in Australia.

The second type are chemical agents. This category includes heavy metals such as methylmercury (which can cause developmental problems if present in high levels) and cadmium (a carcinogen) for which there are industry standards in place in Australia.

This category also includes harder to detect 'biotoxins' that are made by marine algal microorganisms and then accumulate within marine food chains and ultimately can poison humans.

Scombroid straddles the biological and chemical categories since poisoning is due to a chemical (histamine), the post-catch production of which is dependent on enzymes produced by the concurrent overgrowth of fish bacteria.

The key is preventing the bacterial overgrowth. This can be done through proper post-catch handling, in particular cooling and refrigerating caught fish. These two factors are important in preventing poisoning.

Warm-water predators

Of all the potential causes of food poisoning, the most common in Australia are due to the ciguatoxins found in warm-water finfish from both commercial and recreational catch.

Alison Turnbull explains that the ciguatoxin precursor compounds are produced by algae that grow in warm tropical reef areas, often as a result of ecological and/or climatic disruptions. However, she says the geographical range of these organisms appears to be expanding (possibly associated with climate change) as the algae were recently found off the coast of southern New South Wales.

Not all fish accumulate ciguatoxins in their fat deposits but when they do, it is generally older (therefore bigger) specimens that cause problems for human health. Recommendations about which species and sizes to avoid consuming are available to consumers (see page 39), but a simple golden rule is to avoid overly large predatory reef fish.

OzFoodNet data from 2001–10 shows there have been a total of 283 ciguatoxin poisonings in Australia during that decade (compared with 94 cases of scombroid poisoning).

Recent occurrences include cases in northern Queensland and the Gold Coast, with many poisonings resulting from the consumption of Spanish Mackerel (*Scomberomorus commerson*).

"There is a rule of thumb that you shouldn't be eating Spanish Mackerel heavier than 10 kilograms," Alison Turnbull says. "That is a management strategy developed by Sydney Fish Market and most fish wholesalers will be aware of these recommendations but the message also needs to spread to recreational fishers."

The problem with ciguatoxins is their high toxicity, which results in debilitating illness (ciguatera) of unpredictable duration. Most commonly poisoning causes gastrointestinal symptoms (nausea, vomiting and diarrhoea) and neurological effects (headache, tingling and numbness, dizziness, extreme itchiness and hallucinations) or, in more severe poisonings, cold allodynia in which the perception of hot and cold are reversed.

Symptoms resolve over a few days, weeks or months but in extreme cases (or perhaps in a subset of especially susceptible people), a chronic multi-symptom illness can develop that lasts for years.

Currently, there is neither a treatment for ciguatera nor a simple diagnostic test for ciguatoxins, although one is needed since these biotoxins do not affect the appearance, odour or taste of fish and are not destroyed by cooking. Furthermore, once ciguatoxin-exposed people have recovered they are likely to experience worse symptoms if they consume the toxin again.

Limiting risk

"There is a lot of work going on around the world to develop a commercial ciguatoxin test, particularly a screening method that can be used to test fish catches before they reach the market," Alison Turnbull says.

"However, knowing which species and sizes to avoid consuming is an effective food safety strategy and fish you buy from a retailer is safe to eat. It is equally important for recreational fishers who keep their catch to be aware of the species and sizes.

“It is important to realise that poisonings are rare, whereas consuming seafood confers many benefits: it is an important source of protein and nutrients such as iodine, selenium, vitamins A and D, and omega-3 fatty acids.”

Generally, there are geographical ‘hot spots’ for ciguatera around the world, including coastal and oceanic waters off Queensland and the Northern Territory.

However, recreational fishers need to be aware that in February 2014 the NSW Food Authority reported four ciguatera food poisonings resulting from the consumption of a large Spanish Mackerel caught by a licensed fisher on Chaos Reef, south-east of Evans Head, NSW.

Internationally, the high-risk areas generally occur around the tropical band – the South Pacific, Hawaii, the Caribbean and the Gulf of Mexico.

Although biotoxins are also a potential problem in shellfish, the Australian Shellfish Quality Assurance Program has been effective in preventing illness. There are four major groups of shellfish biotoxins, three of which are present in Australian fisheries but actively managed. These are the paralytic, diarrhoeic and amnesic shellfish toxins.

Overall, Alison Turnbull says very few people become ill in Australia from fish poisoning. “Generally, fish poisoning tends to be more of a hazard in developing countries that do not have any management in place and where there is a large percentage of the population subsisting on recreational fishing,” she says.

Adding to consumer protection is the establishment two years ago of a centralised laboratory in Sydney to detect marine biotoxins (other than ciguatoxins) using advanced chemical analysis technology. Prior to this testing was done by mouse bioassays.

“With all these issues, consumers need to be aware that there isn’t just a risk associated with eating seafood – there are also important health and nutritional benefits to seafood, especially to the cardiovascular and immune systems,” she says.

“That is why Food Standards Australia New Zealand analyses both the risks and benefits when deriving its recommended national dietary guidelines that currently recommend two to three serves of fish a week for adults other than pregnant women (or one serve of shark or billfish).” **F**

A summary of hazards in seafood can be viewed at: www.safefish.com.au/media-centre

MINIMISING CIGUATERA RISK

Prohibited species

Sydney Fish Market will not sell any of the following species:

- Chinamanfish (*Symphorus nematophorus*)
- Humphead Maori Wrasse (*Cheilinus undulatus*)
- Paddletail (*Lutjanus gibbus*)
- Tripletail Maori Wrasse (*Cheilinus trilobatus*)
- Red Bass (*Lutjanus bohar*)
- Giant Moray (*Gymnothorax javanicus*)

PROHIBITED SUPPLY REGIONS SYDNEY FISH MARKET WILL REJECT CONSIGNMENTS OF LISTED SPECIES CAUGHT IN THESE REGIONS

REGION	SPECIES
Kiribati	All warm water ocean fish
The following Queensland waters: ■ Platypus Bay on Fraser Island; bounded by the coordinates: GPS South 25 – 01 – 991; North 153 – 11 – 761	■ All warm water ocean fish ■ Spanish Mackerel (<i>Scomberomorus commerson</i>) ■ Mackerels (<i>Scomberomorus</i> spp.) – excluding spotted and school mackerel under 6 kilograms
Marshall Islands	All warm water ocean fish
The following Northern Territory waters: ■ Bremer Island ■ Bonner Rocks ■ Miles Island ■ Immediate vicinity of Cape Arnhem ■ North East Island and Connexion Island (both near Groote Eylandt) ■ Gove Peninsula, in the immediate vicinity of Nhulunbuy	The following species ■ Pickhandle barracuda (<i>Sphyræna jello</i>) ■ Coral Cod (<i>Cephalopholis</i> spp.) ■ Coral Trout (<i>Plectropomus</i> spp.) ■ Red Emperor (<i>Lutjanus sebae</i>) ■ Queensland Groper (<i>Epinephelus lanceolatus</i>) ■ Trevally (<i>Caranx</i> spp.)
Fijian waters	Coral Trout (<i>Plectropomus</i> spp.)

SIZE LIMITATIONS SYDNEY FISH MARKET APPLIES SIZE LIMITS FOR HIGH-RISK SPECIES

SPECIES	SIZE LIMIT (KILOGRAMS)				
	NSW	QLD	NT	WA	PACIFIC COUNTRIES
Pickhandle Barracuda (<i>Sphyræna jello</i>)	N/A	10	N/A	N/A	10
Coral Rockcod (<i>Cephalopholis miniata</i>)	N/A	3	N/A	N/A	3
Coral Trout (<i>Plectropomus</i> spp.)	6	6	6	6	Reject
Kingfish (<i>Seriola</i> spp.)	N/A	10	N/A	N/A	10
Mackerel [various] (<i>Scomberomorus</i> spp.)	10 (whole) or 8 (for headed and gutted fish)		N/A	N/A	10
Giant Queenfish (<i>Scomberoides commersonianus</i>)	N/A	10	N/A	N/A	10
Red Emperor (<i>Lutjanus sebae</i>)	N/A	6	N/A	N/A	6
Reef Cods ■ Goldspotted Rockcod (<i>Epinephelus coioides</i>) ■ Flowery Rockcod (<i>Epinephelus fuscoguttatus</i>) ■ Queensland groper (<i>Epinephelus lanceolatus</i>) ■ Greasy [Spotted] Rockcod (<i>Epinephelus tauvina</i>)	N/A	10	N/A	N/A	10
Lined Bristletooth [also known as Surgeon Fish] (<i>Ctenochaetus striatus</i>)	N/A	10	N/A	N/A	Reject
Spangled Emperor (<i>Lethrinus nebulosus</i>)	N/A	6	N/A	N/A	6
Spanish Mackerel (<i>Scomberomorus commerson</i>)	10 (whole) or 8 (for headed and gutted fish)		N/A	N/A	10
Trevally (<i>Caranx</i> spp.)	N/A	6	N/A	N/A	6
Tuskfish (<i>Choerodon</i> spp.)	N/A	6	N/A	N/A	6

SOURCE: SYDNEY FISH MARKET PTY LTD

Movers and ...

After seven years at the helm of the Australian Rural Leadership Foundation, **LESLEY FITZPATRICK** is stepping down as the organisation's chief executive.

CATHERINE COOPER has completed her term as chair of the South Australian Fisheries Research Advisory Board (FRAB). **RORY McEWAN** has stepped into the role as SA FRAB chair, and is also the new chair of the South Australian Fishing Industry Council.

JOHNATHON DAVEY has been appointed executive director of Seafood Industry Victoria in April 2014.

There has been some movement at Western Australian Fishing Industry Council (WAFIC) with **RICHARD STEVENS**, **NEIL MACGUFFIE** and **JAY SHOESMITH** leaving. **ALEX OGG** started as the new operations manager on 19 May. WAFIC will be appointing two other positions in the near future including a resource access officer and a communications officer.

The FRDC welcomes **JOSHUA FIELDING** to the team. Josh Fielding joined the FRDC in March 2014 as a projects manager. He previously worked at the Australian Fisheries Management Authority in several fisheries areas including Tuna and International Fisheries and Northern Fisheries. During this time he gained experience in several functions relevant to fisheries management, including altering legislation to update fishery management arrangements and incorporating ecologically sustainable development principles into fisheries management. Josh Fielding has also worked for Tasmanian Atlantic Salmon farming company Tassal in 2012 and 2013 as a technical officer. He holds a Bachelor of Science with Honours in Marine Science from the University of Tasmania.

FEEDBACK

FRDC WELCOMES YOUR COMMENTS
frdc@frdc.com.au

MOVERS WE'VE MISSED?

INFO PLEASE TO
Julie Haldane, 02 6285 0415,
julie.haldane@frdc.com.au

Calendar of events

DATE	EVENT	MORE INFORMATION
2 to 6 June	2nd Sharks International Symposium, Durban, South Africa	www.sharksinternational.org
7 to 11 June	World Aquaculture Conference and Trade Show, Adelaide Convention Centre	www.aquaculture.org.au
22 to 25 June	foodpro, Melbourne Convention and Exhibition Centre	www.foodproexh.com
22 to 27 June	5th Congress of the International Society for Applied Phycology, Australian Technology Park, Sydney	www.isap2014.com
24 to 25 June	FRDC Board Meeting, Adelaide	02 6285 0400
30 June to 4 July	Australian Society for Fish Biology and Australian Society for Limnology Joint Congress, Darwin Convention Centre	www.asfbasl.org.au
1 to 4 July	Joint Econometric Society Australasian Meeting and Australian Conference of Economists, Hobart	www.esamace2014.com.au
6 to 10 July	51st Australian Marine Sciences Association Annual Conference – Investigating our Marine Nation, National Convention Centre, Canberra	www.amsa.asn.au/conference
7 to 11 July	The International Institute of Fisheries Economics and Trade 2014 Biennial Conference, Brisbane	http://iifet2014.org/about-iifet/invitation
6 to 7 August	Ridley Aqua-feed Prawn and Barramundi Symposium 2014, Main Beach, Queensland	aquafeed@ridley.com.au
26 to 27 August	FRDC Board Meeting, Canberra	02 6285 0400
20 to 24 October	5th International Otolith Symposium, Mallorca, Balearic Islands, Spain	http://ices.dk/news-and-events/symposia/otolith
11 to 12 November	FRDC Board Meeting, Canberra	02 6285 0400
12 to 19 November	IUCN World Parks Congress 2014, Sydney Olympic Park	www.iucn.org

For a copy of an FRDC project final report go to www.frdc.com.au or contact the FRDC on 02 6285 0400, email frdc@frdc.com.au

NATIONAL BIOTOXIN STRATEGY

1999/332

Aquaculture and wild harvest of shellfish is an economically important and growing industry, but one of the potential problems faced by shellfish growers is the contamination of their product with marine biotoxins, which can induce human illness if contaminated shellfish are consumed. This study was undertaken to provide Australia with a National Marine Biotoxin Strategy. Many states have, or in the past have had, marine biotoxin monitoring programs, but there is no uniformity across the nation. Similar studies have been conducted, such as the 1993 National Residue Survey report by Hallegraef and Sumner. However, this did not lead to the implementation of an Australia-wide monitoring strategy. The main aim of this project has been the implementation of such a program. This has involved a comprehensive review of current monitoring programs both in Australia and internationally, the history and occurrence of toxic and potentially toxic marine microalgae around Australia, an assessment of the risk marine biotoxins pose to public health, and summarises the Food Safety Regulations. A Model National Marine Biotoxin Management Plan (Cawthron Report No. 646) has also been developed.

MORE INFORMATION: Kirsten Todd, Cawthron Institute, +64 03 548 2319

HEALTHY INDUSTRY ASSOCIATIONS

2011/410

This project set out to examine those characteristics that lead to healthy industry associations, by attracting and retaining members, who share responsibilities broadly so that leadership can emerge naturally, and which have a conscious policy of leadership succession. In pursuit of these goals, the project examined Australian seafood industry associations and chose to look outside Australian industries (aquaculture, wild-catch and recreational) and examine several overseas industry associations, as well as land-based Australian primary industry associations. Twenty-two case studies were conducted and a series of resources were developed including: media and web-based materials announcing the project; a presentation at Seafood Directions Conference 2013; reports specific to each industry sector; and a resource kit and DVD/CD delivering the recommendations from this project to the industry.

MORE INFORMATION: Ian Plowman, Ian Plowman Pty Ltd, 07 3870 2231

HIGH-STRENGTH NETTING FOR PRAWN TRAWLING

2008/206

Prawn fisheries around Australia are fuel-intensive enterprises that are stressed financially by rising diesel costs. An avenue for relieving the situation is to improve the energy efficiency of trawling by raising the productivity of fishing for each litre of fuel consumed. The main output from the research undertaken as part of this project is the measurement of the relative performance of trawls made from thin, high-strength netting compared with conventional netting in respect to service life, engineering performance (drag and span of the trawl gear) and catching performance. Some design and operational issues associated with the use of high-performance materials have also been identified and documented, and suggestions have been included to resolve them.

MORE INFORMATION: David Sterling, DJ Sterling Trawl Gear Services, 07 3393 6924

MONITORING NON-TARGET SPECIES

2010/057

In May 2010, the Commonwealth Fisheries Research Advisory Body (ComFRAB) called for research proposals to address an array of fisheries management issues. The analysis of abundance trends for non-target species was identified in that research call as an issue needing attention. The description of the project envisaged by ComFRAB focused primarily on catch rates as an index of relative abundance. Workshops were held to investigate innovative analysis techniques to analyse trends in abundance of byproduct and bycatch species. A major outcome of the workshops was an increased

awareness and recognition of the issues associated with non-target species, and the options being used and that could be used when assessing non-target species (excluding Threatened, Endangered and Protected species). Equally important was the appreciation of some implications of these various options for the future development of management strategies to be developed or adopted in the various jurisdictions. A second major outcome was an increased appreciation of how conclusions reached during the workshops could be used to improve assessments and the management of non-target species. A third major outcome was the decision to develop a collaborative project proposal to explore the limits and choices in catch rate standardisation through the use of simulated multi-species catch-rate data. By knowing the alternative underlying realities that derive from multiple operating models it will be possible to examine how the various analytical methods are adapted to different underlying assumptions in different datasets. This idea for the proposal arose from the increased appreciation during the workshops of the limits to the use of commercial catch-rate data as an index of relative abundance.

MORE INFORMATION: Malcom Haddon, 03 6232 5097, malcolm.haddon@csiro.au

TESTING NEW PUERULUS COLLECTORS

2011/020

This proposal is phase one of three in the development and trial of deepwater puerulus collectors. The project has the ultimate aim of developing cost-effective rocklobster larval collectors that can withstand all weather conditions, can be serviced in deeper water and can be serviced by the fishing industry. Rocklobster fisheries throughout southern Australia are in decline, with resultant direct and indirect losses of hundreds of millions of dollars annually. While the cause of the decline is uncertain, observed declines in the recruitment of larvae is of concern in western and eastern Australia. In Australia, larval (puerulus) collectors have been established in shallow water regions where they are serviced by divers (South Australia, Tasmania and Victoria) and from dinghies (Western Australia). By requiring servicing by department staff, and particularly by dive teams, collectors are expensive to service and are thus limited in their regional distribution to a few sites. During this first phase of the project, through consultation with industry, a design for deep-water collectors was developed. Prototypes of this design were constructed and tested in aquaria with captured pueruli on the seafloor adjacent to an existing inshore shallow collector site on the east coast of Tasmania, and in deep water on the south and south-west coasts of Tasmania. The prototype collectors were successfully deployed, retrieved and serviced by vessels in the commercial rocklobster fleet and vessel masters reported that the design facilitated safe and efficient handling on deck. The prototypes collected significantly more puerulus than adjacent routine collectors in deployments at the shallow site, and collected puerulus for the first time on the deeper and more exposed south-west coast of Tasmania.

MORE INFORMATION: Stewart Frusher, 03 6227 7271, stewart.frusher@utas.edu.au

SAILS CUT FUEL COSTS

2011/229

The biggest expenditure for most prawn vessels is fuel, with the overall cost being 30 to 50 per cent of all annual expenditure. It became clear through energy audits that using sail power as an auxiliary propulsion system could result in tangible benefits in reducing energy consumption. Commercial fishing in Australia uses approximately 205 million litres of diesel fuel per year. Active fishing techniques such as trawling consume large quantities of diesel fuel, predominantly for propulsion power. Russel Kilfoy is a prawn trawl fisher based in Cairns, Queensland, targeting Black Tiger Prawns (*Penaeus monodon*), Endeavour Prawns (*Metapenaeus endeavouri* and *M. ensis*), Tiger Prawns and Banana Prawns. He has taken an active approach to rising diesel fuel prices by incorporating sails as an auxiliary propulsion system for his vessel

in an attempt to reduce fuel usage. The *FV Sea Lion* was found to use 69 per cent of its energy on board for propulsion, which highlighted that the best savings could be made by improving propulsive efficiency. The effect of the sails was recorded over a five-day period on board the *FV Sea Lion*. It was found that fuel savings of up to 13 per cent could be made under certain conditions. If this data is extrapolated to a normal 24-hour operating period, savings of up to 7.3 per cent could be made on the total fuel usage per day. This demonstrates the positive impact that using auxiliary sail power can have on reducing fuel usage. However, the successful application of sails as an auxiliary power source for fishing vessels will depend on each vessel's hydrodynamic characteristics and operational profile.

MORE INFORMATION: Giles Thomas, 0447 876 901, giles@amc.edu.au

TACKLING AGD IN ATLANTIC SALMON

2011/069

Amoebic gill disease (AGD), caused by the pathogenic free-living protozoan *Neoparamoeba perurans*, is the most significant health issue affecting the production of Tasmanian Atlantic Salmon (*Salmo salar*). This project has successfully adapted an isolated perfused gill model specifically to Atlantic Salmon and has provided in vitro results of gill function and branchial vascular resistance in AGD-affected animals. This model represents a novel in vitro method for AGD research that could allow for improved stock selection.

MORE INFORMATION: Melanie Leef, 03 6324 3858, mleef@amc.edu.au

EFFECTS OF LOW INFLOWS

2006/045

Reduced freshwater inflows to the Murray River Mouth and Coorong estuary due to the over-exploitation and diversion of freshwater resources in the Murray–Darling Basin has been identified as a major threat to the local estuarine ecosystem, including fish populations and the productivity of the commercial and recreational fisheries. This project provided researchers with an opportunity to compare the effect of various flow regimes and management scenarios or actions on the abundance and distribution of fish populations and fisheries for the region. Fishery and ecological considerations can now be included through the CSIRO Flagship, Coorong, Lower Lakes and Murray Mouth (CLLAMMecology) Research Cluster Program into a decision-support system framework for the region. The findings of the study will be used to quantify the environmental, social and economic trade-offs of water use in the Murray–Darling Basin. Cost-benefit analyses will be used to determine the volume of water required to maximise fisheries production, preserve fish biodiversity and maintain viable commercial and recreational fishing communities in the CLLAMM region.

MORE INFORMATION: Qifeng Ye, 08 8207 5447, qifeng.ye@sa.gov.au

INVESTIGATING AVG RESISTANCE

2011/003

A genetic basis for resistance to abalone viral ganglioneuritis (AVG) has been demonstrated through abalone family lines showing variation in susceptibility to AVG. However, no commercial selection for resistance has commenced due to outstanding questions on the cost-benefit of selecting for this trait and on the long-term nature of the challenge model, such as its ability to select for resistance across consecutive generations in a program of genetic improvement. Further refinement (such as better estimation of infectious viral dose) and a better understanding of the challenge system may be necessary for adaptation to further studies on genetic resistance.

MORE INFORMATION: Serge Corbeil, 03 5227 5447, serge.corbeil@csiro.au

ONLINE PORTAL IMPROVES MANAGEMENT

2010/534

This project has delivered a proof-of-concept, online, interactive mapping and data delivery tool for the oyster industry and estuarine catchment managers: the Oyster

Information Portal (www.oysterinformationportal.net.au). The purpose of this portal is to demonstrate that there is a benefit of collating information from multiple agency data collections on estuaries and associated catchments and delivering it through a user-friendly online portal, to provide unique insight into the environment and context of the oyster industry.

MORE INFORMATION: Pia Winberg, 02 4429 1522, pia@uow.edu.au

BRUVS AS ASSESSMENT TOOLS

2010/002

Baited remote underwater video systems (BRUVs) are a cost-effective and robust sampling tool for scientists assessing the community composition, distribution, relative abundance and size of Australian marine fishes. In July 2011, a two-day workshop was conducted at the University of Western Australia and attracted 30 invited participants from key research and industry organisations around Australia. The ultimate aim of the workshop was to improve the ways in which BRUVs and resulting data are used to provide essential information for understanding and managing Australian fish and fisheries.

MORE INFORMATION: Euan Harvey, 08 6488 2416, euan.harvey@uwa.edu.au

CLIMATE EFFECTS ON BARRAMUNDI

2010/521

The primary outcome of this project was to provide various stakeholders in the Barramundi (*Lates calcarifer*) fishery with targeted scientific data and models assessing the vulnerability of this iconic species to future effects of climate change. Access to this data will enable stakeholders to identify adaptation strategies and put in place informed planning processes ensuring the future viability of commercial and recreational activities dependent on the species. Overall, the results from this project highlight a degree of flexibility and resilience of Barramundi to cope with temperatures and environmental regimes predicted by future climate scenarios. Physiological tests demonstrate that the species performs robustly under a wide range of thermal conditions, even when challenged with temperature rises expected to occur by 2085 (3.6°C), while models predict increased productivity and expansion of the fishery.

MORE INFORMATION: Dean Jerry, 07 4781 5586, dean.jerry@jcu.edu.au

SUSTAINABILITY OF SOUTH-EASTERN ROCKLOBSTERS

2009/047

This project has improved assessment of the sustainability of the Southern Rocklobster (*Jasus edwardsii*) resource throughout south-eastern Australia. Investigating whether declining catch rates reflect an actual decline in biomass or are a result of changing catchability or recruitment has improved our understanding of the environmental and catchability impacts on the rocklobster stocks. Consequently, this will improve application of the rocklobster assessment model and improve our confidence in the modelling predictions that underpin sustainable management.

MORE INFORMATION: Adrian Linnane, 08 8207 5492, adrian.linnane@sa.gov.au

MONITORING RECREATIONAL CATCH

2005/063

Several independent catch and effort surveys of the West Coast Demersal Recreational Fishery were carried out concurrently in 2005–06 using a variety of survey techniques. These surveys were followed up with an international workshop in 2010 that compared and discussed the benefits and limitations of various survey methodologies carried out in Western Australia and elsewhere. Through these analyses and the workshop, the WA Department of Fisheries has now adopted the most appropriate, cost-effective, ongoing monitoring of recreational fishing using a statewide integrated survey of boat fishing.

MORE INFORMATION: Rick Fletcher, 08 9203 0111, rfletcher@fish.wa.gov.au

For a copy of an FRDC project final report go to www.frdc.com.au or contact the FRDC on 02 6285 0400, email frdc@frdc.com.au

2013 TRAVEL BURSARIES – JAMIN FORBES

2008/314.32

The American Fisheries Society annual meeting is the largest annual meeting worldwide that has a substantial recreational fishing component. Many topics presented were highly relevant to New South Wales recreational fisheries. Current NSW recreational fishing research was presented to an international audience for comment and critique, enabling refinement of research outcomes. The trip enabled Jamin Forbes to learn about new techniques that can be applied to recreational fishing research programs in NSW.

MORE INFORMATION: Jamin Forbes, 02 6959 9031, jamin.forbes@dpi.nsw.gov.au

PEAK BODY COMMUNICATION

2011/400

This project provided six case-study organisations from across the fishing and seafood industry with a communication audit and two capacity-building workshops for each organisation. Extensive consultation with the fishing and seafood industry has identified issues that affect organisation effectiveness that could be addressed through research into improved and coordinated communication strategies.

These issues included defining roles and representation, understanding value, communicating key messages and effectively connecting with the target audience. Consequently, the primary objective of the project was to increase the strength and value of fishing and seafood industry organisations through improved effectiveness of communication with members and stakeholders. A communication guide for the industry was compiled and it is now one of the main outcomes of this project.

MORE INFORMATION: Jill Briggs, 02 6035 7284, jill@ruraltraininginitiatives.com.au

WA BIOSECURITY CAPABILITY

2009/315.16

Three fish health workshops on fish disease investigations, health management, biosecurity and disease outbreak response in aquaculture facilities were completed between October 2011 and August 2012 in Geraldton, Perth (Fremantle) and Cone Bay, in Western Australia. As a result of the project, the Aquaculture Council of Western Australia is upgrading its website to update its listings of consultants for aquaculture and fish health.

MORE INFORMATION: Susan Kueh, 08 9360 2574, s.kueh@murdoch.edu.au

GROWTH OPPORTUNITIES IN A CHANGING CLIMATE

2011/233

The overall premise of this project is that adaptation by Australian fisheries and aquaculture sectors to climate change will be enhanced by increased awareness of markets and opportunities along the supply chain. To date, perceptions regarding the options for fisheries along the supply chain were determined, and used to guide development of adaptation options, based on the social perception studies (status quo interviews). Inefficiencies and potential points for enhancing profitability, including targeted recommendations in relation to efficiencies and reduction of the carbon footprint, were identified using life-cycle assessment.

MORE INFORMATION: Alistair Hobday, 03 6232 5310, alistair.hobday@csiro.au

CLIMATE CHANGE AND RECREATIONAL FISHERS

2011/037

With climate change will come increasing climate variability and stressors such as changing sea level and everything that can be done to ensure resilience of fish populations is essential. This project highlighted the need for monitoring to focus on data that can be used to better predict the future, especially in the areas of recruitment and recording species outside their normal range. These are areas where recreational fishers can play a role in data collection. The need for greater flexibility and responsiveness in fisheries management is clear, as is the importance of moving to a whole-of-stock management approach as climate change alters the dynamics and distribution of fish stocks. This work recognised that understanding and mitigating the effects of climate change on recreational fishing has some

important human dimensions, such as understanding the choices fishers make in response to climate change and the flow-on effects of these choices.

MORE INFORMATION: Colin Creighton, 07 4958 4775, colinmwnrm@bigpond.com

COORDINATED RECREATIONAL DATA

2011/036

Since the 2000-01 National Recreational Fishing Survey, there has been no other recreational fishing survey conducted to provide national estimates. Several state and territory-based surveys have addressed specific management issues, but there has been little, if any, coordination of surveys between jurisdictions. Statistical modelling was used to determine the feasibility of aggregating the available datasets to produce national estimates. It found aggregation was not possible, but the project was valuable in bringing together the latest information collected since the national survey. Following concerns from stakeholders about access to unpublished data, the project developed a framework for a national recreational fishing data portal that would make national recreational survey data available in one, readily accessible place. Recreational fisheries stakeholders can take advantage of this framework and web-based prototype of a national recreational fishing data portal. This may be used in management of specific fish stocks, marine bioregional planning, resource allocation for shared stocks, identification of regionally important areas and economies, and business and infrastructure planning through identification of growth trends. The data portal has also been designed to be a repository for not only the latest catch, effort and participation data, but also other key information for recreational fisheries stakeholders such as key biological information on recreationally important species, direct access to unpublished literature, and recreational fishing regulations by jurisdiction.

MORE INFORMATION: Shane P. Griffiths, 07 3833 5927, shane.griffiths@csiro.au

NATIONAL FISHERIES STATUS REPORTS

2013/233

A recent initiative developed a national scheme to report on the status of Australia's fish stocks that, in 2012, yielded the *Status of Key Australian Fish Stocks Report* (SAFS). This document began the process of dealing with the complexities arising from the existence of eight different jurisdictional schemes around the country. It involved compiling and massaging the information from all those jurisdictions into one format. Now that the first SAFS report has been completed and work is beginning on the next, the FRDC determined that it was timely to examine how other countries were dealing with fisheries performance reporting, identify what may constitute 'world's best practices' in this area, compare these to the Australian situation, and so identify if and how the Australian process could be improved. Despite some similarities, this project found that all jurisdictions around the world differ in the details of how they go about reporting the status of their fish stocks. In particular, the terminology, status categories and tools used all vary. There is not, therefore, any single, detailed 'best practice' manual for how to go about jurisdictional reporting on fisheries and fish stocks. Everyone is doing it differently, but for the same reasons and with the same intended outcomes.

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LET'S TALK FISH

2012/301

The wild-catch commercial fishing industry's operating environment is challenging, and industry has been particularly concerned about the negative effects of high-profile fisheries management controversies. The Let's Talk Fish project was implemented to assist the fishing industry and decision-makers to address these concerns. It is a study of the social acceptability of the wild-catch commercial fishing industry and how those societal judgements influence decisions about the sector's access to fish resources.

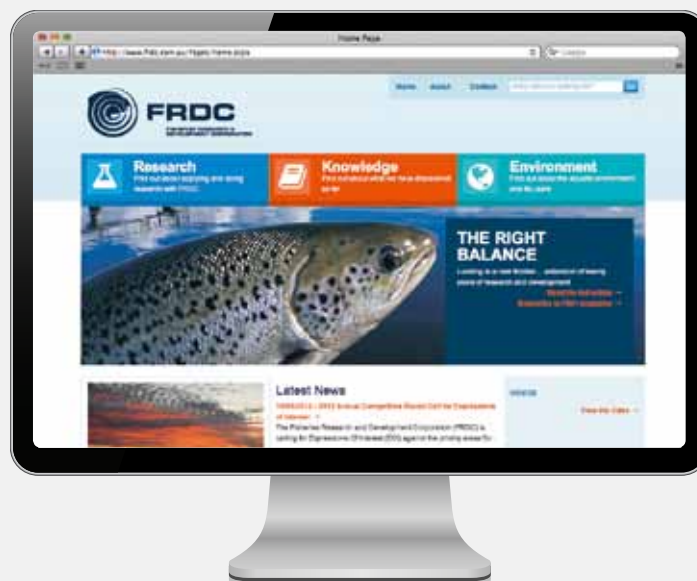
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