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FISH

VOLUME 23 NUMBER 1
MARCH 2015

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F I S H

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FISHERIES RESEARCH AND DEVELOPMENT CORPORATION
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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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ISSN: 1833-4784 (Print) **ISSN:** 2202-7122 (Digital)

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Octopus tentacles. Some world-firsts have come from Australian research into octopus aquaculture. Photo:123RF

Seafood future is ready-to-go

MARKET OUTLOOK

New market opportunities, new marketing techniques and new products are all contributing to a renewed sense of optimism for Australia's fishing and seafood industries

TREND 1: PRE-PACKAGED CONVENIENCE MEALS

TREND 2: SUSTAINABILITY CERTIFICATION

TREND 3: COLLABORATIVE INDUSTRY MARKETING

TREND 4: ONLINE SALES AND MARKETING

By Catherine Norwood

While supermarkets are undoubtedly a major force shaping seafood retail trends, other initiatives such as online sales and collaborative marketing are also giving fishers greater control of their future by forging stronger connections with customers.

Arthur Raptis, CEO of leading Australian seafood supplier A. Raptis & Sons, believes the outlook for the fishing industry is extremely positive. And he is keen to ensure that more people than just fishers know this; he is among several fisheries-specific presenters sponsored by the FRDC at the Australian Bureau of Agricultural and Resource Economics and Sciences 2015 Outlook Conference in Canberra in March.

The Raptis family business was established in South Australia in the 1950s and it remains fundamentally a fishing business, according to Arthur, grandson of the founder. However, it is also one of Australia's largest, privately owned, fully integrated seafood companies, with a long history of harvesting, processing, wholesaling and retailing into both domestic and export markets. As CEO, Arthur Raptis is well placed to identify the trends that are shaping the future of seafood retailing and what they mean for the industry.

Convenience meals

In supermarkets, raw and cooked prawns, and Atlantic Salmon make up the top three seafood categories. Together, they outsell the combined total of all other fresh seafood categories. However, Arthur Raptis says pre-packaged convenience meals are an emerging trend in the major supermarkets.

New technologies have created a wave of ready-to-go products using modified atmosphere packaging (MAP), which replaces oxygen with other gases to stabilise shelf life, and skin packs, which remove the oxygen and vacuum-seal the product with plastic film.

"The ready-to-go meal category has been growing by more than 10 per cent a year across all supermarkets in Australia for the past few years," he says. A. Raptis & Sons already has a range of new products to meet demand, including Atlantic Salmon portions, crumbed flathead or whiting, Saddletail Snapper fillets and garlic prawn cutlets.

"Customers like ready-to-go meals because they are convenient, and because they don't actually have to touch the raw fish. They can take it home, take the plastic off and tip it straight into the frypan. There is no smell because it is sealed, so even if they don't cook it straight away, it's not smelling out the fridge," he says.

A big plus for supermarkets is the potential to reduce labour costs by reducing the need for behind-the-counter service staff. Seafood is beginning to appear more regularly on the same refrigerated shelves as pre-packaged chicken, beef and pork. In some countries, such as Britain, behind-the-counter service for seafood has been almost entirely eliminated in favour of ready-to-go meals.

Arthur Raptis predicts that within 10 years this category will provide the greatest profitability for the seafood industry, with people shopping more frequently for just a few meals at a time.

Demand for seafood is on the rise, and Arthur Raptis believes the future is bright for the Australian seafood industry.

PHOTO: DAVID WALLIS

Sustainability standards

However, Arthur Raptis acknowledges that it is not a simple matter to gain access to a place on the supermarket shelves. Environmental accreditation is a baseline expectation, as is meeting an ethical standards audit – an internal process instituted by both Coles and Woolworths for their suppliers. "If you can't meet those standards, you can't even get in the door," Arthur Raptis says.

"The supermarkets have really led the way in their expectations, even though many members of the public would not really understand what a 'sustainable fishing source' means. Sustainability as a consumer-driven requirement doesn't quite exist yet, but the knowledge and the expectations of consumers are growing."

Collaborative marketing

While supermarkets demand more from their suppliers, they also provide powerful allies who can help build seafood sales, particularly in conjunction with collaborative industry marketing initiatives. Collaborative initiatives also provide sales impetus for the independent seafood sector, which may not have the marketing clout of Coles or Woolworths.

The 'Love Aussie Prawns' campaign, initiated by the Australian Seafood Cooperative Research Centre, is an example, bringing together producers from both the wild harvest and aquaculture sectors, with an annual budget from voluntary contributions of more than $700,000 for the first two years of the campaign.

As one of Australia's largest prawn fishing companies, harvesting from both the Northern Prawn Fishery and the Spencer Gulf in South Australia, A. Raptis & Sons has been a major contributor to the campaign.

"As individual companies we can only do so much, but as a broader group you start to pool your money together and you can engage with experts to guide you," Arthur Raptis says. "Working with Brand Council, there has been a great deal of thought put into the campaign."

The marketing focus has been on promoting the 'specialness' of prawns as an essential part of any celebration. In the first year the campaign worked with independent seafood retailers, expanding this to major supermarkets in the second year.

"Coles and Woolworths in particular have really jumped on board, and that's where most of the product is being sold," he says.

The result has been an increase in the base price of prawns and demand for Australian prawns, both cooked and raw, now outstrips supply.

The increase in demand has been complemented by the growing popularity of television cooking shows, greater awareness about how to prepare seafood and the development of cooking as a hobby, rather than an obligation, he says.

Supermarkets are also making use of an increasingly sophisticated digital marketing landscape. Quick response (QR) codes, website links and serving suggestions on product packaging, supplemented by discount coupons from food or supermarket websites, encourage the purchase of complementary ingredients to complete a meal and drive sales. The partnership between Coles and the recipe website www.taste.com.au (which receives 2.5 million views a week) is just one example.

Online sales and marketing

However, Arthur Raptis says an increasing number of seafood and fishing companies are also getting serious about their branding, with a strong online presence and the use of QR codes to provide more product information. Opportunities in the digital space for fishers include online sales as well as marketing.

The success of online ordering allowed A. Raptis & Sons to close the retail outlet at its processing operations in Brisbane in 2013. It now offers a pick-up or delivery service for local customers, which becomes a drive-through pick-up only during the busy Christmas period.

OUTLOOK 2015

The Australian Bureau of Agricultural and Resource Economics and Science (ABARES) is a research bureau within the Australian Department of Agriculture that provides independent research, analysis and advice for government and private-sector decision-makers on issues affecting Australia's agriculture, fisheries and forestry industries. The program for the Outlook 2015 Conference features several fisheries-specific presentations.

Tuesday 3 March

- Dylan Skinns, Austral Fisheries
  Building relationships with chefs and consumers to develop markets for innovative seafood products

Wednesday 4 March

- Ilona Stobutzki, ABARES
- Arno Verboon, Fremantle Octopus
  Octopus – delivering new export opportunities
- Dallas Donovan, Seafarms Group
  Prawn farming in the north – fulfilling potential
- Arthur Raptis, A. Raptis & Sons
  Trends in seafood retailing

PHOTO: DAVID WALLIS

The full program for the Outlook 2015 Conference and presentations following the conference can be viewed at: www.agriculture.gov.au/abares/outlook-2015

ENGINEERING APPROACH IMPROVES CATCH QUALITY

While customers are often surprised to find that the seafood company A. Raptis & Sons actually operates its own vessels – 15 of them, in fact – the CEO of the company, Arthur Raptis, says fishing continues to take precedence in everything the company does.

However, there is also a good deal of engineering involved and a major focus on technology ensures that fishing operations, and the subsequent processing, packaging and distribution, are always as efficient as possible.

Speed in sorting is critical, as prawns begin to turn black very quickly after being removed from the water. Arthur Raptis says the company has invested a great deal in automating as much of the sorting process as possible so that prawns are caught, sorted, packed and snap-frozen quickly.

The company's newest vessels are fitted with giant tanks on the back, filled with brine water chilled to 0°C , and a conveyor belt running under the water takes the prawns from the tanks through the sorting and packing line.

He says, over time, the improvements in catch handling and onboard processing have increased the overall quality and profitability of the company's catch.

Of a three-tonne haul, for example, it used to be that the first tonne was packed for premium domestic markets. The second tonne, packed after some time had elapsed, would be of lesser quality, and sent offshore for processing before being sold back into the domestic institutional or food service market.

As more time elapsed, the remaining lowest quality product would be packed for export markets and processed as an ingredient for other food products, such as dim sum or prawn balls, sold overseas.

"But the technology on our newer vessels allows us to sort faster and we can pack quickly enough to sell the first two-thirds into premium markets and the final third as processed product for the domestic market," Arthur Raptis says.

"Less is being processed overseas and the products we resell into the domestic food service sector, such as breaded and crumbed prawns, or meat and cutlets, are also returning as much as our premium-grade product.

"We work with customers to place product in the best possible form for that particular market; to do those things cost-effectively takes a great deal of engineering and ingenuity."

He says while it is hardly practical to pack fish at sea into ready-to-serve portions, there have been changes to onboard processes that do reflect demand for smaller, more easily handled units.

Twelve-kilogram bulk cartons were once the standard for prawns, but the crew now pack in varying sizes to meet specific client needs – five kilograms for supermarkets and down to two kilograms for some export markets.

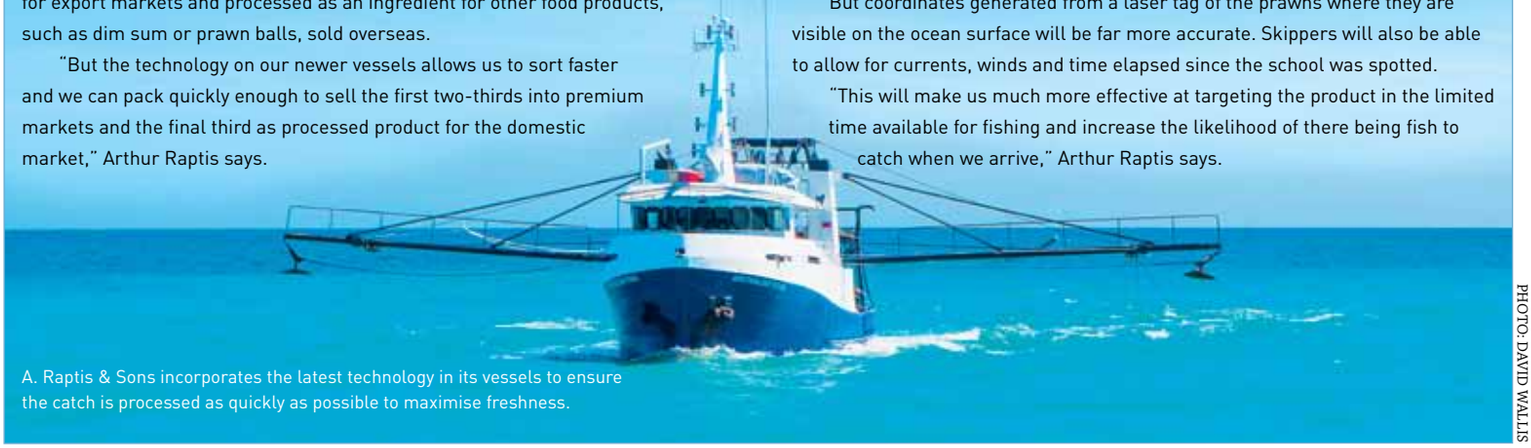
Tracking technology

Always on the lookout for new technology to further improve efficiency, Arthur Raptis is already planning to make use of military-style laser location tagging, which he expects will improve the accuracy of tracking schools of prawns.

GPS coordinates generated from spotter planes can often be out by a kilometre or more. When vessels arrive at the nominated location, there are no prawns; it is a huge waste of time and energy.

But coordinates generated from a laser tag of the prawns where they are visible on the ocean surface will be far more accurate. Skippers will also be able to allow for currents, winds and time elapsed since the school was spotted.

"This will make us much more effective at targeting the product in the limited time available for fishing and increase the likelihood of there being fish to catch when we arrive," Arthur Raptis says.



A. Raptis & Sons incorporates the latest technology in its vessels to ensure the catch is processed as quickly as possible to maximise freshness.

PHOTO: DAVID WALLIS

In December 2014 the company took more than 2000 online orders, mostly for prawns. Christmas sales were supported by a targeted Facebook promotion, which Arthur Raptis says cost one-tenth of a comparable radio campaign.

From the millions of Facebook users in Australia, the company refined its target audience to a closely defined target demographic: women aged 25 to 40 who live in Brisbane, the Gold Coast or the Sunshine Coast, and who list food or seafood as a hobby or interest.

"We reached 35,000 selectively identified people in the four weeks before Christmas. More than 10,000 people have clicked on our advert and we now have 6300 people who are following us – who have 'liked' our website. Most fishing and seafood companies are quite small, but with digital marketing you can do a highly targeted campaign like this for only $3000," he says.

Arthur Raptis expects online business will become an increasingly popular business model, given the high cost of retailing in Australia. For those who already have a seafood business or a factory, it is a relatively small step to develop an online ordering system and offer a delivery or pick-up service. "There are lots of options for companies to approach distributors; refrigerated courier companies are already popping up all over the place," he says.

Export opportunities

In recent years the industry has focused largely on domestic markets as the Australian dollar, at parity with the US dollar, closed off many export opportunities. But Arthur Raptis sees market forces beginning to realign in Australia's favour.

The huge demand for seafood across South-East Asia, and the Free Trade Agreement with China, which will remove tariffs on seafood, are part of this equation. While Japan has been a major seafood export destination for many years, China, including Hong Kong and Taiwan, will be the new growth market, he says.

"Fuel prices are coming down, the Australian dollar is coming down, demand for seafood domestically is going up, export demand is going up. For those in the fishing industry who have been able to hang on through some really difficult times, I think there are good things ahead." F

Planning marine investment

A 10-year plan prioritising marine science investment for Australia is expected to be finalised by June 2015, and the FRDC has been leading discussion about investment required in wildcatch and aquaculture science and food security.

Preparation of the plan has already involved more than six months of stakeholder consultation and discussion in the scientific community following the launch of the discussion paper *Marine Nation 2025: Marine Science to Support Australia's Blue Economy* by the National Marine Science Executive Committee in 2013.

The National Marine Science Plan has eight priority themes:

- sovereignty, security and natural hazards;
- energy security;
- food security;
- biodiversity conservation and ecosystem health;
- dealing with climate change;
- optimal resource allocation;
- urban coastal environments; and
- infrastructure.

White papers on each of the marine science plan's eight themes are expected to be finalised this month.

Australia's marine economy – the 'Blue Economy' – is valued at $47.2 billion a year, which is predicted to grow to $100 billion by 2025.

More information: http://frdc.com.au/environment/NMSC-WHITE/Pages/default.aspx

Crab alert causes Facebook frenzy

A simple biosecurity alert on an invasive species of Asian paddle crab has led to a record number of views of the FRDC's Facebook page. The Department of Fisheries, Western Australia, sent out the biosecurity alert to inform fishers that a specimen of Asian paddle crab (*Charybdis japonica*) had been caught and successfully identified via taxonomic and molecular analysis in late December 2014. The FRDC posted the alert on its Facebook page. The results surprised everyone, including the Department of Fisheries, WA. In the first 24 hours it recorded 120,000 views and by 48 hours more 250,000 views. At last count the tally was approaching 400,000 views.

The Asian paddle crab is not established in Australia, but has significant potential to do so and to become a major pest, so it is important to immediately report any found in the wild. If you think you have found or seen an Asian paddle crab:

- photograph it – from different angles, and include a scale or ruler if possible next to the specimen, as well as photos of the location where you found it;
- record it – size, colour, how, where and the depth at which it was found, using GPS readings if available, or describe in detail the area in which it was found;
- collect a sample in a plastic bag, refrigerate it or keep it on ice (do not freeze); and
- report it immediately to FISHWATCH, 1800 815 507, or use the WA PestWatch App.

More information: Fisheries WA, 08 9482 7333, biosecurity@fish.wa.gov.au

A fact sheet and identification guide are available from: www.fish.wa.gov.au/Documents/biosecurity/asian_paddle_crab.pdf

2015 AUSTRALIAN RECREATIONAL FISHING CONFERENCE

'Managing our Fishing Future' is the theme of the third Australian Recreational Fishing Conference, to be held on Saturday 25 July 2015 at the Gold Coast Convention and Exhibition Centre in Queensland. The conference is being organised as part of the FRDC's Recfishing Research national subprogram. Coordinator Matt Barwick says the aim is to increase engagement with Australia's five-million-strong recreational fishing community on national issues of importance, and to identify priorities for further action following the conference. The event will also celebrate the achievements of individuals and groups within the recreational fishing community through an awards ceremony. The conference will run in conjunction with the Australian Fishing Tackle Association's 2015 trade show at the same venue, from 26 to 28 July, showcasing the latest innovations in recreational fishing, marine and outdoor equipment.

Conference registrations will open on Monday 4 May.

More information: www.recreationalfishingconference.com.au

NEXT GENERATION OF LEADERS

The successful candidates for the 2015 National Seafood Industry Leadership Program (NSILP) have been selected. The program operates as part of the FRDC's People Development portfolio, with gold sponsorship from Sydney Fish Market. Participants this year include:

- **Michel Bermudes**, hatchery manager at Shellfish Culture Ltd, Tasmania;
- **Chloe Clauson**, executive officer, Abalone Industry, SA;
- **Adam Clow**, owner-operator of Southern Cross Fishing, New Zealand;
- **Jennifer Cobcroft**, research fellow, Institute for Marine and Antarctic Studies, University of Tasmania;
- **Johnathon Davey**, executive director, Seafood Industry, Victoria;
- **Hayley Egan**, researcher, Southern Cross University, NSW;
- **Darvin Hansen**, general manager, Tasmanian Seafoods' Margate factory, and vice president of the Tasmanian Abalone Council;
- **Julian Harrington**, project manager, Tasmanian Seafood Industry Council;
- **Aaron Irving**, executive officer, Pearl Producers Association, WA;
- **Rhiannon Jones**, fisheries management officer, Department of Fisheries, WA;
- **Rachel King**, executive officer, Oysters Australia, NSW;
- **Robert Langdale**, Tasmanian-based fisher;
- **Emma Lowe**, assistant director, Australian Department of Agriculture, ACT;
- **Stephen Mayfield**, science leader – fisheries, South Australian Research and Development Institute;
- **Suzanne McEnallay**, operations manager, Wallis Lake Fishermen's Co-operative, NSW;
- **Veronica Papacosta**, director and chief financial officer, Penrith Seafoods, NSW;
- **Josiah Pit**, operations and supply chain manager, Aquarium Industries, Victoria; and
- **Alicia Sabatino**, fisheries management officer, Australian Fisheries Management Authority, Queensland.

Funding for NSILP is provided by the FRDC and Sydney Fish Market. NSILP is delivered by Rural Training Initiatives.

More information: **www.ruraltraininginitiatives.com.au**

STOCK STATUS UPDATE

FRDC executive director Patrick Hone (left) and Senator Richard Colebeck launching the latest update of the *Status of Key Australian Fish Stocks Reports* in December 2014.

PHOTO: EAMON GALLAGHER

REPORTING & ACCOUNTABILITY

The addition of new species further improves reporting on the status of Australia's fisheries and identifies room for improvement

By Catherine Norwood

The second edition of *Status of Key Australian Fish Stocks Reports*, released in December 2014, includes 19 new species in addition to the original list of 49 species formally assessed as part of a comprehensive national fisheries reporting system.

The additions mean the reports now encompass 85 per cent of Australia's wild-catch fisheries by volume, or about 118,700 tonnes of 139,700 tonnes in 2012–13. This represents 90 per cent of the value of Australia's wild-catch fisheries.

In launching the reports the FRDC's executive director, Patrick Hone, said the reports reflected well on the status of Australian fisheries overall, although the assessments would provide a wake-up call in some areas. The long-term aim is to ensure that Australian fisheries are synonymous with sustainability, and that management is based on sound science, he said.

'Sustainability', as used in the reports, relates to the biological sustainability of a stock – rather than referring to broader ecosystem, economic or social viability. Information is also based on biological fish stocks, rather than management jurisdictions, wherever possible.

Assessment results

Of the 68 species or species groups reported on, there were 238 different assessments of stock undertaken, incorporating single populations assessed in multiple jurisdictions, or multiple populations within a single management jurisdiction.

The results show that 129 fish stocks (87.5 per cent of catch by volume) are being fished sustainably, with seven stocks in recovery. There were 19 stocks in decline and 11 identified as overfished.

'Overfished' does not mean a species is in danger, but new management strategies may be required to help the stock recover or, if adequate management is already in place, more time may be required for measures to take effect.

The 11 overfished stocks include Southern Bluefin Tuna (*Thunnus maccoyii*), of which there is only a single global stock, and Bigeye Tuna (*T. obesus*), of which there is a single stock within the Pacific Ocean region.

These stocks are fished by many countries, including Australia, and Australia is part of international management efforts to rebuild the populations of these species. Locally specific stocks of School Shark (*Galeorhinus galeus*), Gemfish (*Rexea solandri*), two stocks of Greenlip Abalone (*Haliotis laevigata*), two stocks of Blacklip Abalone (*H. rubra*), Mulloway (*Argyrosomus hololepidotus*), Golden Snapper (*Lutjanus johnii*) and Black Jewfish (*Protonibea diacanthus*) were also identified as overfished.

Environmental impacts

A new assessment category was introduced to the current report – 'environmentally limited'. This identifies stocks affected by environmental factors, such as a marine heatwave or disease, rather than by fishing. This applies to two species – Saucer Scallops and Blue Swimmer Crabs (*Portunus armatus*) (four stocks) impacted by a marine heatwave in Western Australia. There are also 68 stocks for which there are management plans in place, but there is not enough data to provide a confident assessment.

Identifying problem areas allows fisheries managers and fishers to respond to the issues, and gives consumers and the community confidence in Australian fisheries.

More than 100 leading fisheries researchers have been involved in developing the stock status reports as a scientifically robust, simple tool for fishers, fisheries managers, seafood consumers and the public alike to understand the status of the key wild-capture fish stocks around Australia.

As well as identifying how stocks are travelling, the reports include summaries of how numbers were determined, along with information on catch trends, fishing methods and management. There is information on environmental issues and links to key references for interested people to delve into the science and fisheries.

Future editions are expected to increase the number of species considered and broaden the information provided, although it is unlikely to include all of the 600 species commercially fished (from the 4500 known species) in Australian waters. Later editions may also include formal classifications for broader fishery-level issues such as ecological impacts, economic performance, management performance and social good.

The reports were initiated by the FRDC and the Australian Bureau of Agricultural and Resource Economics and Sciences.

The reports have been produced in collaboration with: government fisheries research agencies in all Australian jurisdictions; the Institute for Marine and Antarctic Studies, Tasmania; the New South Wales Department of Primary Industries; the Department of Fisheries, Western Australia; the Department of Primary Industry and Fisheries, Northern Territory; the Victorian Department of Environment and Primary Industries; the Department of Primary Industries and Regions, South Australia; the South Australian Research and Development Institute; the Queensland Department of Agriculture, Fisheries and Forestry; and CSIRO.

The second edition of the reports represents another step towards greater transparency and consistency of fisheries reporting across Australia. F

The reports are available at: www.fish.gov.au

FISH OF THE DAY

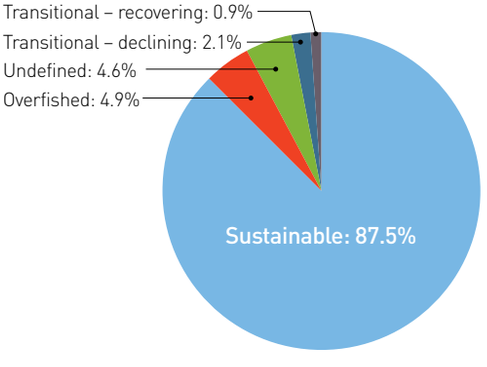
The launch of the second edition of the *Status of Key Australian Fish Stocks Reports* was held at Pei Modern restaurant in Melbourne.

The restaurant features fresh seasonal produce, prepared by chef Florent 'Flo' Gerardin. Originally from France, he says he began his career filleting hundreds of kilos of fish a day. He has been working in Australia since 2009, initially as sous chef at restaurant Vue De Monde, also in Melbourne, and most recently at Pei Modern.

After arriving in Australia, Flo Gerardin says he quickly stopped trying to adapt European recipes to Australian fish, and focused instead on developing dishes to take advantage of the unique characteristics of the local seafood. At Pei Modern he relies on his fishmonger to bring him the best seasonal catch each day, so the menu changes, depending on what gets delivered.

His menu for the launch included Jack Mackerel tartare with rice cracker as an appetiser, followed by King George Whiting escabeche and Southern Calamari with wasabi leaf salad as entrees. Whole chargrilled snapper, sourced from Port Phillip Bay, provided the main course.

FIGURE 1 SUSTAINABILITY OF AUSTRALIAN WILD-CATCH FISHERIES, 2012-13 (BY VOLUME).



SOURCE: FRDC, *STATUS OF KEY AUSTRALIAN FISH STOCKS REPORTS 2014*

PHOTOS: EAMON GALLAGHER

Florent 'Flo' Gerardin at Pei Modern.

Collaboration to streamline fisheries management

GOVERNMENT COMMUNIQUÉ

The first meeting of fisheries-sector government ministers in more than a decade could prove the beginning of an era of cooperative fisheries management

PHOTO: RAMON GALLAGHER

Ministers and senior officials meet in Melbourne.

The benefits of greater collaboration in managing all Australian fisheries sectors was the focus of a meeting of ministers and senior officials from Australian, state and Northern Territory governments, held in Melbourne in December 2014.

The meeting was hosted by the Parliamentary Secretary to the Minister for Agriculture, Senator Richard Colbeck.

Senator Colbeck said the meeting provided a real opportunity for the jurisdictions to continue to work together to improve fisheries management around Australia, including reducing the complexity and duplication of management and the cost to government and industry.

Four themes were the focus of the discussion:

- streamlining regulation by all governments at all levels to reduce unnecessary costs to the fisher and consumer;
- applying common and agreed principles to fisheries management so that everyone understands the basis of Australia's fisheries management, particularly ensuring solid science underpins good fisheries management;
- communicating the effectiveness of Australian fisheries management with the Australian community and markets; and
- using Australia's strengths in fisheries management as a base for maintaining and growing markets domestically and overseas.

Action plan

Participants at the meeting undertook the following actions.

- Welcomed streamlined approaches to environmental regulation and supported moves by the Australian Government Department of the Environment to investigate whether independent accreditation of the sustainable management of a fishery can meet requirements under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Agreed that there are real benefits to be gained from working better across agencies and removing duplication and inefficient regulation.
- Agreed to explore further opportunities for sharing services to reduce costs of fisheries management. For example, the Australian Fisheries Management Authority provides monitoring and compliance services to the Northern Territory.
- Agreed that the state jurisdictions were best placed to work bilaterally on ensuring consistent stock management.
- Agreed further discussion is needed to align recreational fishing surveys so that jurisdictions can better capture the benefits of linking recreational fishing with tourism and economic development.
- Agreed that each jurisdiction had its areas of expertise that would benefit other jurisdictions. For example, the Northern Territory has had success working with Indigenous communities to build capacity and South Australia has a well-developed aquaculture industry with a one-stop-shop approach for environmental and transport approvals.
- Agreed to work towards the development and adoption of biotoxin management plans. Tasmania shared its experiences of the 2011–12 biotoxin event involving the detection of the toxic algal species *Alexandrium tamarense* in mussels and the impact these events can have on Australia's reputation for safe food.
- Agreed to work together to develop a national aquaculture strategy. The strategy will be a national document, owned equally by all governments, along with the aquaculture industry.
- Recognised the importance of food safety standards, aquatic animal health and biosecurity, and the benefits of streamlined approvals for the ongoing success of the aquaculture industry.
- Recognised the need for the wider community to be involved and understand Australia's seafood industry and that industry has a role in explaining clearly and simply how it supports the ongoing sustainability of fisheries.
- Recognised the value of the Australian Fish Names Standard in helping consumers to easily identify which fish they are buying (for example, the use of the name 'flake').
- Acknowledged the importance of the recreational-fishing sector and agreed that working towards the application of more consistent management arrangements, where appropriate, would create benefits for the recreational sector.
- Endorsed the *National Guidelines to Develop Fishery Harvest Strategies* as an important step in fisheries management. The guidelines, developed through an SA-led project funded by the FRDC, provide a national framework to support consistent harvest strategy development across Australian fisheries.

The Australian Fisheries Management Forum will be responsible for progressing actions agreed to at the meeting. The forum is an advisory group comprising senior fisheries officials from all the jurisdictions, the Australian Government Department of the Environment, the Australian Fisheries Management Authority and the FRDC.

Forum members will also develop principles for prioritising and reforming Offshore Constitutional Settlement agreements – the arrangements that determine which jurisdictions are responsible for managing each fishery – and report back to their ministers.

The December meeting was the first time fisheries Ministers have come together to discuss the future of the sector for more than a decade, although forum group members have met regularly. Ministers expressed a desire to meet annually. F

New plan, new approach

STRATEGIC PLANNING

Extensive consultation with stakeholders has helped to clarify the long-term aspirations of Australia's fisheries sectors and identify challenges to be overcome

By Josh Fielding

Ensuring the product of Australian fisheries and aquaculture is sustainable, and is seen to be sustainable, will be one of three leading investment priorities for the FRDC in the next five years. Research priorities, developed together with stakeholders, also include improving the productivity and profitability of the industry and developing key aquaculture opportunities.

At its inception in 1991, the FRDC's focus was primarily on research for the management of commercial wild-catch fisheries. Since then, the FRDC has evolved to reflect the broad fishing and aquaculture stakeholder base and the increasing sophistication of these end-users. It now includes research, development and extension (RD&E) for economic and social drivers of change across the fishing and aquaculture sectors (commercial, Indigenous and recreational), as well as sustainability.

The end-users of the FRDC's knowledge creation face an increasingly complex operating environment with greater risks and opportunities. The FRDC's core commitment to RD&E planning is to work with clients to focus and facilitate RD&E investments that deliver. The key to achieving these results and outcomes for our stakeholders lies in the FRDC concentrating its role in three areas: leadership, collaboration and partnership (Figure 1).

The FRDC will invest in RD&E directed by stakeholder priorities via five broad programs that align with the objectives of the *Primary Industries Research and Development (PIRD) Act* – environment, industry, communities, people development, and extension and adoption.

The new RD&E Plan will see the FRDC implement a major evolution in the way it invests. The FRDC will be more targeted in fewer high-level national priority areas focusing on achieving outcomes. Previous RD&E Plans have tried to cater to a diverse range of end-user needs and wants. This does not mean that priorities outside these areas will not be funded; however, there is more ownership of these priorities given to the sectors and Fisheries Research Advisory Bodies (FRABs).

Over the next five years the FRDC will take a leadership role and target its investment in RD&E to deliver results against three key priorities:

- ensuring Australia's product is sustainable;
- improving productivity and profitability; and
- developing key aquaculture opportunities.

The FRDC will also take a leadership role in national initiatives of RD&E comprising:

- aquatic animal health and biosecurity;
- recreational fishing;
- Indigenous fishing and aquaculture; and
- people development.

The FRDC Plan aims to minimise duplication and to deliver other key planning documents to determine where the FRDC can provide a leadership role and 'fill the gaps'. In doing so, the FRDC will link and align with national initiatives and sector plans. The goal is to also align with national or sector marketing approaches linking to RD&E, in particular the need for market research, development of materials and evaluation of activities.

The FRDC will continue to bring people together to be as efficient as possible in achieving outcomes for our stakeholders. However, the FRDC acknowledges that as some issues cross multiple boundaries or sectors (national issues) a much more proactive leadership role is required by the FRDC to achieve results. F

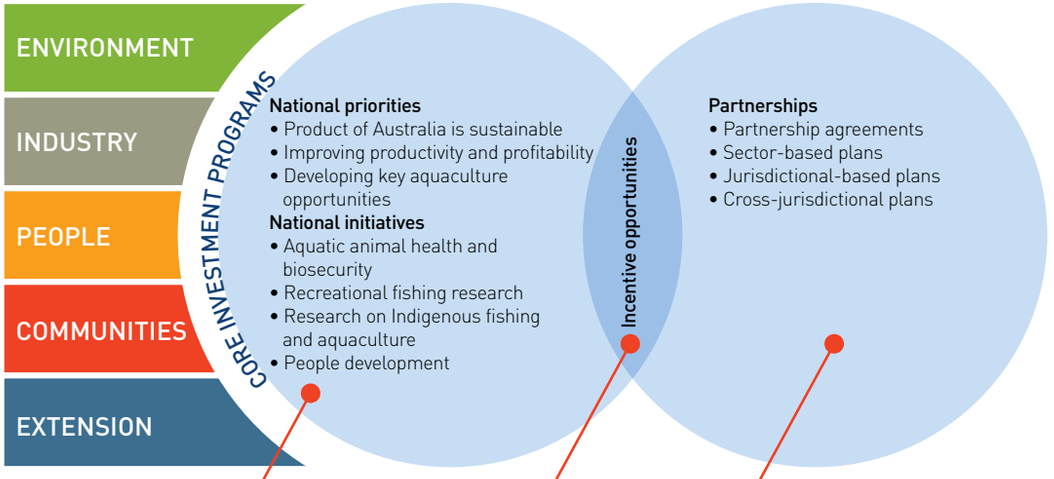
DEVELOPING PRIORITIES

Consultation began at Seafood Directions in October 2013 to clarify long-term aspirations and priorities, build a nationally agreed vision, map international market trends and understand production opportunities/constraints. The FRDC consulted with wild-catch fisheries, aquaculture, Indigenous fishers, recreational fisheries managers, research providers, workforce development and post-harvest representatives and fisheries managers from both state and federal government bodies.

Processes

- Discussion at Seafood Directions 2014.
- The annual stakeholder workshop held with the FRABs in April 2014.
- The FRDC Board strategic planning workshop.
- Several meetings with the FRDC's representative organisations.
- An end-users workshop in July 2014.
- The National Seafood Industry Leadership Program (NSILP) Seafood Community Think Tank organised by graduates of the program from 2013.
- Research projects providing sector-specific data.
- Development of the FRDC RD&E Plan was conducted in parallel with development of the National Fishing and Aquaculture RD&E Strategy, sharing inputs from consultations on this.
- Consultation with the Department of Agriculture, Fisheries and Forestry and Parliamentary Secretary to the Minister for Agriculture and staff.

FIGURE 1 THE FRDC'S ROLE IN DRIVING RD&E INVESTMENT.



Australia's take on sustainability trends

SUSTAINABILITY

How does Australia fare when it comes to global trends shaping the sustainable production and supply of seafood?

By Josh Fielding

In November 2014 *Seafood International* magazine (http://seafoodinternationaldigital.com) produced an article on the 10 leading trends that are shaping the future of sustainable seafood. Sustainability underpins seafood production, harvest and supply – ensuring adequate research, policy and legislation are in place so that seafood can be enjoyed and maintained into the future. The following outlines the international trends identified by *Seafood International*, and how these trends are shaping the industry in Australia.

CORPORATE OVERSIGHT

01 High-level corporate positions to oversee sustainability, sometimes termed Chief Sustainability Officers. These positions exist within seafood production and supply businesses, but also within companies that retail seafood, and this trend is indeed seen here in Australia.

Major aquaculture companies, such as salmon producers Tassal, Huon Aquaculture and Petuna and wildcatch fisheries such as Austral Fisheries, all have staff dedicated to improving and publicly reporting on sustainability. In addition, the two major supermarket chains (Coles and Woolworths) have people employed to monitor and understand the sustainability credentials of seafood, which in turn influences which seafood the companies purchase and sell.

IMPROVEMENTS FOR SMALL FISHERIES

02 Fisheries managers are initiating projects to provide support for fisheries unable to afford their own improvement projects or unable to organise certification through typical channels.

In Australia the Western Australian Government is helping to put all of its state-based fisheries through the pre-assessment process for Marine Stewardship Council (MSC) accreditation. There is also research and development underway to ascertain how small fisheries can demonstrate their sustainability and display this through improvement processes. In early 2014, the FRDC funded a project that brought together a range of fisheries managers from across Australia to discuss the management of small-scale fisheries and share information. Outputs from the workshop include the development of guidelines for the management of small-scale fisheries.

BOUTIQUE AQUACULTURE

03 Much of Australia's seafood can be described as low-volume and high-quality. Some international companies have found benefit from changing their farming methods and creating a more 'hand-crafted' product that taps into the popular notion of food provenance. Australian aquaculture already uses some of the lowest stocking densities in the world and achieves some of the best feed conversion rates (food input to harvestable product). The low-volume, high-quality aspects of Australian seafood production are key selling points.

There are also several 'boutique' aquaculture ventures in Australia. These include some small aquaculture-farm-based Barramundi (*Lates calcarifer*), Mud Crab and Redclaw (*Cherax quadricarinatus*) ventures in northern Australia, marron ventures in WA and even some aquaponic ventures producing small volumes of Barramundi.

CONSUMER AWARENESS

04 Thanks to organisations such as the MSC and their certification program, the Monterey Bay Aquarium's Seafood Watch Program, the Australian Marine Conservation Society's *Australia's Sustainable Seafood Guide* and the Australian Government's *Status of Key Australian Fish Stocks Reports*, consumers have information on the sustainability of the fish they are buying.

Terms such as 'social licence' and 'public acceptability' are common in discussions about Australian fisheries and aquaculture. As such, one of the highest national research priorities for fishing and aquaculture is to ensure that Australian product is both managed and acknowledged as sustainable. Work in this area includes developing standards for the science that is used to evaluate fishing and aquaculture.

BETTER USE OF BYCATCH

05 There is a push worldwide to do more with the 'underutilised' components of catch in fisheries, and Australia is no different. In some fisheries, catch that does not have a high economic return or is difficult and expensive to process is discarded or wasted. There have been initiatives from the retailing and food service sectors to use species that have historically been underutilised. In addition, there is research underway in Australian fisheries to devise ways to better use traditionally discarded fish, whether this be processing for human consumption or for some other use, such as fish meal.

TRACEABILITY

06 The ability to trace fish from the point of catch, harvest or production has always been an important component of sustainability. Worldwide the ability to trace seafood has been enhanced by the use of DNA traceability services. On a local scale the provenance of seafood has become an important component of sustainability and social licence for consumers. As such, Australian fisheries and aquaculture have been doing a lot of work in this area and are continuing to seek ways to better market product.

GENETIC MODIFICATION

07 Aquaculture species that grow faster with less food and other resources play an obvious role in the sustainability arena and genetic modification is technology that could help to achieve this. In the US some salmon aquaculture companies are seeking government approval to sell genetically modified product which, unsurprisingly, is being met with resistance from several groups.

Within Australian aquaculture there are selective breeding programs that are working to improve growth rates, breeding for certain physical traits and to improve disease resistance. There has not been a push into genetic modification in Australia and it is unlikely there would be strong interest in this in the near future.

OCCUPATIONAL HEALTH AND SAFETY AND WORKERS' RIGHTS

08 Sustainability is no longer simply about the environmental impacts of fishing and aquaculture. It also includes the conditions under which women and men work in these industries. Recently there have been issues with workers' rights, namely in some South-East Asian countries. Occupational health and safety is very high on the agenda of all Australian workplaces; the fishing and aquaculture industries are no exception. Recent changes to Federal legislation have only served to strengthen this. Working conditions are well-maintained and workers' rights are strongly protected in Australia, factors which continue to attract international workers, particularly for Australian aquaculture ventures.

PRODUCT INTEGRITY AND SEAFOOD LABELLING

09 Correct labelling of seafood is an important component of sustainability. If it is not accurately labelled, how can it be ascertained to be sustainable or not? This has become an issue for many countries and has attracted significant media coverage in Australia. The recent SBS television program *What's the Catch?* investigated the issue and was followed by an Australian Government Senate inquiry into seafood labelling laws.

Australian law requires the accurate labelling of uncooked seafood, but there are no such laws for seafood once it has been cooked or further processed. The outcomes of the Senate inquiry were published on 18 December 2014 and recommended that country-of-origin labelling on cooked or pre-prepared seafood should be required.

BENCHMARKING

10 An organisation called the Global Sustainable Seafood Initiative (GSSI) (www.ourgssi.org) is developing a benchmarking tool for eco-labels. This tool would provide a consistent benchmark for all seafood certification and labelling programs, to compare the performance of existing programs. The GSSI relies on collaboration and knowledge exchange with seafood experts on sustainability. Australia is working with the GSSI to ensure continued involvement in this initiative. Further information about the GSSI can be found on the FRDC website (www.frdc.com.au). F

MORE INFORMATION: **Australian Made, www.australianmade.com.au; Austral Fisheries, www.australfisheries.com.au; Love Australian Prawns, http://australianprawns.com.au**

NATIONAL SEAFOOD BRANDING: Do we need it?

MARKETING

Should Australian seafood have a common national brand to promote its products in international and domestic markets?

By Peter Horvat

The idea for an Australian seafood brand has been floating around the industry for a long time. There have been trials, meetings, research and agencies engaged to come up with a solution. As part of the FRDC's engagement and discussion about marketing with the seafood industry, the suggestion has again been raised.

Most other primary producers – beef, dairy, fruit and vegetables – are also considering the same idea. The summer 2014 edition of the Australian Farm Institute's *Farm Policy Journal* explores the question with six in-depth articles. It was the topic of the institute's 2014 John Ralph Essay Competition: 'Does the Australian agriculture sector need a common national brand to promote its products in international and domestic markets?'

The articles cover the opportunities and risks of a collective brand. Opportunities highlighted are: increased consumer awareness, working collaboratively and reduced costs. The winning entry suggested producers should build on the Tourism Australia campaign branding products as Restaurant Australia "Ready".

However, the articles also cover several of the risks associated with developing an all-Australian brand. These include not properly planning or testing the strategy behind the brand resulting in poor execution, the failure of one "master brand" (see Brand Architecture) to meet the needs of all producers, and reduced awareness or cannibalisation of individual company brands. Most significantly, if there is no quality control to ensure that products meet the brand expectations, it could result in damage or a reduction in perception of Australian produce.

What is a brand?

A brand is the non-generic name for a product or service; however, marketing specialist David Ogilvy described brands as "the intangible sum of a product's attributes". So a brand is much more than a set of basic attributes such as name, function, design or size. It extends and combines with expectations, memories, stories and relationships that, taken together, account for a consumer's decision to choose that brand over another.

Companies and marketing teams know that a brand can be used to create a specific value perception in customers' minds concerning the qualities and attributes of each non-generic product or service. For example, when consumers think of Rolls-Royce motor vehicles or French Champagne they get the perception the products are more luxurious. This has been created through the strategic use of marketing – product, price, place and promotion – to convince consumers of its luxury category. If all aspects of the marketing mix are not aligned, it can devalue the brand.

How would Australian seafood be perceived by consumers? What would its brand signature be: luxury or commodity? Some sectors, such as pearls, wild abalone and rocklobster, are clearly working towards the luxury market.

Figure 1 shows how brands can be built or used in different ways to provide an overarching message that: draws products together (master brand); uses existing brands to endorse or support another brand (endorsed brand); tells a story about where a product is from (regional brands); or distinguishes one company brand from another (individual brands).

Why brand Australian seafood?

The findings of consumer research funded by the FRDC and the Australian Seafood Cooperative Research Centre show that Australian consumers want to buy Australian, with 90 per cent of Australians more likely to buy food products labelled "made in Australia". But the reality is that consumers cannot readily identify where the seafood they buy is sourced. Both consumer and industry groups reinforced this point in submissions to the recent Senate Standing Committees on Rural and Regional Affairs and Transport Inquiry into the current requirements for labelling of seafood and seafood products.

There is a clear opportunity for industry to brand its seafood as Australian, but does this require a new brand?

Australian Made

One option is to adopt the existing 'Australian Made' logo, launched in 1986. The logo was renamed the 'Australian Made, Australian Grown' logo in 2007 when the Australian Government decided to use it as the centrepiece of its new food-labelling initiative, 'Australian Grown'. In 2011, driven largely by Seafood Services Australia, 'Australian Seafood' was allowed as a descriptor for use with the logo.

The campaign already has strong support from industry, government and consumers, with significant retail partners including Australia's two largest supermarket chains, Woolworths and Coles. The logo is now used by more than 1900 businesses on more than 10,000 products sold in Australia and export markets around the world. For further information visit the Australian Made website (www.australianmade.com.au).

Australian seafood branding

Seafood branding in Australia has historically been the domain of packaged and processed seafood – tinned or frozen. The Simplot Australia brand John West, for example, has been a fixture in Australia homes for the best part of 50 years and today is still one of the best-known food brands. But branding is increasingly being taken on by other businesses with direct links to their fisheries.

Austral Fisheries – Glacier 51 and Skull Island (endorsed branding)

On the Austral Fisheries website (www.australfisheries.com.au), CEO David Carter puts forward the company basis for operating: "Our Business Statement is simple: Austral Fisheries catches and sources sustainable, quality seafood". This simple statement

underpins the company brand and gives a clear indication to consumers that the company is focused on producing high-quality seafood while being environmentally responsible.

This underlying thread – quality and sustainability – has been rolled out in its two signature brands: Glacier 51 Toothfish, and the recently launched Skull Island Tiger Prawns. Both products are endorsed with the Marine Stewardship Council blue tick, and use all aspects of the marketing mix to clearly position the products as being high quality.

Sustainable Barramundi (endorsed branding)

The Australian Barramundi Farmers Association (ABFA) is focused on ensuring consumers can readily identify the product of its members as Australian. In its submission to the Senate inquiry on seafood labelling, the ABFA identifies itself as an advocate for increasing seafood consumption in Australia and truth in labelling. It is keen to ensure there is effective labelling so that consumers, including diners in any venue, can make informed decisions regarding their meal choices.

Linked to this is the ABFA's proactive marketing strategy, developing a Sustainably Farmed Barramundi Certification Program and brand, to assure consumers of the origin and sustainability of the produce, via clear seafood labelling.

President of ABFA Marty Phillips says clear labelling and traceability of Australian Barramundi provides consumers with the information needed to confidently choose a sustainable Australian product.

"Certification is only awarded to those Australian producers who have gone through a stringent compliance exercise and been externally audited to gain accreditation in sustainability and food safety," he says.

Love Australian Prawns (master branding)

Prawn fishers and farmers have invested enormous amounts of effort and money to find, catch or grow the very best prawns they can. However, while Australian consumers love prawns, the product has not always received the attention it deserves.

Market research and basic economics show that competing (with other prawns and species) on price alone is a race to the bottom, where no-one wins. But if you can tell your story, appeal to emotions and not just wallets, then you give people a real reason to love Australian Prawns. And this is why the farmers and fishers have joined together to market their products and sell their industry.

The campaign is based on extensive research and professional insight into consumer behaviour. It is built around the single brand – two prawns forming a love heart, combined with the tagline 'Love Australian Prawns'.

The Love Australian Prawns campaign started in 2013 (with year two underway) and was the first national campaign for an entire seafood category. Materials developed included merchandising kits containing posters, cabinet stickers, recipe and information leaflets and an A-frame. There were also 800,000 recipe booklets provided to more than 825 Australian Woolworths supermarkets and 600,000 booklets provided to more than 370 independent seafood retailers.

Prawn fishers and farmers are now leading the way for the seafood industry with unified and professional marketing, and the rest of the seafood industry is watching.

What is your sector doing? F

BRAND ARCHITECTURE

HISTORY OF BRANDS

The term 'to brand 'or 'branding' comes from the Old Norse "brandr", which means 'to burn'. This form of marking or identification was used for cattle, timber and crockery with the markings or symbols of the owner applied using a hot iron rod. The concept of branding was essentially to depict ownership, in particular of things that had value. This practice dates back several thousand years.

Branding evolved from a way of identifying ownership into a way to identify the creator of a product during the 1800s. Business success was based on ensuring their products were of good quality. For example, if you sold good coffee, whiskey or beer, people would come to your shop and buy it. And as long as you made sure that your product quality was superior to the competition, you were set for success.

The shift from simple products to brands has not been sudden or inevitable. The next evolution in branding arose out of the standardisation of production in the the mid-20th century. This led to many similar products being on the market, which required companies to find new ways to differentiate themselves from their competitors.

MORE INFORMATION: Ross Cammilleri, 08 9314 1615, 0419 196 626, ross@occotech.com.au; Sagiv Kolkovski, 08 9203 0220, 0417 9404 98, sagiv.kolkovski@fish.wa.gov.au FRDC RESEARCH CODES: 2009/206, 2010/212

PHOTO: DEPARTMENT OF FISHERIES, WA

Brave new world of octopus farming

A clutch of octopus (*Octopus tetricus*) eggs.

AQUACULTURE

Countering territorial behaviour and the propensity of octopus to escape from even the most securely closed tank systems have been among a number of achievements and world firsts to come from Australian efforts to develop aquaculture techniques for the species

By Rose Yeoman

Octopus was once considered bycatch in the rocklobster industry and used primarily as bait, but is now considered a gourmet seafood and Australian consumers just cannot get enough. However, wild-capture fisheries are unable to keep up with demand, leading fishers to investigate the aquaculture potential of the species.

Western Australia's octopus fishery is relatively new; it was officially established in 1999 and targets *Octopus tetricus*. But even in its first few years, it was clear that demand exceeded supply.

Brothers Ross and Craig Cammilleri, who founded Fremantle Octopus Pty Ltd and its subsidiary Occoculture Pty Ltd, have been the main drivers behind research into octopus aquaculture. The brothers were keen to move from octopus fishing to 'ranching', where wild-caught juveniles, the bycatch of adult harvest, are grown in land-based tanks or offshore cages.

"Ranching is gaining popularity in Europe – especially in Spain, Italy and Greece, as well as in Mexico – and with its excellent eating qualities and high growth rates (up to three kilograms a year) *O. tetricus* offers real commercial possibilities," Ross Cammilleri explains.

The Cammilleris were granted an aquaculture licence and lease at Garden Island, WA, to ocean-ranch juvenile octopus, but Ross Cammilleri says it is not possible to source enough juveniles from the wild-capture fishery to make ranching independently commercially viable. This requires closing the life cycle of the species and developing tank-based production systems to breed juveniles in sufficient numbers to supply ocean-based ranches.

The dual advantages of this are the preservation of wild stock and the production of controlled-sized animals (about 1.5 kilograms) to meet the market.

In order to move from ranching to a whole-of-lifecycle approach in an aquaculture setting, the Cammilleri brothers approached the Department of Fisheries, WA.

Model octopus farm

Working with the Cammilleri brothers, Sagiv Kolkovski was appointed the principal research scientist to lead a four-year, FRDC-supported project, which has made major gains in understanding the behaviour and life cycle of *O. tetricus*, while analysing its commercial viability for aquaculture.

This includes the development of a 15-tank model octopus farm at the Western Australian Fisheries and Marine Research Laboratories (WAFMRL) based at Hillarys Boat Harbour, north of Perth.

The aim was to imitate commercial reality and develop a system that could be replicated in any country and be a profit-yielding enterprise. The costs of running the system – including equipment set-up, such as tanks and pumps, as well as resources, such as labour, electricity, water and feed – were analysed.

Ranching

Sagiv Kolkovski and his team had to solve several issues to develop the commercial tank-based ranching system. He explains that in the wild, octopus exhibit territorial behaviour and will aggressively defend their range. In Spain and other countries developing this type of aquaculture, this behaviour is controlled by providing hides in the form of PVC tubes, so each octopus has its own territory in which to grow and develop.

"But these hides limited the biomass in the tank and the harvesting and maintenance. This included cleaning, which was a huge issue," Sagiv Kolkovski says. "From day one, I wanted to grow octopus as I grow fish – without a hide."

He and his team discovered they could intensively grow octopus in tanks without hides when individuals were all of a similar size. "When this occurred, none of the individuals displayed aggression or cannibalism, as they inevitably did in a mixed-size population. We found there was an inverse relationship between octopus density in the tank and the degree of aggression and cannibalism. We added so many to the

PHOTO: DEPARTMENT OF FISHERIES, WA

PHOTO: BRAD COLLIS

An octopus interacts with a researcher.

Sagiv Kolkovski (front), principal researcher for the octopus aquaculture study, developed a 15-tank model octopus farm at the WA Fisheries and Marine Research Laboratories based at Hillarys Boat Harbour.

tanks that we had to install flat PVC sheets so they would have more surface to attach to as the tank walls were completely occupied."

Not having hides saved up to 80 per cent of the tank cleaning and maintenance work that would otherwise have been required, which translated into cost savings. "It simplifies the whole system. A tank can be cleaned in just a few seconds, so there is no marine growth or bacteria on the walls," Sagiv Kolkovski says.

World firsts

In Spain, the maximum biomass harvested from aquaculture systems using hides is 15 kilograms per cubic metre of water. The WA octopus farm harvested 54 kilograms per cubic metre, a biomass production rate never before achieved in octopus aquaculture.

It was also a 'world first' to recognise that octopus could be tank-grown without hides and that in high-density, size-matched populations octopus behaviour was modified and switched from being individual and territorial to behaving as a 'school', with no signs of cannibalism or aggression.

Another first was developing a simple mechanical method of preventing them from engaging in the kamikaze habit of hurling themselves out of the tank and onto the floor. Octopus are known to be masters of escape and heavy steel mesh is usually used to cover tanks to prevent this.

Looking for alternatives, the research team first tried a low-voltage pulsing electric fence positioned a few centimetres above the perimeter of the tank, but the escapes continued.

The solution ultimately devised is both simple and elegant: a band of woven shade cloth around the perimeter of the tank.

Shade cloth has a porous, woven structure that permits airflow. This prevents an octopus latching on with the suckers on its tentacles, which require a vacuum to work. The solution completely prevents escape and has the added advantage of being easy to drop down during feeding or when cleaning the tank.

Breeding bottleneck

Early in the project it became apparent that survival rates of paralarvae represented a significant 'bottleneck' in the system and would be the most difficult aspect of closing the life cycle.

As Sagiv Kolkovski explains, octopus species display one of two types of egg production. In some species, up to 150 'large' eggs (like a ball bearing) are produced and the individuals that hatch are 1.5 to 2 centimetres and look and behave like miniature versions of the adult.

In the second form of egg production, which occurs in *O. tetricus*, 100,000 to 200,000 very small eggs are produced and they hatch to produce embryos (called paralarvae) with leg buds, an ink sac and a primitive digestive system. In nature, the chances of any one paralarva from this second group surviving to an adult are much lower than that of a juvenile octopus hatched fully developed.

In the ocean, *O. tetricus* paralarvae develop over a two-month period, and at 55

PHOTO: DEPARTMENT OF FISHERIES, WA

A developing octoups egg.

PHOTO: DEPARTMENT OF FISHERIES, WA

Hatching paralarva.

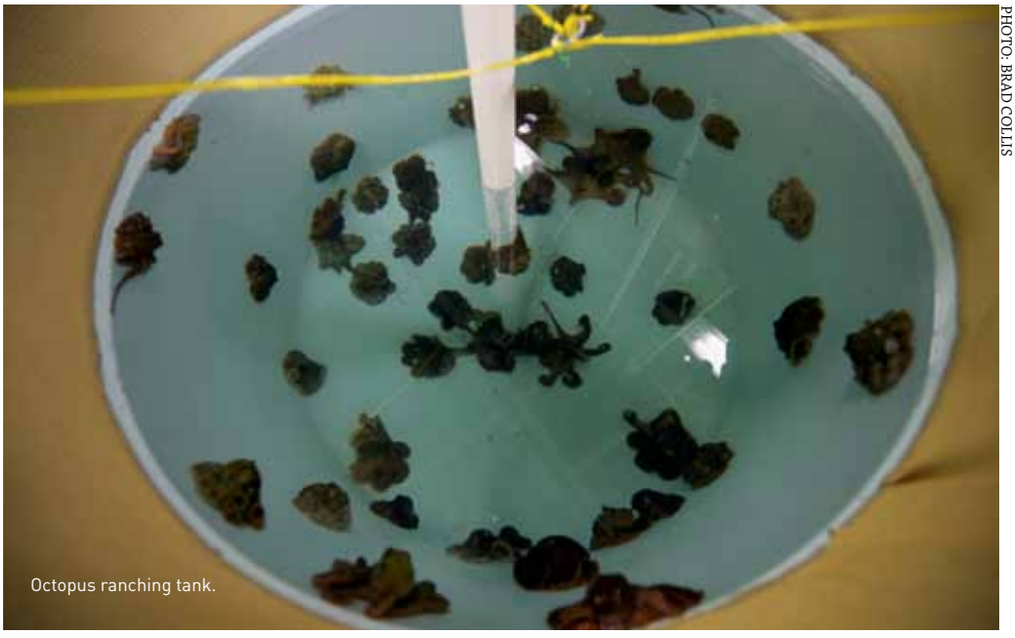


PHOTO: BRAD COLLIS

Octopus ranching tank.

to 60 days post-hatching they metamorphose over 48 hours to become juveniles.

Yet in an aquaculture tank, among the hundreds of thousands of paralarvae produced during the course of the study, only one – an individual nicknamed 'Bob' – survived to develop into a juvenile octopus. This was such a rare and exciting event that technician Nicole Watts baked a cake and held a birthday party in Bob's honour.

Feed efforts

Sagiv Kolkovski says one of the main issues with rearing paralarvae is nutrition and little is known about their nutritional requirements.

"A great deal of effort was devoted to developing an optimal diet. Different protein and lipid sources and levels were tested. Levels and ratios of essential fatty acids were also manipulated.

"The way the diets or 'enrichments' were delivered to the paralarvae was through *Artemia*, also known as brine shrimp. They are filter feeders and were provided with the diets before being fed to the paralarvae," he says.

Other live feeds tested included wild-caught Blue Swimmer Crab (*Portunus armatus*) zoea and rocklobster phylosoma, but due to unpredictability of their supply *Artemia* was chosen as the feed.

An octopus paralarva displays unique feeding behaviour by feeding on adult *Artemia* – which are of similar size to itself – immediately after hatching. A paralarva will catch an adult *Artemia* (which may be bigger than the paralarva itself),

PHOTO: DEPARTMENT OF FISHERIES, WA

A juvenile octopus.

bite the head off and inject digestive enzymes. It then sucks the digested proteins from the *Artemia* body and discards the skeleton, which can become a source of contamination in the tank.

Discarded *Artemia* skeletons are an excellent breeding ground for bacteria, which significantly affect the growth and survival of the paralarvae. Flushing out dead *Artemia*, as is normally done in fish larvae tanks, is impossible due to the similarity of size of paralarvae and *Artemia*.

The issue of separating dead prey from living paralarvae was solved by developing a double tank system where one tank contained the paralarvae and the other clean water. A connecting pipe between the two tanks allowed a gentle current to carry paralarvae from the 'dirty' tank to a 'clean' tank as dead material sedimented out. This process occurred over several hours to reduce any stress on the paralarvae and although survival rates of paralarvae increased, metamorphosis to juvenile octopus was not achieved.

Aside from nutrition, environmental factors were also considered. The team investigated photoperiod and light intensity and found that paralarvae have a strong positive response to light in the first two weeks of life and then develop a more negative response. Light intensity was manipulated and adjusted to suit these physiological requirements as it affected feeding behaviour within the tanks.

'Green water', which is the addition of microalgae into the paralarvae tank, was also tested. While adding green microalgae, such as species in the genus *Nannochloropsis*, to finfish larvae tanks is a necessity and has become standard practice, it had no effect on octopus paralarvae survival or growth.

While the ultimate goal of closing the life cycle of *O. tetricus* was not fully achieved, major advances in understanding were made. Management and natural induced spawning of octopus broodstock was achieved and eggs and paralarvae can now be produced on demand. Larval systems, environmental conditions and nutrition were all developed and knowledge gained in these areas will assist in accomplishing a commercial octopus breeding program in the future.

Global industry

Both Sagiv Kolkovski and Ross Cammilleri acknowledge the need for more research to unlock the nutritional and environmental code required to close the octopus life cycle in aquaculture conditions. But what they have achieved is a number of world firsts in octopus aquaculture and the development of a model grow-out system, which Ross Cammilleri is keen to establish in developing countries such as South Africa, Mauritius, the Seychelles and Sri Lanka.

"When juveniles are captured, they could be taken back to the home where the family would care for them in tanks. This would provide working opportunities to a family and they could sell to a central cooperative, which could manage the advertising, sales and processing.

"We would manage the enterprise, whether it was a cooperative or another structure, but it has to be commercially viable," he says.

He sees it as a way that fishing families and, in particular, women and children in developing countries could earn extra income for the family, which would stimulate the local economy and assist communities. F

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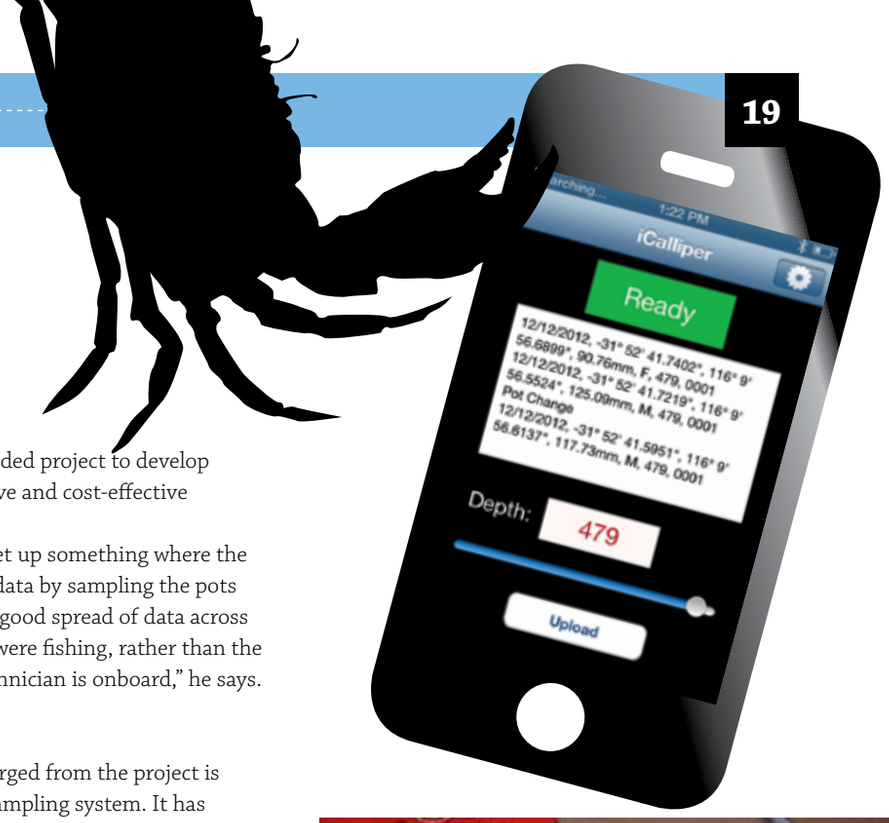
FRDC RESEARCH CODES: 2001/055, 2011/254



Crab app enhances fisheries monitoring

TECHNOLOGY

A new smartphone app that allows commercial crab fishers to collect detailed, near-real-time catch data is proving a cost-effective alternative to traditional monitoring

By Natasha Prokop

Take a pair of vernier callipers, add wireless bluetooth capacity and link it to a smartphone data-recording app and what emerges is a new tool that is revolutionising monitoring for Western Australia's Crystal Crab fishery.

It allows for the ongoing gathering of information as fishers fish across the entire fishery, which spans more than 1000 kilometres of coastline from Fremantle north to Carnarvon. It is a tool that has the potential to be adapted for the monitoring of a wide range of other crustaceans, according to scientists at the WA Department of Fisheries, who have been leading the project.

Crystal Crabs (*Chaceon albus*) are endemic to WA, and are part of the West Coast Deep Sea Crustacean Managed Fishery. The species is slow-growing, lives for up to 30 years and is highly sought after by seafood connoisseurs. They are considered one of the best-tasting crab species; the tender, white flesh has a subtle, sweet taste, thought to be a result of the deep, cold and clean water in which they live.

But collecting high-quality catch data to assist with stock assessments, while keeping monitoring costs down, has been a major challenge for the fishery.

Catch length and frequency data are essential for stock assessments and setting catch quota. In the past this has been collected by research technicians from the WA Department of Fisheries. However, the size and sex ratios of this species vary with depth and location, so data collected a few times a year by technicians was not seen as representative of the entire fishery.

Given the distances involved, and that there are relatively few boats in the fishery, these monitoring trips are also prohibitively expensive.

Seeking to overcome these challenges, Curtin University researcher Roy Melville-Smith has led an FRDC-funded project to develop a more comprehensive and cost-effective monitoring system.

"We wanted to set up something where the fishers could record data by sampling the pots each day, giving us a good spread of data across the whole area they were fishing, rather than the snapshot when a technician is onboard," he says.

Innovative

The system that emerged from the project is called the iCalliper sampling system. It has adapted the widely used vernier callipers, fitting them with a bluetooth function that links with a smartphone via a specially designed app.

This app enables the size and sex of the crabs to be combined with the date, time and location-recording capabilities of smartphones.

The result is a system capable of capturing and transmitting high-quality data to scientists several hundred kilometres away in Perth, whenever fishers return to land.

Developing this technology was not without its challenges, Roy Melville-Smith says. Modifications to the calipers were made based on fisher feedback to make the system as user-friendly as possible, and to ensure fishers could collect data efficiently without hindering their own operations. This included changing touch-screen switches that were too sensitive for rough sea conditions and relocating buttons on the equipment so that those used most frequently by the fishers were within closest reach.

The WA Department of Fisheries oversees the crustacean fishery monitoring program and researcher Jason How says the usability of technology is crucial when the department seeks assistance from fishers with monitoring activities.

"We often rely on the fishing industry to give us information and whatever we can do to make it easier to collect, the more likely we are to get that data," he says. "The better the data we have, the better management decisions we can make."

Further developments

The data the department has received in the year since the iCalliper system was introduced has been both good quality and useful in monitoring efforts. Jason How says there are now plans to modify the system to further enhance its usefulness.

PHOTO: B HEBITON, DEPARTMENT OF FISHERIES, WA

Modified vernier callipers used in the iCalliper sampling system.

The changes would allow fishers to record additional inputs for undersized crabs captured in modified research mesh pots. "With this information we can get a better understanding of the numbers of animals moving into the fishery and then we will have more certainty about how the fishery is performing," Jason How says.

This recruitment data will be particularly useful for the Crystal Crab fishery in WA as it prepares to undergo Marine Stewardship Council certification.

Jason How says the ability of the iCalliper system to gather information more efficiently and to reduce the cost of monitoring means it also has great potential in other fisheries. "It's a great system that has been developed and, with a few minor modifications, it can be used in a suite of monitoring activities for all crustacean fisheries in the state." F

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FRDC RESEARCH CODES: 2013/209; 2014/004

Sound effects

ILLUSTRATION: PAUL DICKENSON

ENVIRONMENT

While humans harness sound to navigate the oceans and its riches, there are growing concerns about the potential impact of industrial noise pollution on marine ecosystems

By Bianca Nogrady

It is easy to think of the ocean as a place of deep blue quiet, especially in comparison to the hectic and noisy modern city environment. But the reality is quite the opposite – our seas and oceans abound with sound: the clicks of fish and animals echolocating, the hollow booms and high-pitched whistles of whalesong, the crashing of waves, and even the distant cracking of southern ice floes.

In a world where vision is often compromised by poor light and distance, sound is essential for communication. Fish and other marine creatures all use noise to communicate, to find mates, to detect predators and to navigate around their environment.

But sound is also an essential tool for a host of industries, including the fishing, oil and gas industries. The fishing industry uses noise to navigate, to find fish, and to warn other creatures away from its catch and equipment. The oil and gas industry uses sound to find mineral deposits deep under the ocean floor; and the mining process itself can be noisy.

Noise is also an inevitable byproduct of boats and shipping. As the commercial and recreational use of marine vehicles increases, so too will noise pollution from engines and equipment.

As the competition for underwater bandwidth has increased, marine noise pollution is becoming a major concern, and evidence is building about potential long-term and far-reaching consequences that could affect life underwater, and those industries that rely on marine life for their livelihoods.

Industries with a stake in the issue are now initiating significant research, in an attempt to tease apart incredibly complex interactions, and to work out exactly if, and how, noise pollution is affecting marine life.

Research limits

The limited research that has been completed to date in Australia tends to involve small-scale, close-quarter experiments that reveal little about the wider population-level effects. Few studies have been done in the Australian environment with Australian species.

"We're not entirely sure how serious an issue it is, in that there's been so little measurement of it," says Geoff McPherson, marine fisheries and acoustic consultant for Marine Acoustic Biodiversity Solutions, and adjunct principal research fellow at James Cook University.

EXPLORATION ALTERNATIVES

While some are looking for ways to reduce the frequency, or control the timing, of seismic surveys, others are looking at alternative methods of surveying for underwater oil and gas reserves.

According to a workshop report by the German-based environmental foundation Okeanos: "They [seismic surveys] produce more noise than is needed for hydrocarbon exploration, the signal is not very repeatable or controllable, and the frequencies produced are not as low as are sometimes necessary for good penetration of the substrate."

The workshop committee suggested that the time had come for air guns to give way to more environmentally sensitive and effective alternatives.

These alternatives include: marine vibrators that use lower sound pressure over longer periods of time rather than loud acute bursts; microseismic monitoring (also known as passive seismic), which involves monitoring the small-scale seismic activity, both man-made and natural, and using that to build up a picture of undersea reserves; and fibre-optic sensors.

www.okeanos-foundation.org

"Most of the available research involves playback experiments of ship noise and while there's bona fide criticism of that methodology from a physics point of view, that sort of information is showing that there is an effect," he says.

In Australia, seismic surveys conducted for oil and gas exploration are becoming the leading concern. A ship tows an array of air guns that discharge high-pressure air into the water every few seconds while crisscrossing the oceanic survey area. Long strands of acoustic receivers record the reflected pressure waves from the sea floor. The recorded data is then analysed to build up a picture of rock layers below the seabed and to reveal any potential oil or gas reservoirs.

A Canadian report, *Effects of Seismic Energy on Fish*[1], identified that adult fish within five metres of the air gun can suffer damage to their swim bladders and ear cells, internal bleeding, and blindness. Other evidence suggested ear damage may not repair for weeks to months after the initial exposure.

The bigger question is how these seismic surveys impact fish populations that experience less intense exposure. Unfortunately, these sorts of studies are much harder to do says Christine Erbe, director of the Centre for Marine Science and Technology at Curtin University.

Marine chatter

"Population-level effects, cumulative effects from multiple exposures and long-term effects are extremely difficult to measure and tease out," she says. "Also, the ocean is naturally very noisy, so we record ice cracking from Antarctica, another impulsive sound, on hydrophones around the southern coast of Australia, several thousand miles away. Animals obviously cope with this natural noise but when it comes to adding industrial noise, the key question is, how much is too much?"

In the wild – as opposed to a tank-based experiment where environmental variables can be controlled – it can be difficult to know if a change in fish or school behaviour is the result of exposure to a specific noise, such as an air gun, or simply the result of fish responding to some other influence, such as a natural noise, a nearby predator or a smell.

And even if the experiment does manage to link the behaviour with the noise, Christine Erbe says the question still remains about the implications of that change in behaviour. Even if behavior changes for an hour after impact, it is unclear whether this would have any impact on the long-term survival of an individual fish, let alone a larger fish population.

The challenge is to clearly demonstrate what impact noise has on fish, and in particular if it is a detrimental one. Anecdotal reports suggest fish respond to noise pollution, but from a policy perspective, anecdotal evidence is not enough.

Geoff McPherson says there are concerns that marine noise pollution could 'mask' fish communication and interfere with normal behaviour.

"The best work done to date on tuna was in the Mediterranean, where Italian researchers built a massive cage underwater with tuna in there," he says. "They had all the ships going past, and they watched the behaviour of oceanic pelagics when impacted by noise, and it disrupted their schooling; it didn't impact on the animal, it didn't hurt it, but it reduced the schooling capability."

Questions unanswered

The Australian Southern Bluefin Tuna (SBT) industry is exposed to the possible affects of seismic surveys, as many of these are being conducted in the Great Australian Bight off South Australia, which is a key location for tuna migration, says Brian Jeffriess, CEO of the Australian Southern Bluefin Tuna Industry Association.

"The actual fish migrate from the Indian Ocean through the Great Australian Bight and stay there generally for two to three months at a time, and then either go back to the Indian Ocean or go to Tasmania and the east coast of Australia," Brian Jeffriess says.

CSIRO conducts an annual aerial survey of the tuna in this fishing ground, which is then used to set fishing quotas for that season. For many years, the survey had shown an increase in tuna numbers. The year that a seismic survey was undertaken, the survey also showed a decrease in tuna numbers.

The following year, when there was no seismic testing prior to the CSIRO aerial survey, the numbers returned to the previous growth trend. He says there may have been other variables that caused the 2012 result, but the timing of the seismic surveys did coincide with the drop in numbers. While there is no verified cause and effect between the two events, the industry remains concerned.

Recruitment issues

Johnathon Davey, executive director of Seafood Industry Victoria, says his industry is also concerned about the potential effects of seismic noise on commercial species such as rocklobster, scallops and finfish.

In Victoria, particularly in the Gippsland Basin, the scallop industry is concerned about seismic surveys occurring in areas that have historically been productive scallop grounds. Johnathon Davey says many Victorian scallop fishers believe scallop bed die-offs a couple of years ago may be associated with seismic surveys conducted through Bass Strait in 2009–10. The Seafood Industry of Victoria has initiated research, through the FRDC, to investigate this issue.

CEO of the South East Trawl Fishing Industry Association, Simon Boag, says the potential effects of repeated seismic surveys in the same areas on fish recruitment has also been raised. He says fishers have reported that fish disappear from an area when seismic testing is being done.

"We know the fish go away. We don't know what the seismic impulses do, but

PHOTO: PHOTOLIBRARY.COM

"Also, the ocean is naturally very noisy, so we record ice cracking from Antarctica ... on hydrophones around the southern coast of Australia, several thousand miles away. Animals obviously cope with this natural noise but when it comes to adding industrial noise, the key question is, how much is too much?"

– Christine Erbe

they certainly move out of the area and it takes some time for them to repopulate."

Ultimately, with regards to seismic testing, and until we know otherwise, all fish need to be treated with the same level of concern. "When seismic surveys operate, they have to have the marine mammal observers on board," Simon Boag says.

Former executive officer of the Pearl Producers Association, Brett McCallum, says seismic surveys are also a concern for the pearl industry. Oysters, like scallops, are attached to the sea floor and cannot swim away to escape noise or vibration from seismic or mining activity.

He says while seismic survey companies agree there is a clear need for research to better understand air-gun impact on adult pearl oysters, their larvae cycle and food sources, they have not yet been willing to fund this research.

"The pearl oyster fishery in Western Australia is the last sustainable pearl oyster fishery in the world, and we would like to see the precautionary principle applied, in relation to the potential affects of seismic surveys on the fishery."

Noise guidelines

While seismic surveys are one of the main concerns in terms of noise pollution in Australian waters, shipping noise is also an issue, particularly in Europe, where underwater noise is now included in any assessment of water quality. In April 2014, the International Maritime Organization (IMO) released its own guidelines on reducing underwater noise from commercial shipping, due to concerns over the impact on marine life.

In Australia, marine noise pollution is regulated by state environment departments and the National Offshore Petroleum Safety and Environment Management Authority under the auspices of several Acts, including the federal *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). There is an EPBC Policy regarding whales and seismic surveys, but no equivalent for fish, despite standards for noise exposure to fish and sea turtles being published in 2014.

There are many existing ways to minimise noise pollution. Geoff McPherson says reducing noise output from boats has the dual benefit of improving efficiency and saving energy, so something as simple as reducing speed when travelling through sensitive areas may save you money and also reduce the impact on marine creatures.

The recent IMO guidelines on underwater noise also suggested a reduction in ship speed to reduce noise. In addition, the guidelines called for propellers to be designed to reduce cavitation – the main source of noise from ships – as well as a focus on hull design to minimise noise, and selection of onboard machinery with appropriate vibration-control measures.

Using sound

Not all man-made sound is problematic for fish or the fishing industry, and indeed sound – in the form of sonar – is an essential part of navigating and locating fish. But sound is also being used to deter interactions between whales and dolphins and fishers or the likelihood that they and other marine creatures will get entangled in lines or nets.

PHOTO: COURTESY OF DAVE ELLIS

"Southern Bluefin Tuna migrate from the Indian Ocean through the Great Australian Bight and stay there generally for two to three months at a time, and then either go back to the Indian Ocean or go to Tasmania and the east coast of Australia."

– Brian Jeffriess

Geoff McPherson says bycatch mitigation alarms, known as pingers, can be attached to nets to warn larger creatures of their presence. "All that is, is a warning device; it's just a noisemaker, it doesn't spatially deter the animals, it doesn't scare them," he says. "They are making a noise that the animal can hear, which should be within their hearing capability, they're just a wake-up call so the animal will then be alert."

But a second application of noise is to more actively deter these same animals from predating fish in nets and on longlines, and here the science is a little more complicated.

Predators such as whales and dolphins use sonar to home in on their targets, so one approach being taken is to try to confuse or block that sonar signal. But it is not as simple as just drowning out the incoming sonar signal.

"No pinger can make more noise than the echoclick of a dolphin, not if it's battery powered," Geoff McPherson says. Instead, the industry has been looking at ways of confusing the incoming sonar signal from the animal, using both active and passive acoustic methods.

"With sperm whales, we're now working on jamming systems so as soon as they click, we click back," he says. The evidence so far suggests this method is effective with sperm whales, but may not work as well against other predators.

"After four years of working on oceanic longline vessels in projects with Japan's Fisheries Research Agency, we found that passive acoustic reflector systems were effective but unworkable in many situations," he says.

However, he says depredation mitigation pingers featuring dolphin sonar activation, and a broad frequency range to prevent dolphins shifting their echo attention around the jamming signal, were associated with significantly better catch returns and profits.

As part of an honours project at the Australian Maritime College, Dean Pease from the Bycatch Program at the Australian Fisheries Management Authority, investigated whether it was possible to mask the echolocation signals from orcas depredating catch such as Blue-eye Trevalla from an auto-longline vessel.

"We looked at what frequency the orcas produced and whether we could replicate their frequency range and use that to mask their own echolocations and basically create enough noise underwater that it became difficult for them to remove fish from the line using echolocation," Dean Pease says.

The pingers used in the trial were not effective, he says.

"We used pingers to produce a range of sounds within the frequency range of orca echolocations. The orcas responded by altering their echolocation clicks to produce one frequency below and one frequency above the noise range produced by the pingers."

Dean Pease says the use of acoustics in these settings is still in its infancy, and the technology required to put portable alarms on fishing gear has only really been developed in the past five to 10 years. F

[1] Effects of Seismic Energy on Fish: A Literature Review, by T. Worcester, www.dfo-mpo.gc.ca/csas-sccs/publications/resdocs-docrech/2006/2006_092-eng.htm

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FRDC RESEARCH CODE: 2013/024

‘Master’ title builds fishery professionalism

PROFESSIONAL DEVELOPMENT

The combination of recognised training and the promotion of professional expertise aims to improve the public perception and reputation of Australia’s fishing industry

By Catherine Norwood

A new program has been launched in New South Wales aimed at helping fishers to regain pride in their profession. Successful completion of the program sees fishers rewarded with the title ‘OceanWatch Master Fisherman’, which recognises commercial fishers as highly skilled professionals who conduct themselves with integrity to ensure the best possible outcomes for their fishery as well as for their customers.

The program brings together fishers’ work practices, local and international codes of practice for responsible fishing, and the Australian Seafood Training Package.

Between September and November 2014 OceanWatch formally trained 58 fishers in the NSW Estuary General Fishery, including an assessment in Certificate 2, ‘Participate in Environmentally Sustainable Work Practices’.

Fishers who completed the training and have also previously completed maritime competency qualifications and food safety training have been recognised as OceanWatch Master Fishermen. These fishers now have their own personal web-based profile and a video of them has been linked to a quick response (QR) code that they can incorporate into their branding and product information.

Using a smartphone, consumers can quickly and easily access information about the fishers and their catch, their specific fishing operations, sustainability information and recipes, all housed on the OceanWatch website (www.oceanwatch.org.au).

OceanWatch executive chairman Brad Warren has been a driving force behind the initiative.

PHOTO: SHANE CHALKER

MASTER (ADJ)
- Having or showing very great skill or proficiency
- Denoting a person skilled in a particular trade and able to teach others

GREG GOLBY is chair of the Wallis Lake Fishermen’s Co-operative, a position he has held for the past two years. He has been a director of the co-op for five years, and an estuarine fisher in the Foster region of New South Wales for 30 years. He is also an accredited OceanWatch Master Fisherman.

He says the Master Fisherman’s course was both informative and a good affirmation that those attending were using industry best practice. He says the discussion about ‘social licence’ – what do fishers need to do to maintain public support for continued fishing? – was one of the most valuable parts of the program.

“People are becoming more seafood savvy and they want to ensure that their food is coming from a secure and sustainable supply. They want to have confidence in our product, and I think the OceanWatch program helps to achieve that,” Greg Golby says. “As an industry, I think we also need to consider how fishers can work together to optimise harvest and market prices. But the fishing industry has operated for a long time on a competitive basis, and it will be difficult to change this approach.”

He says in 2012 the FRDC's Fisheries Research Advisory Body (FRAB) in NSW put out a call for research priorities. Industry groups identified the need to address the poor public profile of fishers and professional development as high priorities.

Responding to these needs, the FRDC funded the 'Professionalising Industry' project, which incorporates the OceanWatch Master Fisherman program. After a year spent developing the program and course materials, OceanWatch ran six courses as a pilot, focusing on the Estuary General Fishery on the NSW north coast. The Estuary General Fishery is a multi-method and multi-species fishery that incorporates finfish and crustaceans. Harvesting techniques include mesh netting, fish seine, fish traps, crab traps, hand gathering and hand lines.

Code of practice

Brad Warren says OceanWatch established a code of practice in the fishery, which was adopted by industry several years ago. This project reviewed and updated it in line with the United Nations Food and Agriculture Organization's Code for Responsible Fishing and changes were adopted to ensure the fishery's code of practice aligned with the international standard. The revised code was then used as the framework for the Master Fisherman's course materials.

OceanWatch also considered the National Seafood Training Package and worked with a registered training provider to ensure the program included training and assessment that is formally recognised. Training materials were developed and delivered by experienced fishers and others working in the industry to ensure the program was relevant and practical in terms of day-to-day fishing operations.

A discussion about the need for fishers to generate community acceptance in order to continue accessing public resources was an integral part of the training program. This included the importance of 'professional' behaviour within the industry, and taking in environmental, consumer and community perspectives, as well as fishers' perspectives. "These discussions have highlighted the benefits of establishing a code of practice for the industry, complying with that code, and being able to promote it within the community," Brad Warren says.

Project partners with OceanWatch and the FRDC include the Master Fish Merchants Association, the NSW Fishermen's Co-operatives Association, Sydney Fish Market, the NSW Department of Primary Industries, the Professional Fishermen's Association (NSW) and the NSW Fishing Industry Training Committee. It was a major achievement of the project to reach consensus on the course program objectives and content despite fisheries management changes underway in NSW, which have caused uncertainty within the industry.

"However, the framework used in the OceanWatch Master Fisherman initial project in NSW is transportable to all Australian fisheries," Brad Warren says. "It offers benefits for fishers, regulators and consumers by improving transparency of industry practices and access to science-based information."

Feedback from participants has been positive about both the content of the training and the overall aims of the program, including the promotional aspects.

Master Fisherman

Among the inaugural group of Master Fishermen is Graeme Byrnes who fishes the NSW mid-north coast estuaries including Wallis Lake and Myall Lake, in the Foster region, and Tuggerah Lake, further south. He says for many of the participants the one-day program consolidated previous training and experience, while also providing information and training about new trends and emerging issues.

"It was a full day and it was a rigorous process. The Master Fisherman training content ranged across 12 or more different disciplines, everything from fish-handling techniques and the chemistry of safe food handling to reporting requirements and fishery regulations, marine pests, and threatened and endangered species."

Graeme Byrnes is particularly keen to see the QR codes put into play. His operation is a small family one, just himself and his brother Phillip, and they focus on high-value catch including Sand Whiting, Blue Swimmer Crabs, Yellowfin Bream, Mud Crabs and Dusky Flathead.

"There's a strong focus on provenance among the Wallis Lake fishers. We're proud of our fishery and the way we do things, so we want to make sure the QR codes are reaching consumers to promote that provenance. All the hard work has been done to set up the accreditation and the information network. Now we have to follow through to make sure retailers put that link in front of their customers – not just in the local area, but in Sydney and other major population centres too."

Operations manager at the Wallis Lake Fishermen's Co-operative, Suzie McEnallay, says more than half of the members of the co-op took part in the Master Fisherman courses offered last year. There has been strong local support for the program and for the industry's code of practice.

The co-op is keen to promote the professional recognition the OceanWatch program has given to its members and is already incorporating the fishers' QR codes into its displays at its retail outlet at Tuncurry, which is a popular summer tourist destination.

"Locals may know how and where their fish are caught, but we have many visitors who don't," she says. "Any information we can put in front of the end consumer is important." F

OCEANWATCH MASTER FISHERMEN

Recognised OceanWatch Master Fishermen have completed formal training and assessment, delivered by OceanWatch Australia and backed by the NSW Fishing Industry Training Committee. Training is linked to the Seafood Industry Training Package Competency Unit SFIEMS201b 'Participate in Environmentally Sustainable Work Practices'.

It also incorporates aspects of responsible fishing including:

- product quality;
- threatened species handling and reporting;
- bycatch reduction devices and techniques;
- animal welfare;
- catch reporting and fisheries management;
- water quality, fish habitat and pollution;
- Indigenous fishing; and
- workplace health and safety.

Recognised OceanWatch Master Fishermen must also have completed food safety training and hold relevant maritime competency qualifications.

PHOTO: SHANE CHALKER

Master Fisherman QR codes are already part of displays at the Walllis Lake Fishermen's Co-operative.

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FRDC RESEARCH CODE: 2014/019

Blue clue aids Snapper tally

A paired, fine mesh 'bongo' net used to sample plankton throughout the water column.

PHOTO: SARDI

PHOTO: SARDI

SARDI's Andrew Oxley is adapting molecular techniques to identify Snapper eggs.

STOCK ASSESSMENT

Sorting the Snapper eggs from those of other species will allow egg numbers to be used to assess fish populations

A molecular marker that turns Snapper eggs a fluorescent blue could revolutionise fisheries management for several Australian commercial species.

Recent advances in genetics are enabling scientists at the South Australian Research and Development Institute (SARDI) to develop a molecular probe that attaches itself to a specific gene target – in this case, a small section of Snapper DNA.

Project leader Mike Steer says the new technique is a big step forward in the management of southern Australian Snapper populations, enabling the easier identification of fish species.

"Until now we have had to rely largely on catch-and-effort information from fishers to determine stock estimates.

"This new approach will help us work out how many Snapper are in our waters, by literally counting their eggs. Once SARDI has developed the molecular marker for Snapper eggs, it can be adapted for use for many other commercial species such as King George Whiting (*Sillaginodes punctata*)."

As part of the three-year program, SARDI is conducting annual surveys of Snapper eggs. Thousands of eggs, believed to be from Snapper, have already been collected and are being kept in storage awaiting DNA identification.

Mike Steer says the daily egg production method has been accepted as one of the most reliable ways to estimate fish stocks. Researchers count eggs in the water column and combine that information with how often females spawn to work out how many Snapper are required to produce that number of eggs.

"The trouble with Snapper and a number of other fish species is that the eggs are difficult to identify visually, even under a high-powered microscope," Mike Steer says. "This new technique gives us the means to identify the eggs and provide more accurate assessments of Snapper stocks."

SARDI molecular biologist Andrew Oxley, who is developing the probe, says to ensure the project's success it is critical to determine that the probe only reacts with Snapper eggs. "I am comparing Snapper eggs with those from about 30 other fish species," he says. "These species are either related to Snapper, may occur in the areas where Snapper spawn, or are species that spawn around the same time in the same area."

The eggs awaiting identification are stored in ethanol, making the surface of the egg permeable to the molecular probe. This will allow the probe to penetrate the cells of the egg and react with the genetic material, a process that turns the egg blue.

The project, 'Developing a fishery independent estimate of biomass for Snapper', has been funded by the FRDC. F

Rocklobster compass set south

WILD-CAPTURE FISHERIES

While most relocated Southern Rocklobster stay put, those that do move have shown a highly accurate sense of direction

A South Australian study involving the translocation of Southern Rocklobster (*Jasus edwardsii*) has provided new evidence that the species has a magnetic-compass-like capacity to orient itself in unfamiliar waters.

The study was primarily aimed at determining whether pale white rocklobsters found in deep water would change their carapace colour to the brighter red preferred by export markets if they were relocated to shallow water sites.

"However, we were also interested in the movement patterns of individual rocklobsters after the translocation event," says project leader Adrian Linnane, from the South Australian Research and Development Institute (SARDI). The results of the research support a long-held theory about rocklobsters' navigation abilities, and were acepted for publication in the prestigious international scientific journal *Marine and Freshwater Research* in August 2014.

The translocation study was undertaken in 2007 at Southend, South Australia, about 100 kilometres from the SA–Victorian border. More than 5000 rocklobsters were physically moved from offshore water 100 metres deep, to a shallow, inshore site on Ringwood Reef where the water is less than 20 metres deep.

Adrian Linnane says previous studies of rocklobster movement were based on rocklobsters tagged and released at their point of capture. The recent SARDI study was unique in that it allowed researchers to monitor movement patterns in rocklobsters displaced from their normal environment.

"This study was successful in that the light-coloured deep-water rocklobsters did indeed change to the preferred red colour within 12 months of being translocated.

"In addition, 60 per cent of all recaptures remained within their new inshore environment, with no evidence to suggest that any significant mortalities occurred," he says. "While most rocklobsters remained resident, some moved considerable distances in a highly directional nature away from the release site. We found that 40 per cent of the rocklobsters recaptured had travelled in a consistent south-west bearing back out into deeper waters. This supports the theory that rocklobsters have some kind of true navigational sense."

Adrian Linnane says females travelled significantly further than males, with one female rocklobster recaptured 48 kilometres from the translocation site after 735 days. "That's quite a distance, considering the only way adult rocklobsters can move is by crawling across the sea floor," he says.

> "While most rocklobsters remained resident, some moved considerable distances in a highly directional nature away from the release site. We found that 40 per cent of the rocklobsters recaptured had travelled in a consistent south-west bearing back out into deeper waters. This supports the theory that rocklobsters have some kind of true navigational sense."
>
> – Adrian Linnane

The reason for the return to specific areas offshore remains uncertain, but researchers speculate that females prefer to release their larvae in offshore currents to improve survival. Information from the research will help inform rocklobster fishery management. "Given that we now know that rocklobsters move between different regions in the fishery, this supports the view that the resource may need to be managed as a single fishery, rather than discrete spatial units," Adrian Linnane says.

The SARDI study, 'Residency and movement dynamics of Southern Rocklobster (*Jasus edwardsii*) after a translocation event', was funded by the FRDC. It followed on from a similar translocation project, 'Spatial management of Southern Rocklobster fisheries to improve yield, value and sustainability', led by the Institute of Marine and Antarctic Studies at the University of Tasmania, and also funded by the FRDC. F

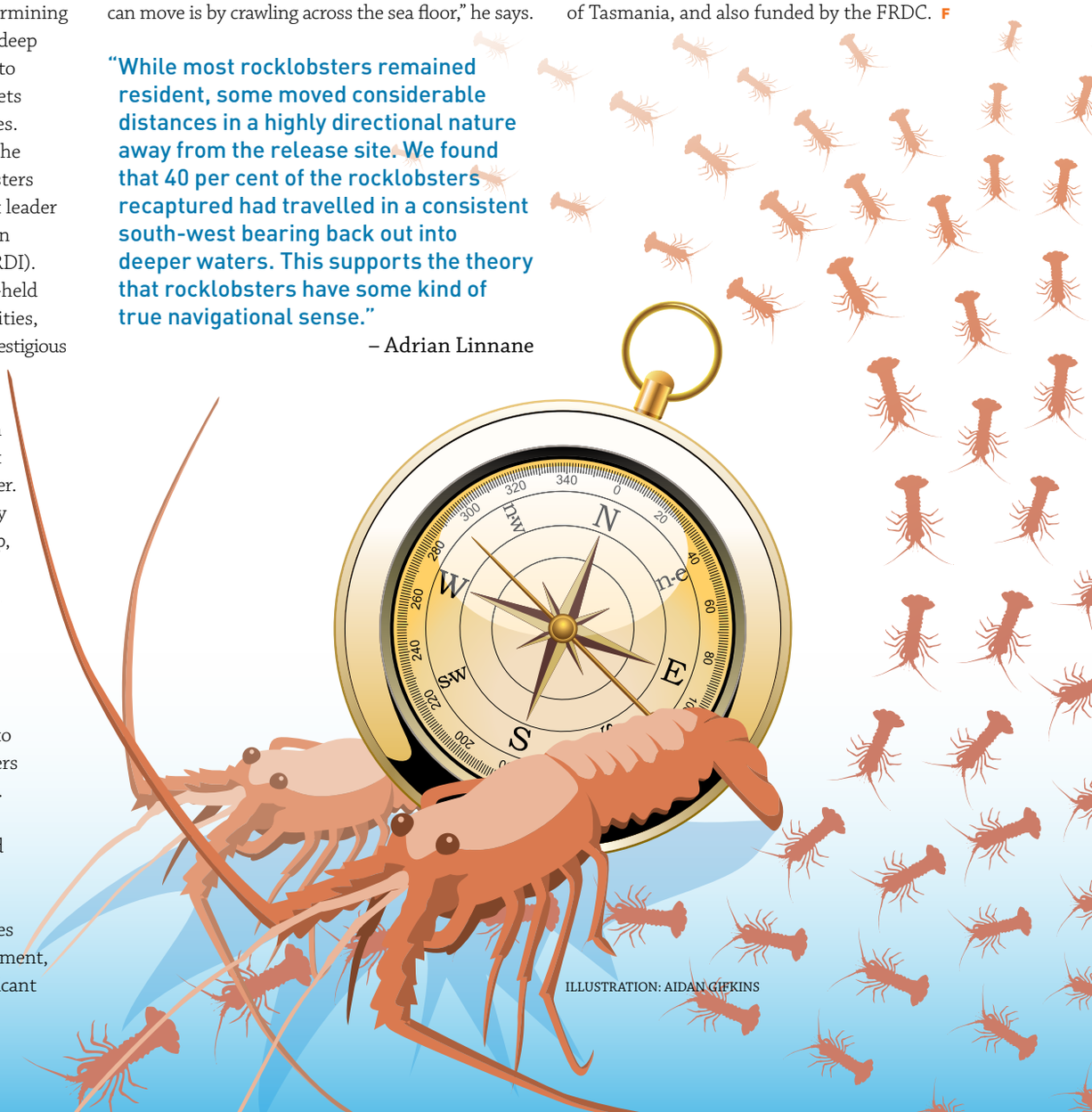
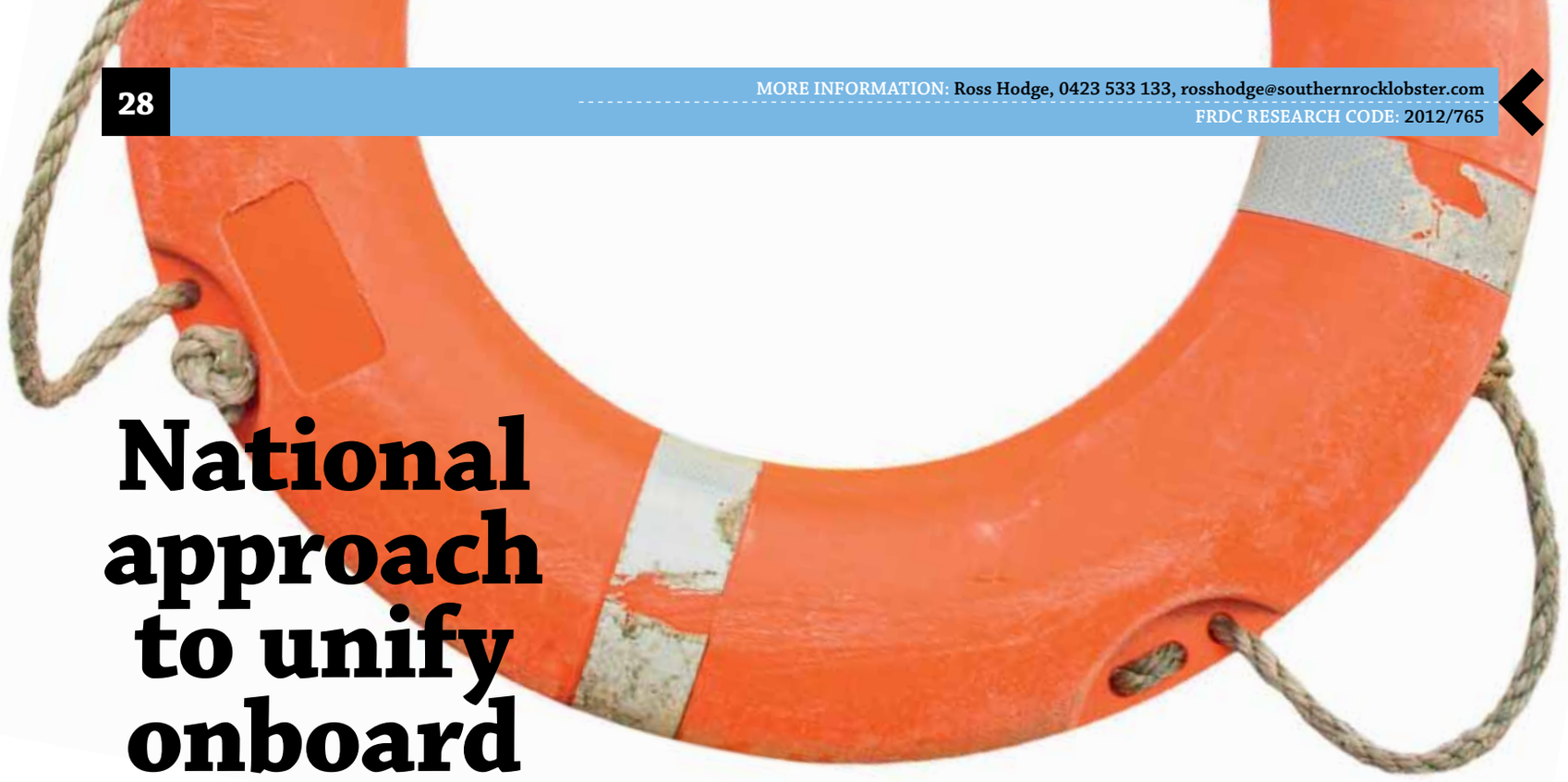


ILLUSTRATION: AIDAN GIFKINS

MORE INFORMATION: Ross Hodge, 0423 533 133, rosshodge@southernrocklobster.com

FRDC RESEARCH CODE: 2012/765



National approach to unify onboard safety efforts

WORKPLACE SAFETY

The fishing industry is in the spotlight as the Australian Maritime Safety Authority leads renewed efforts to improve onboard workplace safety

By Peta MacDougall

Working at sea is a high-risk occupation. The death rate for workers in Australia's (wild-capture) fisheries is 22 times higher than the nation's all-industry average (2010-11).

Improving safety within the fishing industry has been a long-term challenge and since 2013 the responsibility for regulating the onboard workplace health and safety (WHS) of domestic ocean-going vessels has moved from multiple jurisdictions and agencies to one national agency – the Australian Maritime Safety Authority (AMSA).

The newly appointed chair of AMSA is Stuart Richey, a Tasmanian-based fisher and a seasoned skipper, with more than 40 years at sea, who knows personally how important safety is for the whole crew.

In his new role he will help oversee the introduction of recent changes to the National System for Domestic Commercial Vessels, designed to simplify the rules while also lifting baseline safety standards.

These changes have made the safety requirements consistent across all vessels on the sea and inland waterways, including all fishing and tourism operations and passenger vessels. The changes also introduce new minimum requirements, including the need for a Safety Management System (SMS) to be in place on each boat by 1 July 2016.

"The sea is a challenging workplace; conditions continually change," Stuart Richey says. "There can be a lot happening on the deck and one slip of concentration can put you and others in a very dangerous situation.

"Getting the message out to the fishing industry is vital. The seafood industry is now a major focus for AMSA under the new national system, and the development of SMSs will be an important component of this," he says.

Liaison officer for AMSA Wes Oswin says there is plenty of support available to help boat owners develop an SMS through AMSA and its state and territory service providers. He says the aim is to create a commitment to safety at all levels within a business and to make safety top of mind in day-to-day operations.

The revised National Standard for Commercial Vessels (NSCV Part E – Operations) covers Class 3 fishing operations. Copies of the standard, additional guidance material and sample SMSs for fishing operations are available for download from the operational safety section of AMSA's website (www.amsa.gov.au/domestic).

An SMS must identify and control risks and provide a method to ensure that the risk controls are effective. It should include the roles and responsibilities onboard, crew training and induction, procedures for onboard processes, emergency plans, systems for maintenance of vessel and equipment, and logging and recording events.

Some fishing industry groups have already developed safety standards as part of their own certification procedures, and are in the process of updating these to include changes to revised national standards. One such certification program is the Southern Rocklobster industry's award-winning Clean Green program.

Industry initiative

The Clean Green program was established in 2004 to meet emerging market, community and government challenges at all levels of the rocklobster supply chain, an industry worth $300 million and employing more than 2500 people across three states.

While workplace health and safety (WHS) is an essential component of the Clean Green accreditation, the program incorporates many other elements, says the executive officer of Southern Rocklobster Ltd, Ross Hodge.

"It establishes best practice standards for food safety and quality, animal welfare, managing the environmental impacts of fishing operations and sustainability through compliance with the *Environment Protection and Biodiversity Conservation Act*," he says.

"It was the first standard of its type in the world within the fishing and seafood industries and is implemented across the total supply chain, not just 'onboard'. The program is being mimicked across Canada and North America to make their products more appealing in international markets."

Participants are audited by an independent third party Conformity Assessment Body, which is accredited against the International Organization for Standardization (ISO/IEC) Guide 65:1996 and Joint Accreditation System of Australia and New Zealand (JAS–ANZ) Procedure 15.

The Clean Green program is owned and maintained by Southern Rocklobster Ltd, the national peak body owned by rocklobster licence holders across South Australia, Tasmania and Victoria.

Updating the Clean Green program to reflect the changes to the revised national system for commercial vessels is part of its strategy of continuous improvement – one that provides ongoing support to its accredited members.

Stuart Richey says the Clean Green program is an excellent example of how an accepted industry standard can be modified to pick up the AMSA requirements at minimal cost.

"Southern Rocklobster Ltd is to be congratulated for taking the initiative and benefiting all their fishers both from a safety point of view and financially."

Wes Oswin says AMSA has recently been working with Southern Rocklobster Ltd and the South Australian Rock Lobster Advisory Council to update the existing Clean Green SMS to comply with the revised national standard.

"The Clean Green program has also been widened to take into account other types of fishing operations and help them to identify and manage their risks. This will be of great benefit to operators that carry out more than one type of commercial fishing," Wes Oswin says.

"It's great to see that Clean Green participants not only get comprehensive initial training on the program but are provided additional support to customise the SMS to their particular operation.

"This should help to ensure that the owners and crew understand the program, that they develop an SMS that is relevant and specific to their particular operation and that the Clean Green SMS ultimately ensures the safety of the vessel and crew," Wes Oswin says.

Clean Green workshops

Ross Hodge says there will be workshops rolled out in Tasmania, Victoria and SA throughout this year to bring current members of Clean Green up to date on the new safety material.

In October 2014 Southern Rocklobster Ltd held two one-day workshops in the SA northern zone for rocklobster fishers to join Clean Green and will hold the second day of training to complete the program requirements in early 2015. There will also be training sessions offered in the SA southern zone, Tasmania and Victoria for fishers who would like to become accredited with Clean Green and are new to the program.

"Southern Rocklobster's Clean Green program is leading the way in self-regulation and by completing it fishers will meet their legislative requirements for a safe vessel and a safe workplace.

"The introduction of AMSA's National System for Domestic Commercial Vessels has boosted interest from rocklobster fishers in becoming Clean Green accredited, as it is by far the most efficient and cost-effective option for complying with SMS and also WHS regulations," Ross Hodge says.

New WHS code

With the adoption of new 'model' WHS legislation in most Australian states and territories, with the exception of Victoria and Western Australia, the Clean Green program is also updating and expanding its WHS codes to ensure its accreditation complies.

"The new expanded WHS code in the Clean Green program addresses some of the hazardous tasks that employees undertake on the boat, in addition to AMSA's SMS requirements. "Checklists and procedures have been included in Clean Green so fishers can easily address these in their planning and be compliant."

The Primary Industries Health and Safety Partnership (PIHSP), which is part-funded by the FRDC, has recently produced a report and a fishing fact sheet to help employers and workers understand their legal WHS responsibilities and to easily access important information to help meet these requirements. F

Both publications can be accessed at: www.rirdc.gov.au/PIHSP

THE CLEAN GREEN PROGRAM INCORPORATES PROTOCOLS AND PROCEDURES FOR:

- Establishing a safe working environment to meet all vessel operational and workplace health and safety (WHS) legislative requirements including crew safety and induction training.
- Implementing best practice in food safety and quality (GMP – Good Manufacturing Practice) and animal welfare requirements for lobster handling and holding systems.
- Removing environmentally unfriendly practices such as the use of plastic bait box straps and managing responsible disposal and recycling of marine wastes – oil, plastics and cardboard.
- Documented maintenance and cleaning schedules to meet hygiene and sanitation requirements.
- Meeting Australian Quarantine and Inspection Service certification requirements for boats handling live crustaceans for exports to all markets, thus reducing duplication and costs across the industry.
- Monitoring the sustainability of each jurisdiction fishery to ensure compliance with the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) to maintain export approval.
- Creating an awareness of, and managing potential interactions with, protected species such as seals, whales and sea lions.

PHOTO: SOUTHER ROCKLOBSTER

Clean Green program participant Jarrod Day and workplace health and safety trainer Tanya Adams.

Collective achievements through investment

ANNUAL REPORT

Changes to legislation during the past year are making way for new challenges and opportunities for the FRDC and its stakeholders

By Julie Haldane

In 2013-14 the FRDC enjoyed continued support from the Australian Government and industry stakeholders across three diverse sectors – commercial, recreational and Indigenous. Government and industry have high regard for the FRDC and this support plays a vital role in ensuring high quality research priorities are identified and turned into outcomes.

Key achievements in 2013-14

- Seafood partnerships in schools expand
- Program develops new group of leaders
- Community perception of fisheries improves
- New subprograms for recreational and Indigenous sectors
- First year of national prawn campaign completed
- Flake fish name developed and implemented
- New products for sardines and other underutilised species
- Southern Bluefin Tuna fluke management measure adopted
- Australian Wild Abalone brand developed and registered
- Solutions to Pacific Oyster mortality syndrome (POMS) progressed by collaboration with New Zealand
- Production improvements for Yellowtail Kingfish adopted

The marine environment

Generally, Australian fish stocks are in good health. This view is supported by the FRDC-funded *Status of Key Australian Fish Stocks Reports*, which are recognised as a primary source of independent science on fisheries performance. In 2013-14 major strides were taken to develop the second edition of these reports and improve the framework for national reporting.

These improvements saw more species added, along with a new web interface that will eventually allow for more specific views of data at state, territory or Commonwealth levels. In addition, researchers are investigating how to integrate social and economic data and other key issues such as bycatch into future reports.

Working with a new government

The new federal government announced a range of changes it plans to deliver during its term in office. In 2013-14 the FRDC worked with its stakeholders to achieve outcomes in areas where there was a research, development and extension (RD&E) component to government plans.

The government also announced an additional contestable $100 million of funding over four years for the 15 rural research and development corporations (RDCs), which are the principal recipients of this funding. The FRDC worked closely with all state and territory governments to maximise their plans in regard to R&D within the fisheries under their jurisdictions.

Representative organisations

The FRDC is accountable under the *Primary Industries Research and Development Act 1989* (PIRD Act) to representative bodies declared by the responsible Minister. The FRDC's four representative bodies are the National Seafood Industry Alliance, Recfish Australia, the Commonwealth Fisheries Association and the National Aquaculture Council. These four bodies meet with the FRDC Board annually and provide regular advice on research priorities. All four have nominated improved community perception as one of their top priorities for RD&E.

Changes to the FRDC's enabling legislation

The *Rural Research and Development Legislation Amendment Act 2013* made substantial changes to the former *Primary Industries and Energy Research and Development Act 1989* (PIERD Act), which is now known as the PIRD Act.

The key changes are as follows.

- Improved business capability including:
  - support for the development of scientific and technical capacity;
  - development of the adoptive capacity of primary producers; and
  - provision for the funding and administration of marketing of products of primary industries.
- New governance and administration with amended legislation including:
  - a Statutory Funding Agreement is to be introduced from 1 July 2015 that will increase governance, reporting and performance evaluation requirements;
  - FRDC Board selection – a reserve list of candidates will be included with the recommendations from the Selection Committee to the Minister; and
  - The FRDC Annual Operational Plan (AOP) no longer needs Ministerial approval, but needs to be provided to the Minister and the FRDC's four representative organisations before it comes into operation.

PGPA Act

The *Public Governance, Performance and Accountability Act 2013* (PGPA Act) replaced the *Commonwealth Authorities and Companies Act 1997* on 1 July 2014. The FRDC Board (through its Finance Audit and Risk Management Committee), has worked with FRDC management to ensure the Corporation was ready for the changes. The PGPA Act will increase the level of governance and reporting the Corporation undertakes. Ensuring this is done cost-effectively and efficiently has been a key driver in the Board's approach to implementation of the PGPA Act.

Federal budget changes

The 2014-15 federal budget imposed the cost of the Commonwealth's memberships of regional fisheries management organisations (RFMOs), estimated at around $1.1 million a year, from the matching funding provided to the FRDC. The RFMOs are:

- Commission for the Conservation of Southern Bluefin Tuna;
- Indian Ocean Tuna Commission;
- Western and Central Pacific Fisheries Commission;
- Southern Indian Ocean Fisheries Agreement;
- South Pacific Regional Fisheries and Management Organisation; and
- Network of Aquaculture Centres in Asia–Pacific.

This change will result in fewer funds being available for fisheries and aquaculture RD&E. The FRDC Board agreed to the following principles to guide how these reduced funds would be implemented:

1 The industry contribution to the

FRDC is not to be impacted as this dollar figure must be returned to the industry sector as per the PIRD Act.

2 The 2014-15 budget-imposed cost would come from government contributions to the FRDC (which include the 0.5 per cent farm gate value of production (GVP) public good contribution and 0.25 per cent GVP funds provided to match the industry contribution).

3 Distribute the budget cut pro rata across all government public good funds received.

4 Continue to invest on a priority basis.

5 Administration to ensure the budget cost will be efficient and cost-effective.

Development and implementation of new information and technology

The FRDC Board approved the development of a new management system for projects, records and customer relations information. Effective 1 July 2014, the new platform will be more responsive to change and cheaper to maintain. It will leverage existing technologies with 'off-the-shelf' functionality.

New subprograms established

Historically, the FRDC Board has established 'subprograms' or 'coordination' programs to improve performance in an area of need. Subprograms are allocated a budget for RD&E investment, as well as an administration budget. The FRDC Board approved two new 'subprograms': the first focusing on Indigenous and the second on recreational fishing RD&E.

The Indigenous Reference Group has been a coordination group since 2011 and Recfishing Research since 2007. From their inception, both have provided the FRDC with advice, engagement, prioritisation, communication and management services.

A total life-of-project budget of $500,000 will be allocated to each subprogram in each annual competitive round to invest in RD&E.

The FRDC Board has implemented a new Indigenous Reconciliation Policy to ensure that all FRDC business takes into account the needs of Australia's first people.

Seafood CRC

The FRDC has been the largest investor in the Seafood Cooperative Research Centre (CRC) since its inception. The centre has had a combined investment (industry, government and FRDC) of about $31 million over the past seven years.

TABLE 1 FINANCIAL INDICATORS OF RESEARCH AND DEVELOPMENT (R&D) INVESTMENT.

EXPENDITURE	2010–11 $ million	2011–12 $ million	2012–13 $ million	2013–14 $ million
Total expenditure	**25.76**	**29.68**	**25.69**	**27.56**
Total of R&D projects*	21.56	25.98	22.14	22.89
R&D Program 1 (Environment)*	10.14	11.80	8.25	10.21
R&D Program 2 (Industry)*	8.34	9.47	9.57	8.34
R&D Program 3 (Communities)*	0.16	0.47	0.74	0.75
R&D Program 4 (People development)*	1.90	2.12	1.80	1.94
R&D Program 5 (Extension and adoption)*	1.02	2.12	1.78	1.65
Management and accountability	3.40	3.71	3.55	4.67*
Total income to the FRDC	**30.27**	**26.70**	**25.40**	**26.89**
Industry contributions	8.46	7.70	7.98	8.17
Maximum matchable (government) contribution[1]	5.50	5.56	5.83	5.99
Actual government matched	5.50	5.51	5.57	5.96
Government unmatched	11.03	11.22	11.66	11.97
Total government contributions[2]	16.53	16.63	17.23	17.93
Project funds from other parties	1.12	0.46	0.48	0.49*

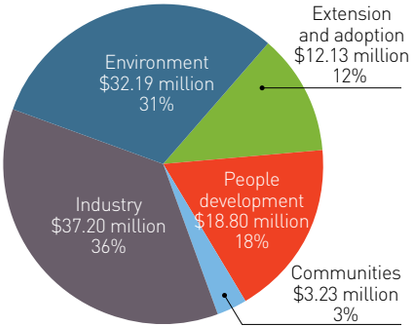
* The FRDC had an increase in $1.2 million dollar write down of assets which increased the cost of Management and accountability in 2013–14.

1 'Maximum matchable contribution' is the maximum amount to which the Australian Government will match industry contributions in accordance with the criteria detailed on page 136 of the FRDC's *Annual Report 2013-14*.

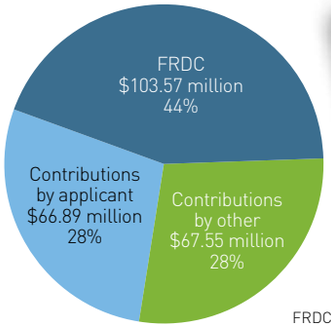
2 The contribution figures are accrual based. Contributions come from the commercial and recreational sectors, research partners, government and project-specific contributions.

FIGURE 1 ACTIVE FRDC PROJECTS UNDER MANAGEMENT AT 30 JUNE 2014.

Total FRDC budget: $103.57 million



Total budgeted investment: $238.01 million



SOURCE: FRDC'S ANNUAL REPORT 2013–14

Significant achievements for the Seafood CRC in 2013-14 were:

- implementation of the national prawn marketing strategy through the 'Love Australian Prawns' campaign;
- establishment of the Australian Wild Abalone brand for direct marketing into China, which has complemented the research on improving market access and price;
- establishment of the national Seafood Trade and Market Access Group to provide a single forum for research-based advice on trade; and
- ongoing success of the SafeFish program and its role, with FRDC support, in reviewing the biotoxin event that closed Tasmania's east coast fishery in October 2012.

The Seafood CRC will finish its tenure in June 2015. It is intended that during the final year of operation the FRDC will assist the Seafood CRC in the transition of activities and projects for ongoing management to completion. F

A complete copy of the FRDC's *Annual Report 2013-14* is available from the FRDC's website (www.frdc.com.au).

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FRDC RESEARCH CODE: 2010/737

Algal toxins have little impact on abalone

FOOD SAFETY

Joining the debate on new international seafood safety standards has allowed Australia and New Zealand to argue for an approach that reflects the actual risk to consumers

By Catherine Norwood

A four-year biotoxin risk assessment of Australian and New Zealand abalone has found that they are largely unaffected by toxic algal outbreaks, even at high alert levels that have resulted in fisheries closures for bivalves such as oysters.

The assessment has helped to protect access to international markets for Australian and New Zealand abalone, and has saved both countries millions of dollars in expensive ocean monitoring programs.

The joint Australian–New Zealand project cost $600,000, with funds from industry and government in both countries. But the return on investment is substantial: it has eliminated the need for a biotoxin monitoring program, estimated at $20 million a year for Australia and $2 to $3 million a year for New Zealand.

Cathy Webb, seafood standards manager at Seafood New Zealand, and Alison Turnbull, from SafeFish at the South Australian Research and Development Institute (SARDI), presented the research findings at the first joint Australian–New Zealand Abalone Convention, held in Queenstown, New Zealand, last year.

Cathy Webb says there had been concerns internationally about the potential for abalone to accumulate biotoxins, based on some events in Chile, Spain and South Africa, where local abalone species had accumulated levels of paralytic biotoxins that exceeded international food safety levels.

In response, the safety standards body the Codex Alimentarious Commission developed a new standard specifically for abalone, rather than applying a bivalve standard to gastropod species. The standard originally proposed would have mandated the need for ocean monitoring programs to demonstrate that Australia and New Zealand complied with safe growing conditions. This would have been "prohibitively expensive", Cathy Webb says.

"However, working with the Codex Fish and Fishery Products Committee, responsible for developing the standard, we argued for a risk-assessment approach, based on the level of risk that would take into account each country's risk management strategy. This has now been incorporated into the final Codex standard.

"Given the similarities between the two countries, it made sense for us to combine forces and work together on this issue," she says. Lead

FRDC RESEARCH CODE: 2009/752.10

Expertise underpins safe fish trade

MARKET ACCESS

Industry participation in the development of international food safety standards is helping to ensure proposed international protocols are workable in Australia

By Catherine Norwood

Helping Australia maintain access to international markets is one of the main objectives of SafeFish Australia, which provides technical advice to international seafood trade negotiations.

SafeFish chair Anne Astin says the aim is to establish a level playing field for Australian products to access international markets. "Unfair rules for trade can have a major impact, stopping access to key markets. However, providing input into the various international processes like the Codex Alimentarius Commission, which develops the international rules around food safety, is complicated and sometimes highly technical, but it is important that it is done.

"It is vital for Australian seafood companies to be engaged early on; it is far easier to influence the rules whilst they are being laid down than to change them retrospectively," she says. While many issues are export-focused, SafeFish also oversees food safety issues related to seafood imports and domestic trade of Australian seafood.

SafeFish's contribution and input into the international risk-based approach for abalone biotoxin monitoring, for example (see above), has been a major success for the Australian industry. The draft standard proposed mandatory testing for marine biotoxins and bacteria in all abalone-growing areas. This would have been costly and unworkable. But the approach finally adopted recognises that hazards and risk management procedures in one country may not be applicable to another.

Industry input

Anne Astin says industry input is a crucial part of SafeFish developing responses to food safety issues. "We need industry to tell us which issues are important, and which practices and risk-management strategies fit with the Australian context. Industry advice helps us to determine whether suggested regulations are practical to implement, and what the potential impact might be."

SafeFish has three working groups: one developing the Code of Practice for scallops, and two groups reviewing guidelines, risk management strategies and maximum allowable levels for contaminants in fish (histamines and mercury). Other issues SafeFish is addressing for input into Codex include food additives in processed seafood (such as sulfites in abalone), parasites in seafood, and methods of analysis for marine biotoxins.

SafeFish welcomes industry feedback or input into all of these.

SafeFish is funded by the Seafood Cooperative Research Centre, the FRDC, Primary Industries and Regions South Australia and industry. Partnership committee members include Food Standards Australia New Zealand, the Department of Agriculture, Seafood Trade Advisory Group (Spiro Markantonakis), Sydney Fish Market (Mark Boulter), Seafood Importer

PHOTO: 123RF.COM

Marine biotoxins in Australia and New Zealand have very little impact on abalone.

agencies were the SafeFish program, through SARDI, in Australia and the Seafood Standards Council, through Seafood New Zealand.

Six commercially harvested species of abalone were assessed for biotoxin uptake. The four Australian species were Blacklip Abalone (*Haliotis rubra*), Greenlip Abalone (*H. laevigata*), Brownlip Abalone (*H. conicopora*) and Roe's Abalone (*H. roei*); the New Zealand species were Blackfoot Paua (*H. iris*) and Yellowfoot Paua (*H. australis*).

During the four years of the project abalone from both countries were tested during algal outbreaks that were severe enough for temporary closures of shellfish fisheries. Abalone collected from affected areas were tested for paralytic, diarrhetic and amnesic shellfish toxins.

Cathy Webb says the risk-assessment analysis took into account the preparation techniques, size of serving and portion of the animal consumed (viscera or meat). All toxin tests used modern analytical methods in accredited laboratories in New Zealand and Australia.

"We found there was evidence of toxin uptake into the gut, and a trace amount into the foot, but through the risk-assessment process, the level of marine biotoxin risk associated with abalone in New Zealand and Australia was overall relatively low, with some small differences based on meal type. All the New Zealand abalone products were determined to have a low or extremely low risk level, as did all but one of the Australian product types. One meal type of sashimi viscera was assessed at low to moderate risk."

The project also highlighted the value of joint research projects between Australia and New Zealand and a partnership approach to managing market access issues. During the abalone convention there was a commitment from the industry organisations and research agencies in both countries to investigate further opportunities for joint projects. F

WHAT IS CODEX?

The Codex Alimentarius Commission was established by the Food and Agriculture Organization (FAO) and World Health Organization (WHO) in 1963 to develop international food standards, guidelines and codes of practice to protect the health of consumers and ensure fair practices in the food trade. The Commission also promotes coordination of all food standards work undertaken by international governmental and non-governmental organisations.

Association (Norm Grant) and Seafood New Zealand (Alastair McFarlane) as an observer.

Experienced direction

SafeFish chair Anne Astin joined in 2014. As the former chief executive officer of Dairy Food Safety Victoria, she brings to the role her extensive knowledge and understanding of primary industry supply and value chains both domestically and internationally, plus excellent navigation of government systems at international, national and local levels. She is also a previous director of Dairy Australia and chair of the Ministerial Forum for Food Regulation's Implementation Sub-committee.

She is a director of Australian Dairy Farmers Ltd and the William Angliss Institute of TAFE, President of the Australian Institute of Food Science and Technology and a member of the Federal Government's Health Star Rating Advisory Committee.

Alison Turnbull has been the SafeFish program manager since July 2013. She has spent many years managing the impact of toxic algal blooms on commercial bivalve mollusc fisheries through her previous role as a human health regulator in Tasmania. She has also acted as a technical adviser to several Australian government delegations at the Codex Committee of Fish and Fisheries Products, particularly around the setting of international standards relating to marine biotoxins in seafood. Her current role is subprogram leader of Food Safety and Innovation, Seafood at the South Australian Research and Development Institute (SARDI).

Natalie Dowsett, a senior research officer at SARDI, has been the SafeFish executive officer since its inception in 2010. Her role is to facilitate the production of research and technical reports, risk assessments and position papers in direct response to industry trade and market access needs and requests. She also helps to coordinate industry and technical input that supports a number of Australian delegations at Codex. F

Natalie Dowsett

Anne Astin

Alison Turnbull

SEAFOOD SAFETY INFORMATION

www.safefish.com.au

The SafeFish website provides access to:

- food safety issues and news;
- published technical and other reports on seafood safety for the Australian industry;
- Codex processes; and
- SafeFish processes and working groups.

Latest publications include:

- *Safe Packaged Seafood: A guide to identifying food safety hazards and determining the shelf-life of packaged seafood products* – published by the Australian Seafood Cooperative Research Centre, in conjunction with the more technical report; and
- *A Guide to the Identification of Food Safety Hazards and Determination of Shelf-life of Packaged Seafood.*

MORE INFORMATION: Cheslav Balash, 03 6324 9687, 0400 876 767, cheslav.balash@utas.edu.au; David Sterling, 0428 331 103, djstgs@bigpond.com; Andy Prendergast, 0427 424 027, aprendergast@australfisheries.com.au FRDC RESEARCH CODES: 2006/229, 2011/209

TWINE DESIGNS TIED TO IMPROVED FUEL EFFICIENCY

A 'W' trawl rigged with batwing otterboards.

PHOTO: UNIVERSITY OF TASMANIA

FISHERY ECONOMICS

Thinner twine combined with a different trawl configuration and otter boards incorporating efficient sails should reduce trawl system drag by more than 35 per cent, new research shows

By Nicole Baxter

Prawn fishers around Australia are expected to benefit from research to improve the fuel efficiency of trawling operations, helping them to better withstand the long-term fluctuations in diesel prices.

Cheslav Balash, a research fellow from the Australian Maritime College (AMC) at the University of Tasmania, says fuel accounts for up to 50 per cent of prawn fishers' operating costs.

His co-researcher and former prawn fisher David Sterling, of Sterling Trawl Gear Services, estimates small trawlers use about 500 litres of fuel a night. Larger trawlers, such as those used in Australia's Northern Prawn Fishery, can burn upwards of 2000 litres a night.

High-strength netting

According to David Sterling, prawn trawlers use 60 to 70 per cent of their onboard fuel actively fishing. To reduce fuel use, fishers need to reduce the drag of their gear as it moves through the water so trawling can be done without having to push the throttle as hard.

In one laboratory-based trial they compared the drag potential of four commercially available nets with standard 24-ply polyethylene (PE). The results of the trial, done in the AMC's flume (test) tank, showed that high strength nets made from thinner twine result in less drag (Table 1).

Sea trials were then done to test the performance of five different nets over five days using a 15-metre commercial trawler with a twin rig configuration. Five trawls were made with each net type: 24-ply PE, Hampidjan Dynex, Ultracross Dyneema, Euroline Premium Plus and Spectra.

During the test trawls one of three different sized kilfoil trawl boards, also called otter boards, was selected randomly for each trawl. The best fuel-saving performance, as identified by reduced drag for a given speed and net spread, was 22 per cent, using the Ultracross Dyneema and Spectra nets, matched with the smallest-sized trawl boards. This result was driven by the reduction in twine diameter from 1.7 millimetres for 24-ply PE nets to 1.2 millimetres for the high strength materials.

The 'W' trawl

Industry development over the years has found that multiple net rigs reduce drag and improve fuel efficiency, compared to conventional single net trawl configurations. As a proposed extension to this work, Cheslav Balash and David Sterling conducted field trials using a 'W' trawl configuration to identify further drag and diesel fuel consumption reductions (Figure 1).

The engineering and catch performance of a conventional single net configuration (Florida flyer) and the 'W' trawl configuration was compared using a 3.56-metre headline length trawl in the AMC's flume tank (Figure 1), and also at sea. Results showed the use of the 'W' trawls in a single or twin-rig configuration reduced drag by about 20 per cent compared to the standard trawl.

They have also compared these results against a trial comparing quad and twin rig configurations with standard trawl configurations, which was conducted by NSW Department of Primary Industries researcher Matt Broadhurst.

From this they estimate that 'W' trawls in a twin-rig configuration could reduce drag by 11 per cent compared to a quad rig with standard trawls (Figure 2). There could also be a cost saving because fewer codends and the associated turtle excluder and bycatch reduction devices would be needed.

In the initial sea trials there was little difference in catch between the standard and 'W' trawl configurations. However, in the latest trials at Moreton Bay in Queensland with

TABLE 1 HIGH STRENGTH NETTING TESTED IN FLUME TANK*.

NAME	TYPE	TWINE AREA REDUCTION COMPARED TO 24-PLY POLYETHYLENE BASED ON TWINE AREA	DRAG REDUCTION COMPARED TO 24-PLY POLYETHYLENE
Ultracross Dyneema	Knotless	33%	31%
Euroline Premium Plus	Single knot	14%	9%
Hampidjan Dynex Standard-mesh T0	Double knot	30%	18%
Hampidjan Dynex T90	Double knot	7%	12% increase

*Tested as two-fathom standard prawn trawls.

FIGURE 1 CONVENTIONAL TRAWL VERSUS THE 'W' TRAWL.

Less drag is imposed onto the wings in the 'W' trawl. Smaller sized trawl boards (otter boards) are required to spread the trawl and, as a result, the overall drag of the system is reduced.

FIGURE 2 QUAD-RIG AND 'W' TRAWL IN A TWIN RIG.

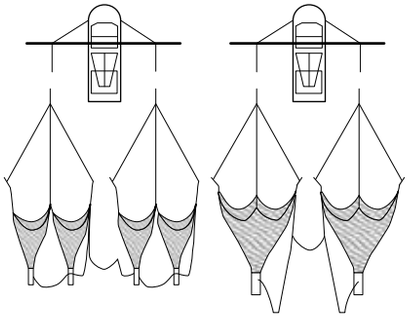
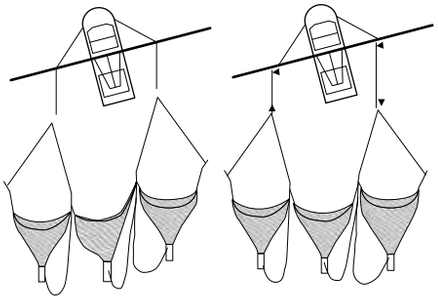


FIGURE 3 TRIPLE-RIG PRAWN TRAWL WITH RUDDER APPLIED (LEFT) AND WITH ADJUSTED TOW POINTS (RIGHT).



full-size commercial trawls, the fuel savings were offset by a 20 per cent fall in the prawn catch when using the 'W' trawl configuration.

Matt Broadhurst and David Sterling plan to test an enhanced version of the 'W' trawl in 2015 during sea trials off the coast of Yamba, 60 kilometres north of Grafton, NSW, in a triple-rig configuration.

Batwing otter board

One benefit of thinner, high strength nets is the opportunity to use smaller trawl boards that are easier to tow, as less spreading force is needed to open the mouth of the nets, and less weight is required to keep the nets at the required operational depth.

A conventional or standard prawn trawl board is a long device set at a high angle of attack (35 to 42 degrees to the direction of travel) to spread the trawl open as it moves along the seabed.

David Sterling has designed a new type of trawl board – the batwing otter board – to spread prawn nets with less seabed contact and less towing resistance. While reducing fuel use, the first trials with the new design also reduced catches by up to 12 per cent, compared to standard otter boards. But a revised batwing design used in further trials has maintained catch rates while reducing fuel use.

"When the batwing otter board is combined with the 'W' trawl, drag is reduced by about 30 per cent compared to a standard trawl and otter board system," Cheslav Balash says. "However, further research and refinement of the design is required to ensure we catch as many prawns as standard trawling systems."

Steering innovation

The Australian Maritime College is also investigating alternative steering mechanisms to reduce fuel use. When a prawn trawler is exposed to winds, the rudder is used to keep the trawler on course, but this increases the effort required to move forward.

A preliminary modelling study has been completed, looking at the merits of controlling tow point location, allowing the trawling gear to square itself, rather than applying the rudder to ensure a prawn trawler stays on course (Figure 3). Cheslav Balash says given the promising results of the initial study, the next step is to study a physical model in the flume tank, to fully develop an estimate of how much fuel can be saved, and produce a concept design for a practical technology to implement the scheme on a trawler.

Monitor fuel

Aside from applying technological innovations when they become available, David Sterling says there are some steps fishers can take now to improve fuel efficiency. Fitting fuel flow meters to check how much diesel is actually being used is a worthwhile starting point.

"The amount of energy required to push a boat through the water grows exponentially with speed so a simple way to reduce fuel consumption is to travel slowly to fishing grounds."

Incentives for skippers to reduce fuel use can also be effective, and can help align the skipper's priorities with the owner's or manager's. "When I managed skippers, instead of paying them 18 per cent of the gross catch, I'd pay 23 per cent of the difference between the gross catch and half the fuel," David Sterling says. F

AUSTRAL FISHERIES IMPROVES FUEL EFFICIENCY

Austral Fisheries operates 10 of the 52 trawlers working in Australia's Northern Prawn Fishery (NPF) and has improved the fuel efficiency of its fleet through a combination of finer nets and quad-rig trawl configurations.

Litres of fuel used per kilogram of prawns produced is one of the company's performance benchmarks, sitting on 2.9 litres per kilogram of Tiger Prawns, and one litre per kilogram of Banana Prawns.

The company had tested twin, quad and tongue nets in the 2005-06 Tiger Prawn season and found the greatest fuel-efficiency gains from quad gear, although these had been banned from the fishery in 1987. In 2007, after the Australian Government funded the Structural Adjustment Package (SAP) and different gear types were allowed in the NPF, Austral Fisheries changed immediately to quad gear.

"We had already started using low-drag netting with our twin nets at that stage," says Austral's general manager Andy Prendergast. "We reduced the net drag by 27 per cent by going from a 2.1-millimetre material down to a 1.7-millimetre low-drag net sourced from India."

Educating skippers to be conservative with fuel management, especially in the top end range of the main engine performance, has also helped improve efficiency.

However, Andy Prendergast says the major contributor to the improved fuel-catch ratio is the SAP, which bought out 18 boats in 2007, leaving 52 operating in the fishery today. Prawn stocks have been recovering and boats have been catching more prawns per boat every time they go fishing, he says.

PHOTO: AUSTRAL FISHERIES

Trade trifecta opens seafood markets

INTERNATIONAL MARKETS

The removal of tariffs will allow Australia to be more competitive in satisfying the growing Chinese market for seafood

By Catherine Norwood

New trade agreements with China, Japan and South Korea are expected to provide opportunities to expand Australia's seafood exports, particularly of abalone and rocklobster.

The China–Australia Free Trade Agreement (FTA) signed in November 2014 is the most recent and offers the largest potential new markets, with all tariffs on seafood to be removed over the next four years.

Parliamentary Secretary to the Minister for Agriculture, Senator Richard Colbeck, says while seafood consumption has increased globally in the past 15 years, per capita consumption of seafood in China has increased 57 per cent since 2000.

"There is also expected growth in demand from Chinese consumers for higher-end seafood products, much of which will need to be imported," he says.

China is already the leading destination for Australian rocklobster and abalone exports, which have tariffs of 15 per cent and 14 per cent respectively.

Participants at the Seafood Exporters Forum.

PHOTO: FRDC

Japan agreement

The Economic Partnership Agreement between Japan and Australia, which came into effect this year, has already seen the tariff on abalone and rocklobster reduced from seven per cent to zero on 15 February 2015. Japan's 3.5 per cent tariff on Australian tuna will also be phased out over 10 years.

Deputy director of Australia's Seafood Trade Advisory Group, Wayne Haggar, says while China has overtaken Japan as the leader for abalone and rocklobster exports, the removal of Japanese tariffs would make Australia more competitive against competing exports from South Korea and Chile, as Australia's reputation for quality is already well established.

Korean trade

Under the Australia–South Korea Free Trade Agreement, the tariff on rocklobster and on frozen and preserved abalone will be reduced from 20 per cent to zero over 10 years. However, live and fresh-chilled abalone (20 per cent tariff), and eels (27 per cent tariff) have been excluded from the agreement.

Wayne Haggar says the Seafood Trade Advisory Group has already prepared a submission about the exclusions in the South Korean agreement, for consideration as part of the Australian Government's negotiations in the Trans-Pacific Partnership Agreement. Although South Korea is not a party to the negotiations, it has shown interest in joining. There are 12 countries involved in the Trans-Pacific Partnership, including Australia, and five of Australia's top 10 trading partners.

General manager trade and market development with the Australian Seafood Cooperative Research Centre, Jayne Gallagher, says the seafood industry has been working quietly and consistently for many years to establish Australia's reputation as a source of premium, high-quality food.

"With the successful conclusion of the China FTA, the industry will increase its market development efforts and focus on building preference for Australian seafood products. We will be able to compete on a level playing field."

Following a Seafood Exporters Forum in November, and workshop in January, the Seafood Trade Advisory Group is expected to continue to focus on new issues that arise as the trade agreements come into force. Members include abalone and rocklobster exporters, and it is supported by the Australian Seafood CRC, the FRDC, Southern Rock Lobster Ltd and the Abalone Council Australia Ltd.

Executive officer with Australian Southern Rock Lobster Ltd, Ross Hodge, says recent Seafood CRC research has rated China as the number one market to target for future trade. The research has identified that as the supply chain infrastructure improves in China's second and third-tier cities, and as consumer incomes increase, so too will the potential for significant markets in those cities.

"The China FTA will enable exporters of Australian Southern Rocklobster to leverage these research findings and work collaboratively to substantially expand our market presence in China," he says.

Executive chair of the Abalone Council Australia, Dean Lisson, says the China FTA will make a real difference. The Australian Wild Abalone™ program is one campaign the council already has underway to differentiate Australian product from competitors.

"While we have had success with our efforts, the conclusion of the China FTA will provide the platform for us to maintain the momentum and secure the future of our industry as exporters of premium seafood." He expects the 14 per cent import tariff on abalone will be successively reduced to about seven per cent within two years, and then to three per cent, before being removed entirely. F

For more information on trade matters visit: www.frdc.com.au/trade

MORE INFORMATION: Redmap, www.redmap.org.au
FRDC RESEARCH CODE: 2011/088

Marine changes are shared experiences

PROFILE

Local, lived experiences add value to the science documenting changes in our marine environments, says researcher Gretta Pecl, supporting better decisions for the future of our fisheries

By Catherine Norwood

As a child, marine ecologist Gretta Pecl enjoyed an annual family holiday in the Victorian coastal community of Torquay, but that was the extent of her exposure to the ocean; even seafood was a rare inclusion on the menu.

While her mother may have been paranoid about sharks and stingers and the other unknown dangers lurking in the deep, for Gretta Pecl, it sparked the desire to learn more about those unknowns. "Just how bad could it be?" she asked.

She quickly discovered that "brilliant" was a more apt description of the underwater world. As a young researcher, she spent a great deal of time out on the water. At least three months each year diving and fishing in Coles Bay or around Maria Island off the east coast of Tasmania – and all in the name of work – seemed an ideal way to spend summer.

These days, her 'diving into the unknown' is more metaphorical. But sharing both the hunt for new information and the findings of the hunt is equally satisfying. She sees working with stakeholders and local communities as crucial to the success of her research, particularly when it comes to evaluating the potential impact of climate change.

In February 2016, she will convene an international conference, 'Species on the Move', looking at the changing patterns of wildlife across the globe – both on land and in the oceans – as a result of climate change.

Experiencing change

The information on what is happening to wildlife is not the sole domain of scientists, Gretta Pecl says. The picture is incomplete if it does not incorporate the experiences and knowledge from relevant industry and community groups, such as commercial and recreational fishers.

From the local Tasmanian Bridgewater Anglers Club, to internationally renowned scientists, all experiences can contribute to the larger picture.

"Even someone who only goes fishing a few times a year, but who returns to the same place year after year comes to know what is normal, and to recognise changes," she says.

Tapping into that information is essential to helping to make the best, most informed management decisions possible, and in identifying priorities for research, she says. But having 'lay' information accepted as legitimate data by the scientific community has proved an ongoing challenge.

Based at the Institute for Marine and Antarctic Studies in Hobart, where she is an associate professor and the deputy associate dean of research, Gretta Pecl is also the force behind Redmap – the citizen-science-based range extension database and mapping project.

The idea for Redmap, she says, emerged from a failed research proposal. As a marine ecologist she was keen to study how the snapper that were beginning to venture south into Tasmanian waters fitted into the local environment. What were they eating, were they breeding, and what impact did they have on local fish species?

Recognised evidence

But the official response to her proposal was that "there was no evidence of snapper in Tasmania". This was despite reports of snapper catches from commercial and recreational fishers, which had been the impetus for the proposal. "I felt that the fishers' reports were being disregarded because they weren't in a recognised scientific format," Gretta Pecl says.

She had been won over by the value of community input following her experiences with Tasmania's rocklobster fishers. This was as part of a 2008 interdisciplinary investigation into the vulnerability of a Tasmanian east-coast rocklobster fishery to climate change.

Whether or not the fishers believed in climate change, they contributed detailed information about the changes they had observed in the fishery during the previous decade. Gretta Pecl says they provided a wealth of new information, identifying changes of which researchers were not even aware.

"I realised then that while we need our traditional structures and scientific information, we also need the knowledge that is inherent in industry, in stakeholders to make a complete picture," she says.

Gathering that information from stakeholders is what the Redmap project is all about. "I wanted to provide a place where observations from fishers and divers could be counted and become part of the scientific record. It also provides a place others can go to, to validate their own experiences that 'it's not just me'," she says.

Data challenge

At the same time, Redmap addresses what Gretta Pecl sees as one of the major challenges facing Australia in terms of identifying changes in the distribution of marine species – the lack of data. And climate change is only one contributing factor.

"Compared with many other countries around the world we are data poor in terms of historical information about our fisheries. We also have more than 55,000 kilometres of coastline to monitor, so we need to get creative," she says. "I see Redmap as a small part of that."

"I realised then that while we need our traditional structures and scientific information, we also need the knowledge that is inherent in industry, in stakeholders to make a complete picture."

– GRETTA PECL

Redmap began in 2009 as a Tasmanian mapping project, providing a web portal through which community members could submit photographs and reports of any unusual catch. The species in each report is then verified by scientists.

In 2012 it became a national program, with support from 20 different scientific institutes and 80 scientists on the verification panel to support community reporting. Redmap observations continue to suggest a largely southward extension in the range of various marine species, providing an early indication of what species might be doing, and identifying potential research priorities. Data from the project has featured in a number of international publications, including the prestigious *Global Environmental Change*.

While journal articles provide international scientific validity, the number of presentations and newsletters featuring Redmap initiated by the fishing community is evidence of stakeholder acceptance of the project's value. "There is a real sense of community ownership," Gretta Pecl says. "This is a gratifying outcome for the researcher, who recognises that many in the fishing industry have been sceptical about climate change in the past, although I strongly suspect that has largely changed now."

The importance of community acceptance and involvement in the science was also an insight that emerged from her past work with fishers. "We can do the best science in the world, but if that science isn't accepted as legitimate by the industry, then our work is essentially irrelevant."

She says engagement and communication with stakeholders is a personally satisfying part of her role. However, she is also keen to return to some 'pure ecology' – the kind of work that launched her career, looking at the life history and environmental interactions of species.

Her early work focused on the life cycle of Northern Calamari (*Sepioteuthis lessoniana*) and Southern Calamari (*S. australis*), initially in Queensland, where she completed her Bachelor of Science and PhD at James Cook University, and then in Tasmania, where she began working with the University of Tasmania in 1999.

She cut back on her field research and laboratory work while her children were young – she and husband Jason have two daughters, aged 8 and 9. In 2015 she hopes to get back out onto the water and into the laboratory with an interdisciplinary project, funded by the Australian Research Council, to identify why some fish species are extending their range, but others from the same region are not.

New projects

Gretta Pecl is also part of an international team working on a global change research project funded by the Belmont Forum, to assess the coastal food security issues and vulnerability of communities in Africa (including Madagascar), Brazil and India.

This builds on similar vulnerability assessments undertaken for the east coast of Australia, and particularly the east coast of Tasmania, where ocean warming is occurring at three to four times the rate of overall ocean warming. Gretta Pecl says this is as a result of changes to the East Australian Current over the past 40 years, which have brought more warm waters further south.

She says the sites for the Belmont project, including Australia, are all in the top 10 per cent for rates of ocean warming – climate change hotspots – although they are not the only places where climate changes are significant.

"We're fortunate in Australia that we don't have a critical dependence on seafood for food security. But there are extensive changes taking place in the ecosystem and we can use our understanding of what is happening here to help other regions where food security is a more critical issue."

She is keen to encourage more debate about the opportunities and challenges for fisheries and fisheries science in 10, 20, even 100 years time, outside the bounds of the strict formal scientific reporting format. The international Species on the Move conference in 2016 will be one such opportunity to do this. As the newly appointed editor-in-chief of the journal *Reviews in Fish Biology and Fisheries*, Gretta Pecl has also initiated a 'Future Seas' series of articles, providing space for science-based speculation and personal opinion. Through this kind of discussion she hopes to see creative solutions emerging to help the fisheries sector overcome the challenges it is facing.

"In a period of rapid change, there are multiple impacts on marine ecosystems. We also have more demand for seafood globally. We need to find out how our ecosystems are changing, so that we can make better decisions into the future, to maximise sustainable production," Gretta Pecl says. F

Obituaries

Vale FRDC director David Thomason

The FRDC Board and staff are saddened by the death of FRDC director David Thomason who passed away in November 2014 after a short but valiant fight against illness. David Thomason was the mastermind behind some of Australia's most awarded and effective marketing campaigns, and was appointed an FRDC director in November 2012.

David Thomason started his career with Cottee's foods in 1968 and stayed with the company for 20 years before moving to George Weston Foods, where he was marketing manager for a decade. He joined Meat and Livestock Australia (MLA) in 1998.


David Thomason

While at MLA, David Thomason worked with some of Australia's best agencies including The Campaign Palace, Host and BMF, and was widely applauded for his commitment to creativity. Over his 12-year tenure at MLA as general manager – marketing, David Thomason was responsible for campaigns including the Dancing Butchers, 'Red meat feel good' with Sam Neil, and Sam Kekovich Australia Day for Lamb.

More recently, he was a board member of Certified Australian Angus Beef and the Australian Seafood Cooperative Research Centre, as well as the FRDC, and was also a founding board member of the Primary Industries Education Foundation.

David Thomason was passionate about how marketing could transform an industry. With legislation passed in December 2013 to enable the FRDC to undertake marketing, his appointment to the FRDC Board was very timely.

While on the FRDC Board, he encouraged and guided the transformation of the marketing function. He tirelessly made his time available to anyone interested in understanding or pursuing seafood marketing. David Thomason's legacy will continue as the FRDC builds on his early work. He will be greatly missed by many agricultural and other professionals throughout Australia.

David Thomason is survived by his wife Sue and children Josh, Drew, James and Edwina. F

Tribute for recfishing innovator

The FRDC remembers John Dunphy who died in Osaka, Japan, on 8 January 2015. John Dunphy was a highly respected innovator within the recreational fishing community, who provided his extensive knowledge and foresight to advance the fishing industry at large, as well as in an advisory capacity to government fisheries departments.

He founded his family business, Dunphy Sports/Fishing Imports, south of Sydney, in 1981, and shortly aftewards secured Australian and New Zealand distribution rights for Shimano tackle and equipment. During the next 30 years he and his family helped to build the brand from relative obscurity into the leading name in fishing tackle in Australia and the Oceania region. When Shimano Japan bought Dunphy Sports/Fishing Imports in 2008, John Dunphy remained with the company in an advisory capacity until 2011.

As a great innovator of fishing tackle, John Dunphy created the baitrunner reel (a threadline reel that feeds line out with no resistance, with a quick engagement bar). The innovation was adopted and produced by Shimano and continues to be extremely popular. A great proponent of catch-and-release fishing, he promoted the knotless Environet, developed by Australian Dave Irvine, which causes minimal harm to the fish, and took production from small-scale local operation to mass production in China.

John Dunphy also advocated the use of lures, especially squidgees, which played a huge role in catch-and-release fishing gaining acceptance. He also promoted tag-and-release fishing, especially at game fishing tournaments, through sponsorship, trophies and prizes.

He supported recreational fishing licences, with the proviso that the funds only be used to improve recreational fishing, and also contributed his own funds to a range of projects. A study tracking the movements of Black Marlin (*Makaira indica*) via the use of ultrasonic tags would not have happened without his support.

John Dunphy was a strong advocate of measures to ensure Australia's passion for fishing was sustainable for future generations, such as fish restocking, and his legacy is one he and his family can be proud of. F

Interested in an FRDC final report?

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or contact the FRDC on 02 6285 0400, email frdc@frdc.com.au

PREPARING FOR CLIMATE CHANGE 2011/039

Case studies have been prepared on four species in south-east Australia – rocklobster, abalone, Blue Grenadier and snapper – to evaluate possible climate change adaptation strategies. These are considered indicator species for their ecosystems, have high commercial or recreational value, and are likely to be negatively affected by climate change. The goal of the project was to identify adaptation options to enhance the profitability of commercial fisheries and maximise opportunities for participation in recreational fishing. Strategies identified included:

- establishing biomass levels that need to be maintained in order to enhance resilience to increased variability in recruitment;
- improving governance systems of fisheries to enhance adaption to climate change and other stressors, including formal harvest;
- establishing ecological, economic, social and community performance indicators with transparent mechanisms for trade-offs between competing objectives;
- identifying key parameters in individual fisheries or jurisdictions to assess the impacts of climate change; and
- determining whether cost-effective options for collecting this data are in place or can be established.

Interested in an FRDC final report?

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The fishing industry should consider participating in a strategic environmental monitoring program that would contribute to future investigations of the impacts of climate change on marine systems and dependent industries. Australia's Integrated Marine Observing System would be well placed to take a leadership role in establishing greater industry involvement and maintaining this program.
MORE INFORMATION: **Gretta Pecl, 03 6227 7243, gretta.pecl@utas.edu.au**

HARVEST STRATEGY REVIEW REPORTS 2012/225

This project produced four separate reports relating to material prepared to facilitate the 2013 review of the Commonwealth Harvest Strategy Policy (HSP) and its guidelines. Some aspects considered were directly related to the policy itself while others related to the guidelines, which determine how the policy is interpreted.

The first review document, *Technical reviews for the Commonwealth Harvest Strategy Policy*, considered six major fields in the field of harvest strategies relating to reference points and harvest controls and each of these sections considered an array of different issues. The second review, *Technical Reviews for the Commonwealth Harvest Strategy Policy: Economic Issues*, considered issues around the use of maximum economic yield (MEY) as the overall target for the Harvest Strategy Policy.

The third review, *A Technical Review of the Implementation of the Commonwealth Fisheries Harvest Strategy Policy*, detailed issues relating to the difficulties encountered when implementing the Commonwealth Harvest Strategy Policy across the diversity of fisheries within the Commonwealth of Australia. The final review, *Technical Reviews for the Commonwealth Harvest Strategy Policy: Technical Overview*, attempted to summarise the findings of the first three reviews and then identify particular issues for consideration by the review committee.
MORE INFORMATION: **Malcolm Haddon, CSIRO, 03 6232 5097**

ABALONE PERFORMANCE MEASURES 2007/020

This project has successfully developed a management strategy evaluation (MSE) simulation framework for testing specific performance measure and harvest control rule strategies for use in Australian abalone fisheries. Development of the simulation framework is complete and can now be adapted for different jurisdictions, or used to test specific scenarios of interest to management. Scenarios already tested include rebuilding virus-affected stocks in Victoria, while allowing some fishing to continue, and the effect of changing legal minimum length and total allowable catch on Tasmania's south-west coast. The South Australian abalone management plan has also benefited from the international review of management objectives and performance indicators held as part of this project. The simulation framework has suggested modifications to the state's new harvest strategy. Output from the MSE framework will also help design of the multi-criterion decision-analysis management framework to be introduced into the Tasmanian abalone fishery.
MORE INFORMATION: **Malcolm Haddon, CSIRO, 03 6232 5097**

DIARIES MONITOR RECREATIONAL FISHERIES 2008/005

This study provides confidence in research-angler diary (RAD) and general-angler diary (GAD) programs as innovative approaches to monitoring small-scale recreational fisheries. Both programs were found to be cost-effective and scientifically robust if managed diligently and supported by the angling community, fishery managers and researchers as methods suitable for monitoring recreational fisheries.

RAD and GAD programs can foster greater stewardship and engagement of stakeholders in the collection of information needed for fisheries management and sustainable use of key fisheries resources in recreational fisheries. The RAD method provides for valid stock-performance indicators; the GAD method provides for valid fishery-performance indicators.

These innovative monitoring methods provide a basis for a consistent national approach to monitoring and to enhanced management of recreational fisheries. A guide ('toolkit') provides for the establishment of RAD and GAD programs to enhance the ability of government, industry, researchers and recreational fishers to apply angler-diary programs. A Queensland case study demonstrates how angler-diary programs could incorporate routine tag and release of fish for improved understanding of availability and movement of various size classes in a population among regions. Victoria's ongoing angler-diary programs won two prestigious awards as part of the 2011 World Environment Day Awards and media coverage resulting from the awards widely promoted the programs.
MORE INFORMATION: **James Andrews, 03 5258 0232, james.andrews@depi.vic.gov.au**

INDIGENOUS AQUACULTURE FORUM 2009/336

The 2010 forum and the bursary funding enabled 32 people, including 10 bursary recipients, to participate in a facilitated dialogue on a range of Indigenous-specific aquaculture development issues. All states and territories were represented at the forum, which provided a good cross-section of experience and knowledge in Indigenous aquaculture business development. The forum was a mix of presentations and a workshop, comprising small group and plenary sessions to achieve the following priorities identified by the bursary recipients and 2008 forum participants – in order of priority:

- industry representation;
- a list of Indigenous aquaculture ventures and businesses;
- fundamentals of success;
- new professional networks and relationships;
- business planning process;
- what research and development is happening or planned; and
- a contact list of people working in this area and what they do

The focus of the forum was to provide both the input and the outputs that would address the key priorities. The workshop was successful, with 100 per cent of participants reporting the forum had a high degree of influence on future investment decisions.
MORE INFORMATION: **Dan Machin, 08 9492 8819**

PACIFIC OYSTER BREEDING PROGRAM 2006/227

This project has focused the Australian Seafood Industries (ASI) Pacific oyster breeding strategy on economic outcomes – that is, reducing the cost of production. The size and structure of the breeding population has changed to allow greater genetic gains on a sustainable basis. The goal is to produce 50 families per year and 42 families were produced for the 2009 year class, an increase from 24 families in the previous strategy. A new nursery system has been implemented to produce the expanded population. Data collection and storage systems have been completely revised to allow more efficient data collection and storage, and safeguards against data loss. A new genetic evaluation system has been implemented, which will provide more accurate selections, and a revised commercial deployment strategy has been implemented, which will increase the supply of selectively bred spat to industry.
MORE INFORMATION: **Peter Kube, CSIRO Marine and Atmospheric Research, 03 6232 5222**

MODIFIED FYKE NETS REDUCE BYCATCH 2008/017

The Victorian eel fishing industry has been proactive in the reduction of bycatch in the fishery, developing and using a range of bycatch-reduction devices and practices over many years. It has further developed fishing equipment and modifications to existing fishing gear, specifically to reduce the risk of interaction with protected wildlife and other fauna in the fishery, and is now at a stage of trialling different gear types and further developing prototypes. Fyke nets with modified codends were found

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to minimise the retention of some protected wildlife species, notably platypuses, while continuing to effectively catch eels. Other species, such as tortoises, although apparently unable to escape from the nets, remained alive in the nets until release. Fyke nets containing escape tubes were found to significantly reduce the incidental catch of small fish species, but the quantity of eel catch was also reduced.

The modified fyke nets can be used in locations where the incidental bycatch of protected wildlife may occur, such as in wildlife reserves, to improve the management of bycatch while still enabling commercial eel catches to be made. Further refinement and development of this gear is required to improve the likelihood of uptake of the technology in the fishery.

MORE INFORMATION: **Graham Milner, Western Victoria Eel Growers' Group, 0428 988 899, audentes@bigpond.com**

FRDC AND CRC RESEARCH PUBLICATIONS 2011/525

The FRDC and industry are working to increase community awareness of industry sustainability practices and, through this, support for the seafood industry. This project was initiated through discussions between the FRDC and the National Aquaculture Council (NAC) in 2011, with RDS Partners being engaged to work with this team in 2012. The aim was to produce an accessible and comprehensive bibliographic database of reports and associated publications from all relevant environmental projects funded by the FRDC, the AquaFin CRC and the Seafood CRC with regard to tuna, prawn, salmon and edible oyster aquaculture. The database is a publically available source of bibliographic information demonstrating the current depth and breadth of relevant scientific research published in Australia (with some relevant overseas examples) regarding natural environmental issues associated with tuna, prawn, salmon and edible oyster aquaculture. The database was expanded to include important papers relating to those that were the result of FRDC, AquaFin CRC and Seafood CRC funding.

MORE INFORMATION: **Tom Lewis, 03 6231 9033, tom.lewis@rdspartners.com.au**

LEARNING FROM EUROPEAN SEAFOOD EXPO 2011/412

The aim of this project was to give five future leaders a better understanding of the international benchmarks for sustainable seafood production and marketing. Jointly sponsored bursaries provided by the FRDC and the Western Australian Fishing Industry Council (WAFIC) provided an opportunity for industry to network and meet seafood people from around the world during the 2012 European Seafood Expo in Brussels, Belgium. The program was intense, covering seafood morning, noon and night, and bringing people from all sectors together on a voyage of discovery with a mentor to ensure that all are engaged in the activities. Sponsored participants indicated that they thoroughly enjoyed the experience and all of them came home with ideas, contacts and sufficient material to make the exercise a success to them personally, their businesses and consequently to the industry. Bursary recipients were asked to address some key issues during their stay, with information gathered to be converted to at least one article to assist industry.

MORE INFORMATION: **WAFIC, 08 9432 7777**

CLIMATE ADAPTATION STRATEGIES 2011/040

The project was developed in response to the threats to fisheries' value, biodiversity and ecosystem function posed by the effects of climate change on Australia's estuarine and coastal marine ecosystems, which are already heavily impacted by changes in land and water use. The project involved extensive review of climate change adaptation strategies from across the world and evaluated their usefulness under Australian conditions through reviewing case studies, through interviews with workers from all levels of science and management from across Australia, and by reviewing modelling tools and using advanced qualitative modelling.

We found that successful adaptation strategies needed to be developed in a broad context, focusing on whole-of-systems, long-term outcomes. Traditional climate change adaptation frameworks were identified as too rigid for use across Australia's diverse estuary and coastal marine systems. No single approach is suitable given the range of plant and animal assemblages, climates, and region-specific threats and matters of contention. As a result the project developed a set of general principles to help direct adaptation strategies regardless of the particular situation; to help guide, but not constrain, the development of informed adaptation policies, plans and actions. In addition, to assist those tasked with adaptation strategy delivery, the project produced a review of available tools and frameworks, together with recommendations for the situations in which they are likely to be useful, and a checklist of components to consider when developing effective adaptation strategies.

MORE INFORMATION: **Marcus Sheaves, James Cook University, 07 4781 4144, marcus.sheaves@jcu.edu.au**

RD&E CAPABILITY AUDIT 2013/410

This report provides an analysis of the research, development and extension (RD&E) effort supporting Australia's fishing and aquaculture industries in 2013. Since the release of *Working Together: The National Fishing and Aquaculture RD&E Strategy* in 2009, the FRDC and the Strategy Governance Committee considered that significant changes have occurred in national RD&E capability, especially within state government agencies. The FRDC commissioned RDS Partners to repeat the RD&E capability audit in 2013, to provide Australia's agencies investing in RD&E with an understanding of current RD&E capability and capacity and future demand.

As in the 2009 RD&E capability audit, data was collected through voluntary return and one-to-one follow-up. Of the 108 organisations or individuals invited to participate in the 2013 capability audit, 56 provided a response and 51 of these provided capability information. Comparison between years focuses largely on the 32 organisations that responded in both 2009 and 2013.

A small increase in the number of full-time equivalent (FTE) researchers was reported across these organisations. Overall, there was a relatively large increase in FTEs in the fisheries, aquaculture and post-harvest capability areas and a large decrease in the number of FTEs in the communication/extension, environment and ecosystems capability area.

MORE INFORMATION: **Tom Lewis, 03 6231 9033, tom.lewis@rdspartners.com.au**

AGE LINK TO TOUGH FISH SYNDROME 2010/207

A major achievement of this research is the confirmation of fish age as the primary driver of toughness in cooked Saddletail Snapper flesh. Knowing the cause provides confidence to develop solutions and make business decisions for the reef-fish fisheries.

The influence of other fish physiological factors was shown to have little impact with respect to fish flesh toughness. Additionally, there was no apparent connection between flesh toughness and seasonality or year-to-year conditions. The possibility of toughness being engendered through inappropriate chilling immediately post-capture was ruled out as a factor contributing to tough fish syndrome (TFS).

The outcome following on from identification of the cause of TFS surrounded developing procedures for reducing the incidence of tough fish where the cause was preventable. However, as post-harvest handling was not a contributor to toughness, implementing alternative handling procedures was irrelevant. The focus of this outcome shifted to developing strategies to ensure fish at risk of exhibiting TFS did not enter the value chain. This was addressed by provision of currently available technology on non-invasive ultrasonic imaging and near-infrared spectroscopy to the industry partners.

MORE INFORMATION: **Sue Poole, Queensland Department of Agriculture, Fisheries and Forestry, 07 3406 8689**

Movers and ...

The FRDC farewells digital communication specialist RACHELLE ETIENNE-BREIDENBACH, office administrator RITA LIN and projects manager PELE CANNON. We wish you all the best for 2015.

SCOTT WISEMAN has resigned as executive officer of the Queensland Seafood Industry Association. ERIC PEREZ, formerly Native Title officer, has been appointed as executive officer.

ALLISON WEBB has joined Fisheries Victoria as director of fisheries management and science. ROSS MCGOWAN is now director of earth resources and MARK EDWARDS is acting executive director, fisheries.

The new general manager at the Tasmanian-based hatchery Shellfish Culture is GREG BOWERS.

ANNE ASTIN has been appointed independent chair of SafeFish.

RIK BUCKWORTH has relocated to Darwin to the Tropical Ecosystems Research Centre.

FRDC Board director RENATA BROOKS has left the New South Wales Department of Primary Industries to devote her time and energy to directorships and other opportunities within the world of fisheries and primary industries.

FEEDBACK
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MOVERS WE'VE MISSED?
INFO PLEASE TO
Julie Haldane, 02 6285 0415,
julie.haldane@frdc.com.au

Calendar of events

DATE	EVENT	MORE INFORMATION
3 to 4 March	ABARES Outlook 2015, Canberra	www.agriculture.gov.au/abares/outlook-2015
15 to 17 March	Seafood Expo North America & Seafood Processing North America	www.seafoodexpo.com/north-america
14 to 15 April	FRDC Board Meeting, Hobart	02 6285 0400
21 April	Seafood Expo Global and Seafood Processing Global, Brussels, Belgium	www.seafoodexpo.com/global
20 to 22 May	NAAFE Forum 2015: Economic Sustainability, Fishing Communities, and Working Waterfronts, Ketchikan, Alaska, USA	www.oregonstate.edu/dept/IIFET/NAAFE/Home.html
28 to 30 April	2015 Trans-Tasman Rock Lobster Industry Conference and 9th Rock Lobster Congress, Esplanade Hotel, Fremantle	http://wrlc.com.au
26 to 30 May	World Aquaculture 2015, Jeju, Korea	www.was.org/meetings/default.aspx?code=WA2015
10 to 11 June	FRDC Board Meeting, Darwin	02 6285 0400
6 to 11 July	Third Australasian Scientific Conference on Aquatic Animal Health, Pullman Reef Hotel, Cairns	joanne.slater@csiro.au
25 July	2015 Australian Recreational Fishing Conference, Gold Coast Convention and Exhibition Centre, Queensland	www.recreationalfishingconference.com.au
23 to 26 August	Aquaculture 2015, Le Corum, Montpellier, France	www.aquaculture-conference.com
25 to 26 August	FRDC Board Meeting, Canberra	02 6285 0400
8 to 10 September	Seafood Expo Asia, Hong Kong	www.seafoodexpo.com/asia
11 to 14 October	The 5th International Symposium on Stock Enhancement and Sea Ranching and the 2015 Australian Society for Fish Biology Conference, Aerial Function Centre, University of Technology, Sydney	www.asfb.org.au/events
21 to 23 October	6th International Oyster Symposium, Cape Cod, Massachusetts, USA	www.oystersymposium.org
25 to 27 October	Seafood Directions, Crown Casino, Perth	www.seafooddirections.net.au
17 to 18 November	FRDC Board Meeting, Canberra	02 6285 0400


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