FISH

FISHERIES RESEARCH & DEVELOPMENT CORPORATION **NEWS**

VOLUME 24
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JUNE 2016

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Contents

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FRDC
Fisheries Research House,
25 Geils Court, Deakin, ACT 2600;
Locked Bag 222, Deakin West ACT 2600
T 02 6285 0400 **E** frdc@frdc.com.au
W www.frdc.com.au
To contact the FRDC or individual staff members see the FRDC website (www.frdc.com.au)

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FISH is available free. To subscribe, contact the **FRDC**
T 02 6285 0400 **E** frdc@frdc.com.au
FISH is online at www.frdc.com.au

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

FRDC executive editor: Peter Horvat
Deputy editor: Ilaria Catizone

Coretext editor: Catherine Norwood
Creative director: Tim Claeys
Coretext, PO Box 12542, Melbourne Vic 8006
T 03 9670 1168 **F** 03 9670 1127
E enquiries@coretext.com.au **W** www.coretext.com.au
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FEATURES

4 Gulf model to manage marine interactions
6 Fisher experiences help align safety regulations
8 International endeavours
12 Digital directions lead to a new E-FISH frontier
14 Festivals celebrate seafood
17 FRDC's new staff and Adelaide-based office
18 *FISH* readers share their views
20 Listening to the fish song
22 US insights into localised supply chains
25 More species to expand key fish stocks reports
26 National impact from Tasmanian POMS outbreak
30 Collaboration to maximise new aquaculture opportunities
31 Early parasite detection research wins science award
32 Bridge-building needed for Indigenous fisheries research
34 China warehouse secures new route to market
35 Name change makes species' origin crystal clear
36 Health check to identify omega-3 gap
36 Balancing the benefits of seafood
38 Model master

REGULAR

7 In brief
40 Final reports
43 Movers and ...
43 Calendar of events

FRDC HOME **www.frdc.com.au**
UPCOMING EVENTS **www.frdc.com.au/Pages/Calendar.aspx**
RESEARCH **www.frdc.com.au/research**
KNOWLEDGE **www.frdc.com.au/knowledge**
ENVIRONMENT **www.frdc.com.au/environment**
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VIDEOS
FRDC FISHERIESRESEARCHAU
www.youtube.com/user/FisheriesResearchAU/videos
FISHFILES **www.youtube.com/user/FRDCFishfiles**

COVER
Chef Kira De Spain preparing restaurant Olé paella's signature paella at the Fremantle seafood festival in February.
Photo: Brad Collis

8 International endeavours

20 Listening to the fish song

FEEDBACK
FRDC welcomes your comments
frdc@frdc.com.au

26 National impact from Tasmanian POMS outbreak

MORE INFORMATION: Bronwyn Gillanders, University of Adelaide, 08 8313 6235; Tim Ward, SARDI, 08 8207 5433

FRDC RESEARCH CODE: 2011/205

GULF MODEL TO MANAGE MARINE INTERACTIONS

ECOSYSTEM MANAGEMENT

New modelling of the Spencer Gulf marine ecosystem helps to identify how changes to one aspect of the ecosystem affect others

By Annabel Boyer

South Australia's Spencer Gulf is a crowded environment when it comes to marine and human interactions. It harbours productive fishing and aquaculture sectors, along with coastal tourism, ports and shipping, defence operations and mining interests. Alongside these activities are conservation areas and a range of iconic species.

These myriad activities makes the gulf an ideal location to study how changes in one area of operation can affect other parts of the marine ecosystem. Since 2012, several SA research teams have been working collaboratively to develop modelling systems that are capable of investigating the complex interactions of human and marine life involved. With the projected development of new ports and mining, understanding the effects of these activities might help to solve problems before they manifest and establish new means of managing competing interests in complex systems.

Bronwyn Gillanders is the principal investigator on the Spencer Gulf Ecosystem Development Initiative (SGEDI), which is developing models to understand the Spencer Gulf. The SGEDI has been funded by a diverse group of partners and is supported with nearly $2.5 million of investment from industry. Investors include BHP Billiton, Santos, Arrium, Alinta, Nyrstar, Centrex Metals, Flinders Ports and the FRDC. Research partners include the University of Adelaide, the South Australian Research and Development Institute (SARDI) and Flinders University. "There is lots going on besides just fishing and aquaculture. Other activities relate to shipping for example," Bronwyn Gillanders says. The gulf is also home to a range of iconic species, as well as marine parks. The

PHOTO: NICK KETLEY

Modelling is helping to identify the competing interests and impacts of different industries in the Spencer Gulf.

research has looked at interactions among activities and their potential cumulative effects.

The project has looked at a range of potential changes in the Spencer Gulf – from the effects of shipping activity and increases in mining, to the potential impact of increased sardine fishing on other marine species in the gulf. The FRDC's contribution to understanding the Spencer Gulf, alongside the larger SGEDI project, has focused primarily on developing models that can be used to assess how changes to fishing and aquaculture might influence components of the ecosystem.

The modelling addressed three potential 'what-if' scenarios around increases in finfish aquaculture, Australian Sardine catch and Western King Prawn effort and catch. SARDI's Simon Goldsworthy led the application of the Ecopath with Ecosim (EwE) modelling framework that was initially developed at Canada's University of British Columbia but is now used around the world. Simon Goldsworthy says the EwE modelling framework provides an opportunity to bring together information provided by a diverse group of oceanographers, marine biologists and quantitative ecologists.

Fishing and aquaculture

The Spencer Gulf is known as a key production hub for both high-quality and high-value seafood. A clean, environmentally friendly image is a valuable asset to the seafood producers that operate there. Bronwyn Gillanders says being informed about the potential impact of other industries on the marine environment is an important part of the seafood sector's reputation, as well as operational management.

The models measure the effects of changing food web dynamics in a system that incorporates information on currents, nutrients and the distribution of habitats such as seagrass. The project coupled several different models to assess how fishing and aquaculture can interact with each other and affect broader ecosystem structure and function. It illustrates the value of an approach that combines several different models, thus approaching some of the actual complexity that is present in the Spencer Gulf itself, making it an accurate and useful tool for managing the health of fisheries there.

Aquaculture

Eighty per cent of SA's aquaculture production comes from the Spencer Gulf. SARDI oceanographer John Middleton led the development of models to examine potential development scenarios involving both increasing and reducing nutrients from aquaculture into the system. Significant changes in biological response were found in relation to changing nutrient conditions. Model scenarios suggest that increased nutrient loading from aquaculture will result in increased levels of phytoplankton, detritus and gelatinous zooplankton (sea jellies, salps and dolioles).

Australian Sardine fishing

The SA Sardine Fishery in the Spencer Gulf is the largest Australian fishery by weight with much of it used for aquaculture in the gulf. When researchers modelled increased catches of Australian Sardines they found that animals that predate upon this species would not be greatly affected because they also prey on a wide range of other species. Increased catches of Australian Sardines appear to benefit squid, anchovies and

" There is lots going on besides just fishing and aquaculture. Other activities relate to shipping for example."

BRONWYN GILLANDERS

Point Lowly, in South Australia's Spencer Gulf.

PHOTO: BRONWYN GILLANDERS

Blue Mackerel with accompanying benefits to the prey of these species that offset the reductions in abundance of Australian Sardines. Simon Goldsworthy says it is likely that the increases in the abundance of other prey species was due to decreased competition from Australian Sardines.

Western King Prawn Fishery

The Spencer Gulf Western King Prawn Fishery is certified by the Marine Stewardship Council as sustainable. Simon Goldsworthy simulated several different scenarios to understand the impact of increased prawn fishing in the gulf. Unlike Australian Sardines, modelling for increased catches of Western King Prawns showed that the most affected species are those that eat Western King Prawns. Researchers developed a model that takes into account the bycatch at levels of fishing above historical levels. In this case the model suggested that increased fishing would affect a range of species of fish, marine birds, seals and sharks. Simon Goldsworthy says this model provided a good tool to explore and understand what happens when there are changes in management practices or fishing methods.

Integrated marine management

John Middleton, from the oceanographic team at SARDI that has worked on the modelling, says that biophysical studies made by his team have provided a management tool for ecosystem carrying capacity. He says this allows government managers to assess the impact of existing and proposed expansions of aquaculture.

The extension of this tool to incorporate other aspects of the ecosystem studies will help inform integrated marine management – a means of dealing with competing and conflicting interests. The ultimate aim of this research is to provide resource managers and stakeholders with independent and credible information about the likely effects of different management options.

Simon Goldworthy says the work has provided a base model that could be used as a tool to manage the Spencer Gulf in the future: "We are now in a position where we can further develop the model and use it as a tool to provide possible outcomes of different management scenarios, providing capacity to improve future management of marine natural resources in the Spencer Gulf in an ecosystem-based management framework."

SARDI's Tim Ward says that an international workshop held at SARDI in 2015 looked at the practical steps towards integrated marine management and identified what has and has not worked internationally.

He says there is potential for the Spencer Gulf to be used, once the research is completed, as a case study for other multiple-use systems in Australia and around the world.

Simon Clark of the Spencer Gulf and West Coast Prawn Fisherman's Association sees integrated marine management as a long-term goal for the gulf. He says while the models do not yet give his industry much information, it is a starting point and he is positive about how this research could provide a foundation for a more integrated management system.

"If we can improve our baseline understanding of how the system operates, all sectors can work within that system harmoniously."

Simon Clark says that, for the Spencer Gulf and West Coast Prawn Fisherman's Association, improving visibility as a user of the system goes a long way to setting up relationships to work towards those integrated management goals. While research is underway to support this future management style, he says the first hurdle will be for government to adopt such a system.

Bronwyn Gillanders is positive about the application of the research.

"Eventually, this research could be used to create a web-based decision-making tool that will allow industry stakeholders, policymakers and members of the public to better understand the processes going on in the Spencer Gulf," she says. F

MORE INFORMATION: **Australian Maritime Safety Authority, www.amsa.gov.au**
FRDC RESEARCH CODE: **2015/401**

Fisher experiences help align safety regulations

WORKPLACE SAFETY

Practice using emergency equipment can pay off in an emergency at sea

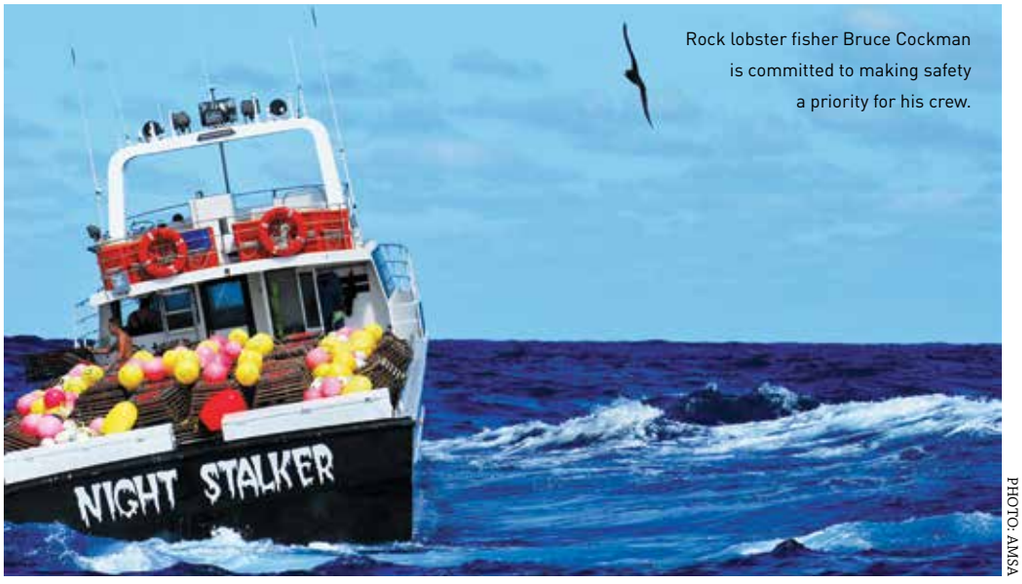
By Australian Maritime Safety Authority

Two-way collaboration, including sharing the knowledge and experience of people who work at sea, is fundamental to the Australian Maritime Safety Authority's (AMSA) approach to providing regulatory services to the domestic commercial vessel industry.

As the national regulator since July 2013, AMSA is responsible for the safety of vessels and seafarers operating in the domestic commercial industry. This safety oversight will expand from July 2017 to also include a national safety regulation role to provide regulatory consistency to marine industries across the country. This is being implemented under the National System for Domestic Commercial Vessel Safety (National System).

AMSA strives for a relationship where owners, operators and other industry members can be a part of creating a national system that aligns safety outcomes with more consistent regulation.

AMSA is seeking input from industry on the proposed changes to legislation and the way AMSA plans to offer its services from July 2017. This includes talking to operators, crew and others in the industry about their experiences. These conversations inform regulatory changes and help AMSA achieve simpler regulations and safer operations. An example of such engagement is between AMSA and Western Australian fisher Bruce Cockman, who explains how a close call that happened on his boat changed the way he thinks about safety.



Rock lobster fisher Bruce Cockman is committed to making safety a priority for his crew.

PHOTO: AMSA

Washed overboard

"The boat broached down a big wave at Big Bank, north of the Abrolhos Islands," he says.

"The boat was sideways and the deckie was 20 metres off the boat in the water hanging onto the deck hose. We hadn't done any drills at the time and all the pots had fallen into the water and all the ropes were tangled so there was nothing to throw to him. The life ring was above our heads, but we didn't think of that at the time. That's where doing drills comes in; nothing like that has ever happened since but, if it does, we'll know what to do."

Bruce Cockman mainly fishes for rock lobsters off the coast of Dongara, WA, as part of his family company. He also does some wet-lining for Western Australian Dhufish and Snapper in that area and he holds licences in other fisheries as well.

He admitted that when he first started fishing, safety was not high on his list of priorities. "We didn't have any safety guidelines. We would just be diving on pots ourselves and it was all probably a bit crazy, but nothing happened to us. There always used to be a lot of boats around. You could always see two or three boats from wherever you were fishing. But now the fleet is shrinking," he says.

"Where I go on the fishing grounds there's no one around. I'll often go two or three weeks without seeing another boat, so safety is important."

Be prepared

In the past, Bruce Cockman did not do any practice drills or have safety procedures in place, but since the incident at Big Bank his working practices have improved.

"For the man-overboard drill we've now got harnesses and a procedure to pull people on board – so next time we'll remember the safety equipment," he says.

"We've got a safety management plan, which we've had for the last couple of years. A consultant came on the boat and helped us make a basic plan. The next step will be to upgrade it, but the drills are there."

He says his crew often ask why they have to drill when other boats do not: "But things *do* happen and I want to be ready when they do."

Luckily, at Big Bank everything turned out fine, but Bruce Cockman admits it took about three hours to sort everything out and several crew members were injured. Now his boat is fitted with Emergency Position Indicating Radio Beacon (EPIRB) stations and he makes a point of training his crew to use them.

He has also replaced his rigid life raft. "Now we anchor out a lot, and inflatable life rafts are a good thing. If you're going to go over you want to be in one of them" he says.

When asked about the National System, which began in July 2013, Bruce Cockman is hopeful.

"As long as the National System brings consistency between all the boats, it will be positive." F

Adelaide nets World Fisheries Congress

A successful joint Australia–New Zealand bid to host the 2020 World Fisheries Congress is expected to bring more than 1500 delegates to the Adelaide Convention Centre on 11 to 15 October 2020.

The World Fisheries Congress is organised by the World Council of Fisheries Societies and held every four years, with the aim of advancing and promoting international developments and cooperation in fisheries science, conservation and management.

This year, the South Korean city of Busan will host the 2016 World Fisheries Congress on 23 to 27 May.

Australia last hosted the congress in Brisbane in 1996, where an action plan for the next 25 years was put forward. The Adelaide event will provide a timely opportunity to assess what has been achieved in the interim.

The 2020 congress will also focus on the challenges of fishing sustainably and maintaining prosperous fishing communities from oceans and rivers whose functional integrity and conservation values are facing increasing pressure.

The bid was led by the Australian Society for Fish Biology, the South Australian Research and Development Institute and the FRDC. Other bid members included the University of Adelaide, the Adelaide Convention Bureau, CSIRO, the New Zealand Ministry for Primary Industries and the SA and New Zealand seafood industries.

NEW BOARD LEADS WOMEN'S NETWORK

By Irene Stefanou

Western Australia's Leonie Noble has taken on the position as president of the Women's Industry Network Seafood Community (WINSC). WINSC promotes and encourages women to better themselves by offering scholarships and opportunities to attend national conferences and advocate on behalf of women with the main goal of increasing female representation in industry and government bodies.

Leonie Noble will be supported by immediate past president and New South Wales director Mary Howard. Other executive members are: WA director and vice-president Gaylene Newton; Queensland director and executive treasurer Anne Whalley; and South Australian director and secretary Karen Holder. Other WINSC directors include Trixi Madon (Australian Capital Territory), Marianne St Clair (Northern Territory), Mary Brewer (Tasmania), Maria Manias (Victoria) and Barbara Konstas (director at large).

PHOTO: KERRY FAULKNER

Leonie Noble

Suzanne Martin

ANIMAL HEALTH SCHOLARSHIP

By Irene Stefanou

Tasmanian veterinarian Suzanne Martin has been awarded a scholarship to help develop her personal and professional skills through the Women's Industry Network Seafood Community (WINSC). She plans to use the scholarship to study advanced aquatic animal care and husbandry at the Canadian Aquatic Institute at the University of Prince Edward Island in Canada this year.

"The scholarship is a tremendous opportunity to learn more about aquaculture management systems overseas and develop relationships with and learn from farmers and researchers dealing with similar challenges to those facing aquaculture enterprises here in Tasmania," she says. The scholarship funding is provided through a grant from the FRDC on behalf of the Australian Government.

FOCUS ON LEADERSHIP

The FRDC is sponsoring two seafood sector participants in the next Australian Rural Leadership Program (ARLP), to begin in August 2016.

They are Helen Jenkins from Deception Bay, Queensland, and Alex Ogg from Fremantle, Western Australia.

Helen Jenkins is executive officer of the Australian Prawn Farmers Association. Alex Ogg is operations manager at the Western Australian Fishing Industry Council.

The 23rd ARLP will begin in August with an experiential session in the Kimberley, WA. Five sessions will follow over 15 months, including immersion in regional communities, involvement in Canberra's political scene, and an eye-opening visit to one of our closest neighbours – Indonesia.

Participants will be eligible to undertake a Graduate Certificate of Australian Rural Leadership, from James Cook University, in concert with the ARLP.

MORE INFORMATION: **Peter Horvat, peter.horvat@frdc.com.au**

International endeavours

INTERNATIONAL MARKETS

The Brussels Seafood Expo provides an annual snapshot of the global seafood market and opportunities

By Peter Horvat

The global seafood market is diverse and complex. It changes like the ebb and flow of the tide but can provide endless opportunities for savvy producers, although Australia's role is small when compared with some countries.

To get an idea of just how big the seafood industry is, and what potential there is, one visit to the Global Seafood Expo in Brussels, Belgium, will almost get you there.

The expo features more than 1700 exhibiting companies from more than 75 countries. Exhibitors supply nearly every type of fish, seafood and seafood-related product or service. More than 26,000 buyers, suppliers, media and tyre kickers from 140 countries visit during the three-day event. The expo provides a good snapshot of what is happening in seafood globally.

Despite the recent terrorist attacks in Brussels and Paris, about a dozen Australian companies attended the expo. Companies represented covered the spectrum – small to large and both wild and aquaculture – although there was no coordinated Australian presence.

I attended this year's expo looking to develop an export market strategy for the FRDC. The trip offered me the opportunity to look at several different options and approaches that would provide value for industry members that are exporting seafood globally.

The FRDC is looking at export trade markets because, as industry and government indicated, this was a priority when the FRDC was developing its five-year Research, Development and Extension (RD&E) Plan – especially after signing three new trade agreements. The RD&E Plan also clearly showed that there was market failure in coordinating Australia's seafood presence internationally.

After speaking with a range of people who are exporting or who are looking to export, it is clear that whatever approach or direction the FRDC takes, it will need to suit a broad range of exporters and be able to deliver a result for all of them. These include companies that are:

- starting out, not yet exporting but looking to explore and understand the landscape;
- occasionally shipping product (when they have excess produce or the Australian dollar is favourable);
- regularly shipping small batches of their products to key markets; and
- primarily export-oriented and ship larger volumes regularly – for example, rock lobster, abalone or tuna.

So what did I see at the expo? I saw potential opportunities for everyone.

PHOTOS: PETER HORVAT

Fish of every type and species were on show.

Matching buyers and sellers

Buyers from all over the globe attend, and not just big commodity buyers such as the major supermarkets. Buyers cover the whole range from hotel chains, restaurant food and beverage managers to provedores who are looking for speciality products that meet specific buying criteria.

With 26,000 buyers attending, this is a huge opportunity; even if only one per cent came to look and buy Australian seafood, that would be more than our companies could supply.

Also attending this year's Global Seafood Expo were three Nuffield Scholars: Dan Richards, Abby McKibben and Dennis Holder. All three were taken aback by the size, scope and scale of the expo.

Dan Richards, general manager at Humpty Doo Barramundi, summed up what he saw: "If you want to see what the leaders in global seafood are up to, then Brussels is the place to be. Whether you are looking for processing equipment, product forms or market contacts, it is all there. Your biggest challenge at the show is trying to get around the show and take it all in over three days. I'll certainly be back for another bite."

1. (From left) Nuffield scholars Abby McKibben, Dennis Holder and Dan Richards, and Renee Vajtauer, executive officer for the Commonwealth Fisheries Association. **2.** Fisheries scientist Ray Hilborn and Dan Richards visit the European Union Parliament. **3.** Slicing and dicing made easy. **4.** Some not-so-pretty fish on show. **5.** Machines that skin, pin bone and slice.

Australia in perspective

South Australian Blue Swimmer Crab fisher Dennis Holder says being in Brussels for three days was a "mind-blowing experience".

"It helps show the trade in seafood worldwide and puts into perspective where we fit in the world. The benefit for any Australian fish companies coming is the exposure to the huge scale and diversity of fish products that are available; and volume of fish trading that occurs worldwide," he says. "Canada exported thousands of tonnes of lobster to the European Union in 2014, as an example.

"The show also allows you to speak to other fishers and gain an insight into the issues and problems surrounding fishing worldwide and our problems are not unique, they are worldwide."

Abby McKibben, brand manager at Huon Aquaculture, says: "It was fantastic to see how the same seafood products on offer in Australia are supplied and presented so differently to markets in various other countries across the world.

"If you're supplying Australian consumers directly and want to remain competitive then this expo is a must, especially given the continued rise of international entrants to the Australian market. I'm leaving with more knowledge of the global seafood landscape than I could have ever hoped to get from just the internet and have made useful contacts and expanded my seafood network to continue discussions post-expo," she says.

Market trends

This year, for me, the expo showed that the pace of change in the seafood category has slowed, matured and is now refining some of the

WHY EXPORT?

The value of Australian seafood exports including edible and non-edible fisheries and aquaculture products is $1.3 billion per year.

While Australian exports are primarily dominated by high-value products, such as rock lobster, tuna and abalone, a growing number of small producers now see value in exporting their produce.

The signing of three trade agreements will result in significant reductions in trade tariffs and will also spur more companies to consider exports. More customers, sale of excess production, recognition, or prestige and access to processing facilities are some of the reasons these companies will export. For most, the main driver will be to improve sales and profitability. Seafood companies need to make a good return on investment from their sales, and expanding the market and customer base will also drive up the value of their products.

technology that it uses – machines that skin, pin bone and slice to a specified portion size, different skin coat packaging and new plastic fish boxes. One piece of equipment did stand out, more so for the plastic packaging it used – a vacuum-seal zip-lock bag. Nothing innovative you may think, except that the bags can now be cut and printed to look like anything you can think of.

Another area where I think innovation is still occurring is around how seafood is prepared. There were thousands of plain, frozen blocks of fish and prawns, but there was also a range of new value-added products on show. These products look to use lower-value cuts mixing them with other products – for example, diced fish wrapped in a banana leaf, seafood doughnuts (yes, really) and crab souffles – all packaged, frozen and available for your convenience.

Seafood stands alone

One of the options being explored is to develop an Australian seafood stand that services the needs of all Australian participants. Australia has previously had a stand at Brussels, but changes in the Australian dollar, priorities and personnel saw this fall away. Some industry members have now approached the FRDC to look again at options for this and various other seafood shows around the world.

I met with Diversified Communications – organisers of the major seafood expos (www.seafoodexpo.com) in Brussels, Hong Kong and Boston – to get a better understanding of the drivers and opportunities for having a stand, what alternate options might look like and, most importantly, to find out the costs to establish and run an Australian stand.

The bottom line is that running a trade booth at a large show takes considerable planning and logistical coordination, as well as a solid investment of funds to do it well. How much of each depends on what the industry is looking to achieve. To return to the four types of companies outlined above, it is clear that each group has a different set of requirements, ranging from just having somewhere they can use as a base and find a seat, up to the provision of meeting rooms, refrigeration, and a site that showcases their brand and allows for customers to come along and try the products. Not surprisingly, the cost goes up the more options you add.

I am interested to hear from any companies that would like to participate in a joint Australian seafood stand and what features they would like. Email me directly (peter.horvat@frdc.com.au) with your thoughts.

National benefits

Speaking with other stand organisers from Russia, Canada and Scotland also


1


2


3

1. (From above) Stunning Red Drum (*Sciaenops ocellatus*) from the Gulf of Mexico.
2. Are seafood donuts the next big thing?
3. Packaged, ready-to-eat options are a growing market segment.

FRDC ACHIEVES APPROVED-BODY STATUS FOR SEAFOOD

On 15 March, the FRDC formally received notification that it had been approved under the Export Market Development Grants scheme as an 'approved body' for generic international promotion of the Australian seafood industry.

Approved bodies are entitled to claim expenses that are for the export promotion of their associated industry and its broader membership. This means the FRDC will be able to claim back expenditure up to $150,000 per year on export market activities. It is envisaged that these funds will be then reinvested into trade market activities.

The FRDC is drafting a policy and how-to guide that will underpin the activities that will form part of its overarching offer to industry. This will not only bolster the FRDC's ability to deliver services and activities but also reduce their cost.

WINE EVENTS WITH POTENTIAL FOR JOINT SEAFOOD PROMOTION

EVENT	LOCATION	DATE
Vinexpo Asia-Pacific	Hong Kong, China	24 to 26 May 2016
Australian Grand Tasting	Seoul, South Korea	2 September 2016
Australian Grand Tasting	Tokyo, Japan	6 September 2016
ProWine	Shanghai, China	7 to 9 November 2016
Australia Day Tasting	Shanghai, China	26 January 2017
ProWein	Dusseldorf, Germany	19 to 21 March 2017
China National Food, Wine and Spirits Fair	Chengdu, China	23 to 25 March 2017

"It was fantastic to see how the same seafood products on offer in Australia are supplied and presented so differently to markets in various other countries across the world."
ABBY MCKIBBEN, BRAND MANAGER AT HUON AQUACULTURE

provided insight into how they approach establishing a presence and funding it.

The Russian stand was paid for by industry contributions – basically user pays.

Canada uses a mixed method, whereby the Canadian Government coordinates export promotion across all states to ensure a high level of integrity and that the focus remains on the country master brand and not on individual provinces or companies. That said, within the Canadian stand, the sub-brands such as Ontario or Clearwater were very visible.

The Scottish stand received some funding from industry, but the Scottish Government also provided significant funds. All three countries were very clear about the benefits of attending events such as the Global Seafood Expo in Brussels.

All three said that, at the country level, many millions of dollars of sales had been written over the three days. However, they did concede being able to show a return on investment at the company level was more difficult, as some companies were there for different purposes and with different product mixes.

Wine Australia joint opportunities

Over the past several years, the FRDC has been building a partnership with Wine Australia to co-brand and promote our industries. This has included coordinating the prawn and oyster industry to partner for the launch of Aussie Wine month in Sydney (see *FISH* June issues for 2014 and 2015).

With the recent opening of the new FRDC office in Adelaide co-locating with Wine Australia, we have been looking to build on what the two organisations can do collaboratively. Export market development is at the top of that list.

Wine Australia's general manager of marketing Stuart Barclay says the focus for wine at present is to work with key small-to-medium-size premier companies and brands that will help showcase the regional diversity and outstanding quality of Australian wines in markets around the world. This signifies a change to the historic focus on commodity products and he believes fits well with where he sees Australian seafood positioning itself.

Wine Australia is not only showing the technical expertise and craftsmanship that underpin the quality, it is also adding in some of the winemaker's personality such as being bold, caring and authentic.

This approach aligns with much of what some seafood industry companies are doing to convey an emotional story with their products – think Austral Fisheries' Skull Island Tiger Prawns, Australian Wild Abalone or Southern Rock Lobsters Clean Green program.

Prior to attending the Global Seafood Expo I met with Laura Jewell, Wine Australia's head of market for the UK and Europe, who outlined the approach taken for its activities in Europe. It was clear that for some markets – the UK for example – the wine audience had a very singular, almost traditional approach, when it came to industry communications, and to step outside these norms brings some risk.

However, Laura Jewell does see an opportunity for seafood to be involved, and for it being a good way to change things up a little and add more colour and depth to some events, to really show how food and wine can work well together, accentuating the value and beauty of both.

We have identified several events that could be highly suitable for partnering (see the table above), and a further few could be undertaken if circumstances were right; for example, if industry people were in town when an event was on. More information on the events is available on the Market Programs page at the Wine Australia website (www.wineaustralia.com).

Seafood participation in a wine event would provide a cost-effective value add-on that is very different to that of a broad seafood trade show. It would most likely be a much more targeted engagement with only a few and, in some cases, only one sector or company participating in the event. This could range from a tasting, wine matching, or offsite dinner showcasing both seafood and wine. F

PARTNERS NEEDED

The key to developing an export market plan is to understand which products are being exported to which markets.

The FRDC trade portal provides a good overview of export (and import) seafood movements. If you have not seen the new dashboard visit the portal (http://frdc.com.au/trade/Pages/MarketDashboard.aspx).

Knowing which seafood products are being exported is a start, but we also need to know which companies are interested in partnering and participating in any of these events.

If you are interested in being part of any export market events, whether an Australian seafood stand, a Wine Australia event or even just to go along as an observer to get some more information, please let us know.

MORE INFORMATION: **Peter Horvat, peter.horvat@frdc.com.au**
FRDC RESEARCH CODE: **2016/500**

DIGITAL DIRECTIONS LEAD TO A NEW E-FISH FRONTIER

COMMUNICATION AND MARKETING

From solid scientific foundations, the FRDC will expand communication efforts to the food-service sector

By Peter Horvat

With the June issue of *FISH*, I reach a personal milestone: it is my 50th issue as editor of the magazine.

The magazine has come a long way since starting. The first issues in early 1992 were no more than a couple of pages. It expanded and was written by Mal Maloney and designed by Daphne (Duckie) Bryant. The distribution model was pretty simple; it was included inside other magazines (some of which have long since passed) as an insert.

The problem with this was we were never sure how many people actually received our publication.

The next evolution was to change the delivery model to send it directly to members of the fishing industry. The rationale was that we wanted to keep industry members up to date with our endeavours, since they are an integral part of our R&D effort. This view has not changed to this day.

So it was with a great deal of trepidation that the FRDC changed to direct mail. When we started, we had only a few thousand readers, but in time we built the list to a point where we believe we now go to almost 95 per cent of the licensed fishers and aquaculture companies.

The main aim of *FISH* is to tell a story that is factually correct, focuses on R&D and intertwines with how people use the knowledge that comes from the research the FRDC funds. To expand our capacity, the specialist writing company Coretext was brought on board to diversify our writers and enhance the overall delivery – including producing a digital version for Apple and Android tablets.

At the same time, the FRDC has been looking to improve how we deliver content in other formats including websites, social media, news bulletins and video – noting the feedback from our reader and stakeholder surveys (see pages 18 to 19) informs our approach.

The next stage of our evolution is now underway with two exciting initiatives. The first will see the FRDC web platforms redesigned to integrate how we deliver information for each website and drill down to more specific information. Pieces of information will join together and be easily accessed from anywhere in the websites. This will fundamentally change how users find information. Imagine a website where you can find everything we know about a particular species on the one page – research, sustainability, flavour, catch, or even where to buy it – this is what we are striving to build.

The major part of the development focuses on the *Status of Australian Fish Stocks Reports*, the third edition of which will be released in early December 2016. Therefore, our goal is to launch all the websites around this time.

The challenge for me as the FRDC's manager of communications and editor of *FISH* over the past decade has always been about achieving a balance between three things: a focus on research, telling a good story that is relevant to stakeholders at that time, and where to position ourselves in relation to industry or fisheries management. Ultimately, whatever platform we deliver content through, this challenge remains the same.

> "The main aim of *FISH* is to tell a story that is factually correct, focuses on R&D and intertwines with how people use the knowledge that comes from the research the FRDC funds."
>
> PETER HORVAT

Anthony Huckstep

PHOTO: PETER HORVAT

E-FISH News

The second new piece of work for the FRDC is the development of an electronic *FISH* newsletter that will target food service and the media. Both are influential and often lack accurate information on the status of the Australian seafood industry.

Another key driver for taking this approach is the first FRDC national priority – that Australian fishing and aquaculture products are sustainable and acknowledged to be so. The FRDC has lots of information. We should now focus more on distributing it to a wider audience.

To help bring the E-FISH News to life and ensure it hits the mark, the FRDC has engaged award-winning writer and editor Anthony Huckstep. What we are hoping to deliver is good content and creative design, with a bit of edginess thrown in.

Some industry members will be familiar with Anthony Huckstep from the many visits he has made to see where produce comes from. Over the coming 12 months he will visit both fishers and chefs to understand what stories and information they would like to receive. F

PHOTO: PETER HORVAT

A NOTE FROM E-FISH EDITOR ANTHONY HUCKSTEP

I've been in publishing for more years than the annual kilogram per capita seafood consumption Down Under (18.7 kilograms). The way in which we communicate has changed dramatically, but the significance of each medium should not be lost on anyone. Print remains as vital as ever, but online offers a brave new world of opportunity.

While *FISH* is an outstanding conveyor of the brilliant work funded by the FRDC, the very nature of online means we can share information far beyond the realms of the FRDC's capabilities. We can deliver the most up-to-date discussion on seafood in one neat and refined little email for one's dissection and digestion from myriad platforms. It's just a click of a button. It means we can deliver video content on fisheries, species and chefs who rely on seafood to underpin their cooking ethos.

The e-newsletter will also provide a vehicle to share the knowledge with a far wider audience to help dispel the myths of what is the most misunderstood sector in the food industry.

Providing the media and the food-service sector with access to information on a regular basis will not only help make seafood the hero of the plate, but also the centre of the discussion like never before. Access to knowledge changes lives and we're here to share it with whoever wants to listen.

We'll discuss what seafood the critics are eating, what chefs are doing with the catch of the day and, when and where possible, how consumers' sentiment and understanding of the category is being enhanced.

Ultimately, the FRDC and our amazing fisheries are the basis of knowledge, we're simply the conduit to help share that. Perhaps in the process we'll even help Australians raise their average of a meagre 18.7 kilograms per capita annual consumption of seafood.

Award-winning journalist Anthony Huckstep is the national restaurant critic and columnist for *Delicious*, food and drinks writer for *The Australian*, QANTAS magazine, *GQ Australia* and co-founder of MetalMouth – an annual dinner paying homage to great food and heavy metal. He spent 13 years editing the award-winning *foodService* magazine (Australian Business Magazine of the Year 2011) and reviewed for the *Sydney Morning Herald Good Food Guide* over many years. He also penned Luke Mangan's *The Making of a Chef*, the narrative for *Sepia: The Cuisine of Martin Benn* and will release *Australian Seafood & Fish – a kitchen companion* in October 2016.

Above: Chef Colin Barker (left) from Boathouse on Blackwattle Bay, Glebe, NSW, with Anthony Huckstep.

MORE INFORMATION: **www.fremantleseafoodfestival.com.au; Bart Beek, www.essencefoodstudio.com**

Festivals celebrate seafood

COMMUNITY ENGAGEMENT

Seafood festivals provide an opportunity to connect with the community and help the seafood sector tell its story, from the source to the final dishes served

By Brad Collis

Some 20,000 seafood aficionados flocked to the Fremantle Seafood Festival in late February to celebrate Western Australia's large and diverse seafood sector. The festival, which organisers hope to establish as a permanent fixture on Fremantle's events calendar, has a twofold aim: seafood education and industry promotion.

The festival is about showing people what is available from the WA seafood industry, with the overarching message 'buy fresh, buy local'. The message was reinforced by a 'tastes of the regions' marquee profiling different seafood regions: the Gascoyne Coast Bioregion, the North Coast Bioregion, the South Coast Bioregion and the West Coast Bioregion.

"Explaining how the industry is managed, how it is sustainable and meets global Marine Stewardship Council certification, is a big part of the festival," says 2016 festival director Peter Woods. "It gives people a greater appreciation of the size and diversity of our industry."

Part of the festival's goal of raising community and consumer awareness of these unique bioregions was a Fisherman's Table Seafood Feast. Diners joined seafood chefs Josh Catalano and Peter Manifis, watching them prepare fish from the regions and then experiencing the different tastes and cooking styles. The four bioregions cover a vast area of deep-sea, coastal and estuarine habitats and species, and consequently provide a mouth-watering smorgasbord of seafoods.

The Western Australian Fishing Industry Council (WAFIC) is a major sponsor of the festival. WAFIC's CEO John Harrison says the event is a great opportunity to talk with people who are keen to learn more about WA fisheries, which are among the best-managed and most sustainable in the world.

"The seafood tastings cooked by celebrity

Chef Kira De Spain from Olé Paella preparing the restaurant's signature dish – paella – at the Fremantle Seafood Festival in late February.

PHOTO: BRAD COLLIS

chef Peter Manifis and his team from our booth throughout the festival were hugely popular, exposing participants to the fantastic quality and taste of some of the 'unsung heroes' or more unknown species of the WA fishing industry," John Harrison says.

Masterclasses

The many tasting stalls representing Perth and Fremantle seafood restaurants were complemented by a popular cooking masterclass run by Melbourne seafood chef Bart Beek. He ran eight booked-out classes over the two days. The classes took participants through the hands-on preparation of spiced crispy-skin Cone Bay Barramundi and accompanying condiments, including an avocado foam and a soy glaze (see recipe). Bart Beek, who trained at the famed Le Cordon Bleu in Paris, runs the award-winning Essence Food Studio in Melbourne. Even for him the festival broke new ground in seafood education: "When Peter Woods first raised the masterclass idea I was thinking of

PHOTO: BRAD COLLIS

Danny McAuliffe (left) and Stuart Fergusson from prominent WA seafoods business Catalano's Seafood.

five or six people ... we ended up with 160."

He concentrated on a single dish using a locally supplied fish, Barramundi, and 10 cooking stations equipped with portable induction cooktops. "Because of the instantaneous control you have over the heat these are ideal for fish for which you want a nice crispy skin without overcooking the fillet." Bart Beek is a passionate educator and responds enthusiastically to the questions people raise about cooking seafood. "A lot of people say they can cook steak but not fish because they are worried they will undercook it. So they treat it like steak and overcook it.

"So I explain the 'heatwave' factor. Heat one side hard for a few minutes (for a thick fillet such as Atlantic Salmon) and that heat will radiate through. You then only need to lightly cook the other side, whereas a lot of people will cook both sides the same."

Common questions

He says two of the most frequent questions relate to cooking scallops and calamari. "For scallops I put 12 in a hot pan, placing them like the hour marks on a clock face as I work my way around the pan. When I get to 12 I start turning them over. By the time I am back to 12, they are done. It's that quick."

For calamari rings he scores a crosshatch pattern on the inside, three millimetres deep and five millimetres apart, then places them between two wire cake racks. "The racks are placed onto a hot chargrill for 90 seconds and turned for another 90 seconds. That's it. You cook quickly with intense heat."

Bart Beek has been cooking since he was

CRABS TO THE FORE AT MANDURAH

By Catherine Norwood

Seventy kilometres south of Perth lies Mandurah, Western Australia's second-largest city and host to one of Australia's longest-running seafood-based festivals, the Mandurah Crab Fest.

This year's event on the weekend of 19 and 20 March was the 18th annual festival, which attracted more than 100,000 people. The festival is sponsored by Channel 7 and it has proved to be a popular day trip for visitors from Perth, offering a broad program of activities including water sports, live music and, of course, seafood.

President of the Mandurah Licensed Fishermen's Association (MLFA), Damien Bell, has been involved in the festival for more than a decade. He says events such as this provide fishers with an opportunity to engage with the community and reach new markets, although they will only get out of it what they put in. For some fishers it might be enough to sell their product; others may want a larger role that promotes their fishery and fishing as well as their seafood.

For many years, MLFA ran its own stall at the Mandurah festival to build the profile of the Peel-Harvey Estuarine Fishery and the local product. In addition to the traditional Blue Swimmer Crab the region is famous for, known locally as "blue mannas", MLFA also trialled local Sea Mullet with festival-goers – a species that was in the past considered a bait fish. Served in tempura batter and fried by staff from the local award-winning restaurant Redmanna Waterfront Restaurant, Damien Bell says the response from those who tried it was very positive.

In recent years, local fishers have not had their own stall; the WA Department of Fisheries has instead operated a booth to promote sustainable management and field questions about the fishery. This year the Marine Stewardship Council (MSC) also attended to promote sustainability certification, which is underway for the Peel-Harvey Estuarine Fishery.

By the time of the 2017 Mandurah Crab Fest, Damien Bell says the Peel-Harvey Estuary should have received its MSC sustainability certification, and he expected local fishers would again take a stand in order to promote the achievement. But for the past two years, he has attended the festival in an unofficial role and provided feedback to the festival organisers.

He says the event has become so big that there is no way local fishers can supply all the crabs required. However, it is essential that the quality of seafood – and the way it is prepared – is maintained. Otherwise it could do more harm than good and turn people off the seafood the event is trying to promote.

The importance of the local fishery

PHOTO: TRAVIS HAYTO

is such a well-recognised and integral part of the Mandurah community that the festival also promotes the South West Catchments Council's ongoing 'Home River Ocean' water-quality program. Its 'Save the Crabs, Then Eat Them' campaign focuses on reducing nutrient run-off from garden fertilisers into the Peel-Harvey Estuary, in order to protect crab populations for future harvest.

More information:
www.crabfest.com.au;
www.homeriverocean.com.au

PHOTO: BRAD COLLIS

Melbourne seafood chef Bart Beek shared his knowledge and his mantra "cook with passion".

fishfiles

CALENDAR OF CELEBRATIONS

Upcoming seafood events include:

Hervey Bay Seafood Festival
14 August 2016
Fishermen's Park, Urangan Boat Harbour, Hervey Bay, QLD
www.herveybayseafoodfestival.com.au

Ceduna Oysterfest
29 September to 2 October 2016
O'Loughlin Terrace, Ceduna, SA
www.ceduna.sa.gov.au/oysterfest

Narooma Oyster Festival
1 to 2 October 2016
Narooma, NSW
www.naroomaoysterfestival.com

Palm Cove Reef Feast
6 to 9 October 2016
Palm Cove, QLD
www.reeffeast.com.au

Taste of Tasmania
28 December 2016 to 3 January 2017
Various events across TAS
www.thetasteoftasmania.com.au

Tunarama
25 to 29 January 2017
Port Lincoln, SA
www.tunarama.net

For a full calendar of seafood events visit: www.fishfiles.com.au

a young boy, helping his mum in the kitchen, but says even though he grew up in Port MacDonnell, South Australia, he did not begin appreciating seafood, especially Australian seafood, until he was a professional chef.

"There are more than 2000 species of edible seafood in Australian waters. Compared with anywhere else in the world that is an extraordinary resource." Teaching Australian consumers about this resource and how to appreciate it in the kitchen has become his life's work.

Peter Woods says it is clear from the enthusiasm of visitors to the Fremantle Seafood Festival, including big crowds who turned up to simply watch the masterclasses, that people are interested in seafood: "They want to know it is a sustainable industry and they want to know how best to cook the fish."

Continued evolution

This year was the festival's second year, with plans underway already for an expanded program in 2017, including masterclasses extending to other fish species such as squid and prawns.

Located within the iconic Fremantle Fishing Boat Harbour, the festival had its origins more than a decade ago as an add-on to the Blessing of the Fleet – an annual event initiated in 1948 by Italian migrants. Many had emigrated to Fremantle after World War II from Molfetta near the heel of Italy, and Capo d'Orlando in Sicily, bringing this ancient European Catholic tradition to their new home fronting the Indian Ocean.

The WA industry has changed considerably since those days, but it has never lost its community presence. The Fremantle Seafood Festival, following a brief incarnation as the Sardine Festival, continues that tradition of bonding people with the industry, its customs and most importantly, its wonderful catch. F

PHOTO: ADAM BRUCE

SPICED CRISPY-SKIN CONE BAY BARRAMUNDI

Bart Beek's recipe provides a perfect portion of Cone Bay Barramundi seasoned and pan grilled until the skin turns crisp and golden.

- Preparation time 30 minutes
- Cooking time 15 minutes
- Serves 2

Berbere spice mix (8 parts whole to 7 parts ground):

This makes enough for 10 portions

- 1 tsp black peppercorns
- 1 tsp whole ajwain seeds
- 2 tsp coriander seeds
- 2 tsp cumin seeds
- 1 tsp whole allspice
- 1 tsp whole fenugreek seeds
- 4 cardamom seeds
- 1 tsp dried chilli flakes
- ½ tsp ground cloves
- ½ tsp ground nutmeg
- 1 tsp ground ginger
- 1 tsp ground cinnamon
- 3 tsp salt flakes

In a frypan using moderate heat, dry roast (without oil) the peppercorns, ajwain, coriander, cumin, allspice, fenugreek and cardamom. Stir continuously while on the heat for five minutes or until fragrant. Remove to a mortar and pestle. Grind until fine, then add in the remaining ingredients. When cool, place into an airtight container and store until required.

Barramundi:

- 30ml extra virgin olive oil
- 2 x 140g Cone Bay Barramundi (skin on)
- Salt flakes to taste

Preheat a heavy-based non-stick frypan for two minutes on 'sear' level using an induction cooker and add in the olive oil. Season the fish and place skin-side down and hold down for 1.5 minutes using a palette knife to maintain total contact of the skin onto the pan's surface. Allow to cook for nine minutes, until the skin turns golden and crisp. Turn over and cook the other side for three minutes, until just cooked. Place the bottom side onto a plate sprinkled with salt flakes and the spice mix.

Soy sesame glaze:

- ½ lime (juice only)
- 15ml extra virgin olive oil
- 30ml dark soy sauce
- 30ml water
- 5ml sesame oil
- ¼ tsp xanthan gum

Place all the ingredients into a blender and process until combined. Transfer to a container.

This beautiful summer dish is presented dusted with a spice mix, served on avocado with a touch of soy sesame glaze. Bart Beek suggests it be accompanied by a lemon couscous and tomato summer salad, scented with nasturtiums and a sherry walnut vinaigrette.

FRDC's new staff and Adelaide-based office

PHOTO: KYAM KYAW SOE HLAING

PHOTO: JAMES KNOWLER

Above: Executive director of the FRDC Patrick Hone (right), shares out prawns at the launch of the new FRDC office in Adelaide.

Left: Christopher Izzo, Nicole Stubing, Skye Barrett, Leah Fergusson, Alison Connelly and Annabel Boyer.

CORPORATE SERVICES

Additional staff boost the FRDC's regional capabilities

By Ilaria Catizone

On 22 April 2016, Senator Anne Ruston officially opened the FRDC's new Adelaide office. This location will be shared with the Grains Research and Development Corporation and Wine Australia and will house six FRDC staff members.

Wayne Hutchinson began working with the FRDC from Adelaide in February 2016, and is now joined by five more newly appointed staff members. Alison Connelly and Leah Fergusson will job-share the role of support officer at the FRDC, assisting project managers with management of funded projects from conception to completion, while also managing the meetings for the Research Advisory Committees (RACs) that approve these projects. They are an experienced job-sharing team, having had a similar work arrangement at the Australian Seafood Cooperative Research Centre (Seafood CRC) where they worked for seven and five years, respectively. Alison Connelly also worked at Dbusiness Events. While at Seafood CRC Leah Fergusson obtained a diploma in management and they both worked closely with the FRDC team, which they now look forward to getting to know better.

Nicole Stubing joins the FRDC in her first position in industry after finishing her undergraduate studies. She recently graduated from the University of Adelaide with a Bachelor of Science in natural resources (honours). She already has a solid network of contacts within the fishing and aquaculture sectors and research community of South Australia, which she acquired while working with the South Australian Research and Development Institute (SARDI) and the oyster industry as part of her honours year. She is now taking on a six-month cadetship with the FRDC.

Skye Barrett joins the FRDC Adelaide office as a full-time project officer (research) and will work closely with the New South Wales, Queensland, Northern Territory and Western Australian RACs to manage projects from each jurisdiction. She has a family background in the SA commercial fisheries sector and holds a Bachelor of Science in marine biology (honours) as well as a Graduate Certificate in economics. She has been employed at SARDI as a research officer, working predominantly in the wild fisheries program since 2010.

Christopher Izzo also joins the FRDC Adelaide office as a full-time project manager (research) and will work with the Commonwealth, SA, Tasmanian and Victorian RACs to manage projects in these jurisdictions. Chris Izzo has a diverse research background in fisheries and fish biology. He has a doctorate from the University of Adelaide and has worked on various commercial species ranging from cockles to sharks.

The Canberra office has also had some changes, with Annabel Boyer joining as the new communication officer. She has an extensive background in journalism. Before taking on the role at the FRDC, she spent two years in Mongolia working with a small not-for-profit organisation on a project to investigate Mongolia's media companies. This was an opportunity to experiment with different methods of information collection in a newly democratic country and it also gave her an interest in research and getting a picture of the world through statistical analysis. F

MORE INFORMATION: **Peter Horvat, peter.horvat@frdc.com.au**
FRDC RESEARCH CODES: **2016/500, 2011/514**

FISH readers share their views

COMMUNICATION

Readers provide feedback that will help to shape future issues of *FISH* magazine

By Annabel Boyer

The results of our 2016 survey of readers of *FISH* magazine are in. *FISH* staff thank everyone who took the time to respond, with a total of 217 respondents.

The survey was carried out by market research company Intuitive Solutions and provides valuable feedback to guide the production of the magazine for the next few years.

It also provides a sense for us here at the FRDC of who *FISH* readers are. The survey results show that our readers are a diverse bunch, including recreational fishers (27 per cent), commercial fishers (23 per cent), government agencies (11 per cent) and academics (11 per cent).

It is important to note that *FISH* goes out to almost all commercial licence holders (80 to 90 per cent of recipients), which means we received a higher rate of responses by other sectors.

"One of the major reasons for conducting the survey is to work out whether we are meeting the needs and interests of our readers," says Peter Horvat, FRDC's manager of communications, trade and marketing.

Across two key measures there has been a slight lift in ratings:

- likelihood to recommend *FISH* magazine to others – score of 8.3 out of 10 (up 0.2 from the previous survey); and
- importance for the FRDC to continue to produce/distribute *FISH* magazine – score of 8.4 (up 0.1).

In addition, more than one in two subscribers (55 per cent) reported that once they finish reading *FISH* they either pass it on to someone else or leave it in the office for others to read.

This means that our readership reaches far beyond our subscriber list. Respondents said they share the magazine with an average of 2.3 other people.

Importantly, most respondents 'strongly agree' (51 per cent) or 'agree' (42 per cent) that *FISH* magazine is a valuable way to find out about what is new in R&D in fishing and aquaculture.

Our readers' interest in research is further highlighted by the fact that 41 per cent of respondents read it thoroughly and 54 per cent read articles of specific interest. That only leaves four per cent of respondents who say they just scan through the magazine.

It is also heartening for us here at *FISH* magazine headquarters that 61 per cent of respondents reported following up on information that they had seen in *FISH* and 47 per cent say that *FISH* has taught them something new. As a scientific organisation that seeks to dispel misinformation with the research it funds, these results are in line with the FRDC's goals.

While most readers were satisfied with *FISH* magazine, they were able to identify opportunities to strengthen the content, suggesting more stories on:

- conservation, including the environmental impact of both commercial and recreational fishing;
- more balance between research and news as well as different viewpoints;
- greater breadth of information for research, events and stories; and
- recreational fishing articles.

This broad range of topics reinforces the diversity of *FISH* magazine's audience. One of the challenges for us here at the FRDC is to cater to this diverse audience. However, this is made easier by the finding that for most respondents (49 per cent), research stories are the first articles read, followed by industry news and case studies. This means we can continue to have a strong focus on R&D.

Getting the balance of stories right is a challenge. Every issue goes through a planning process to ensure broad coverage that will appeal to our whole audience.

It is important to remember, however, that the FRDC is neither a management agency nor an industry body and our primary remit is around research, development, extension and now marketing.

Many readers showed concern in their comments about the environmental impact of printing and distributing *FISH* magazine.

We are conscious of this, but also that a majority of respondents clearly indicated that they still preferred a printed magazine. However, we would like to highlight the availability of *FISH* as a digital download.

You can access individual articles through the FRDC's website (www.frdc.com.au/fish) or download the entire magazine through iTunes as an iPad app, or through Google Play for an Android tablet or phone (see www.frdc.com.au/fish for instructions). F

READER COMMENTS

"Would like to see a short snippets section – where fishers can submit their own comments and ideas and feedback on articles (so FISH is more interactive and responsive)."

"Write more about the small fishers, net and crab fishers."

"As a recreational club fisher, information could include catch-and-release techniques best suited to surf and estuary fishing."

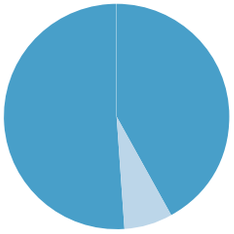
"It's a good attempt to communicate across an industry whose participants have little in common apart from making their living from the water – from the tropics to the Antarctic."

"Particularly enjoy articles on research, and how science is being used to combat issues."

"Wider range of view points and challenging existing parochial viewpoints – more industry innovation success stories."

FISH, BY THE NUMBERS

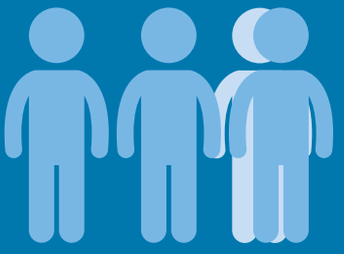
FISH MAGAZINE'S VALUE TO FISHING AND AQUACULTURE



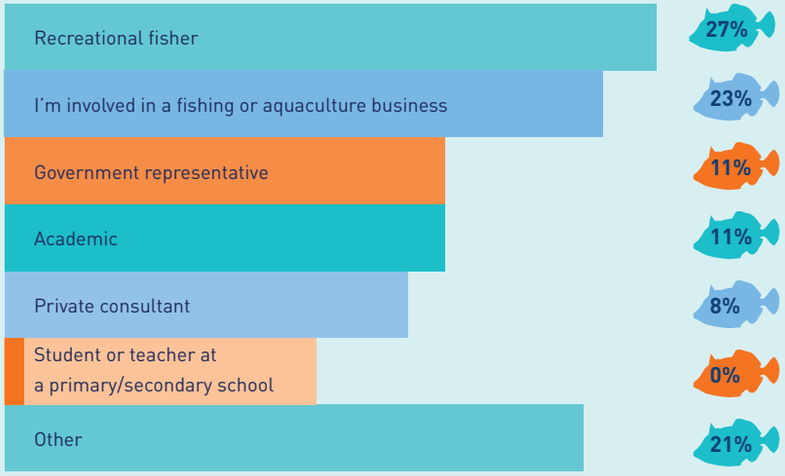
93% Readers agree or strongly agree *FISH* magazine is a valuable way for the industry to find out what's new in research and development.

7% Disagree

3.3
AVERAGE NUMBER OF READERS PER COPY



MAIN ROLE OR INTEREST OF RESPONDENTS



47%
OF READERS LEARNT SOMETHING NEW

10% introduced new systems or approaches

READER COMMENTS

"Links and portals that point you to internet-based research papers that really get into very detailed things about particular species."

"Add more articles about freshwater fish, restocking, fishing, please. It's vital to the bush that we continue to attract tourists out here and the fishing is an enormous attraction."

"We disseminate information from the magazine to our alumni and particularly highlight articles that are about members of our alumni. It's a great product."

"More cool science stories please! I loved the 'not your usual catch' piece and the Eureka Awards in December 2015 magazine."

"It is informative, interesting and easy to access and read, for many levels. We have recommended it to numerous people, including teachers. Keep up the great work!"

"Add more articles regarding overseas advances in R&D."

MORE INFORMATION: Miles Parsons, 08 9266 9252, miles.parsons@curtin.edu.au
FRDC RESEARCH CODE: 2010/004, 2004/051

Listening to the fish song

ILLUSTRATION: SONIA KRETSCHMAR

FISH BEHAVIOUR

A better understanding of why some fish species 'vocalise' allows passive acoustic monitoring to aid management strategies

By Bianca Nogrady

We think of the underwater world as a largely silent one, where vast tracts of still blue are only occasionally punctuated by the bass glissando of whale song or the playful squeaks of dolphins, and the shoreline with only the soundtrack of a steady, rhythmic pulse of waves on rock.

But far from being a silent herd, fish have voices and they are not afraid to use them. Marine environments are awash with creature communications, from predators seeking prey, 'wannabe parents' seeking partners and property owners protecting their own. Some of these vocalisations would go largely unnoticed by human intruders, lost to the backdrop of reef noise, while some are so loud that divers in close proximity report them to be painful.

Sound is extremely important for underwater creatures, says Miles Parsons, from the Centre for Marine Science and Technology (CMST) at Curtin University. "You're talking about fauna that are in a medium where their primary method of communication is through sound, because light doesn't travel particularly far in water," he says.

The emerging fields of bioacoustics and fisheries acoustics take advantage of this. These explore the use by fish and other marine creatures of vocalisations, using passive acoustics or active acoustics (artificial noise such as sonar). "Active acoustics are where you're sending out an acoustic signal and looking at the return that comes back," Miles Parsons says. "Passive acoustics are where you're just listening for a signal, which from our perspective is listening to the noise that's produced either by an animal – whether it's a fish or a whale or dolphin – or anthropogenic noise such as seismic surveys."

Fish vocalisations are a particular area of interest because of what they can reveal about fish movements, behaviour, populations and the impact of human noise. Not all fish are vocal, but many species use sound – including several commercially significant fish species – and they produce it in a fascinating diversity of ways.

The two most common methods of producing sound are stridulation – which involves rubbing bony body parts, such as teeth, together – or by vibrating the swim bladder and using muscles around the bladder to vary the rate of those vibrations. Some fish have more control over the sound they produce than others.

The vibrating method is used by the Mulloway (*Argyrosomus japonicus*). Male fish are equipped with special muscles that effectively allow them to strum the swim bladder, producing sounds described by researchers as series of short grunts ("bup"), long grunts ("baaarp") or short calls ("thup"). The males gather and chorus in a spawning ground, with the goal of seducing lots of females into the area.

Not only does the swim bladder muscle

enable a diversity of sounds, but it also produces incredible volume. Miles Parsons and colleagues have been studying a population of Mulloway in the Swan River in Perth for many years. When they first looked at the source levels of the Mulloway vocalisations, they were shocked at the volume.

"But when you talk to divers, if they're within a metre or so of a large Mulloway and it's producing sound, it's actually quite painful, which verifies that this is the kind of level you're looking for."

While the mechanisms of fish vocalisations are interesting in themselves, the noises provide a useful method for studying fish populations, such as the Mulloway found in the Swan River. In a study funded by the FRDC, researchers from Curtin University took underwater sound recordings from a region of the Swan River using hydrophones, noise recorders and data loggers placed at various levels from the surface to the river bed. These, along with similar monitoring at sites along the Western Australian coastline, collected in excess of 1.84 terabytes of recorded data, representing 9015 hours of recordings. It is a wealth of data that the researchers are still mining, but it is already revealing new information about the habits of the Swan River's Mulloway. "The sound levels you have can relate to the number of calling fish that are in the water at the time, so that gives you an index of how many fish are there," Miles Parsons says. But it is not quite as straightforward as it sounds.

"With Mulloway, you need to know whether or not it's the males or the females that are producing sound," he says. "If it's just the males, that becomes easy if you know what their rough ratio of males to females is. But you also have to know whether all the males call or is it just the adults or over a certain spawning mass."

Their analysis revealed different chorus characteristics at different sites. It also showed that peaks in chorusing activity related to tide levels, giving some insights into Mulloway spawning behaviour. The lunar cycles and seasons also influenced their vocalisation patterns. The survey also found that while one particular region had the highest numbers of chorusing Mulloway, this spawning aggregation moved around quite a bit, suggesting that attempts to assess the size of Mulloway populations would need to rely on more than one site. "It starts to give you an index of the relative number of fish that are around in the area and when you look at that over time you can then start to compare whether or not one season has more fish in an area than another." Delineating spawning areas for fish, particularly commercially significant species, and understanding when those spawning areas are in use is important for ensuring these areas are protected during key spawning times. Miles Parsons says this technique of passive acoustics – monitoring fish vocalisations and doing surveys – is already being used in several places for just this purpose.

The project was also able to look at how human noises affected the Mulloway. "The boats go past them and completely mask all of their sound, but that didn't stop them from calling," Miles Parsons says. "They still sit there and call, but it might be that it affects whether or not the female can hear it." The study also used fixed recordings at points along the coastline to look for evidence of vocalisations from other significant fish species, such as the West Australian Dhufish (*Glaucosoma hebraicum*), Snapper (*Pagrus auratus*) – the FRDC's Fish Names Committee has highlighted this will change in the future to *Chrysophrys* – and Black Bream (*Acanthopagrus butcheri*). But in the case of the Snapper and Bream, the fish were keeping silent, or vocalisation just was not their style. West Australian Dhufish do produce sound, but are a lot quieter than the Mulloway.

Fish are not the only marine creatures contributing to the soundscape of the marine environment. Reefs are surprisingly noisy places, and the nature and volume of this noise can give some indication about the health of a reef; a loud reef may signal more recruitment than a quiet reef, Miles Parsons says. This is a very recent area of research and understanding the relationship between the habitat and its (potential) residents is only just beginning. Technology is a key element in passive acoustics. "You used to only be able to go out and take these few minutes of recordings every now and again, but over the past 20 years or so, CMST and other research groups have been developing long-term recorders," he says. "So we've had these systems that have been able to record for six months to a year on a schedule of a few minutes every 15 minutes for over a decade. We're really only now able to look at changes on a 'long-term' scale."

This is enabling the analysis of soundscapes of coral reef environments to create a catalogue of fish calls, which can then be used to monitor how the health of the reef responds to changing environmental factors. Miles Parsons says he would also love to set up long-term recordings along the Swan River to monitor the movement of these spawning aggregations over greater distances. F

Noise affects fish predation

Man-made noise has long been recognised as a pollutant in the marine environment but, until recently, research into its effects on wildlife focused largely on mammals, says fish biologist Mark Meekan, principal research scientist at the Australian Institute of Marine Science (AIMS) in Perth.

As the oceans become noisier, the need to understand how this change is affecting other marine creatures has become clear. Mark Meekan has been studying how passing boat noise affects reef fish during a critical period in their lives, when the young damselfish are emerging from the plankton and settling on the reef.

"Those small fish are very vulnerable, a lot of them get eaten and they're at a time when they really need their wits about them to learn what a predator looks like and what's going on in the reef environment," Mark Meekan says. Unfortunately, introducing noise such as that of two-stroke outboard motors makes things much riskier for these young fish. The AIMS research suggests that being exposed to man-made noise substantially reduces the young fish's performance in the face of predators: put simply, they are more likely to be eaten."What we found is that predators were far more successful at eating these little guys in the presence of noise and we think that had to do with the fact that the fish were slower to initiate an escape response, they let the predator closer to them and this essentially tipped the scale towards the predator's favour," Mark Meekan says.

Interestingly, the noise of the motorboats did not seem to distract predators in the same way that it distracted their prey. If both were equally distracted, it would lessen the problem considerably but the imbalance in the impact can disturb the ecosystem.

While damselfish serve as a good model species for reef fish, Mark Meekan says there is a need to expand this research to other fish and marine species. The results could help shape interventions to reduce the impact of noise on sensitive coral reef ecosystems.

These interventions could be as simple as using four-stroke instead of two-stroke engines, as they run much more quietly.

"It's really about finding out what the effects are and trying to do something about them that is practical and simple and a sensible way that benefits everyone."

More information: Mark Meekan, 08 6369 4039, m.meekan@aims.gov.au

MORE INFORMATION: Peter Horvat, 02 6285 0400, peter.horvat@frdc.com.au
FRDC RESEARCH CODE: 2015/504

US insights into localised supply chains

PEOPLE DEVELOPMENT

New perspectives on Australian performance and opportunities emerge from seafood summit

By Ilaria Catizone

In the land of big (is best) business, the community is still keen to support local fishers, small-scale fisheries and their products. This is the finding of four Australian fisheries sector representatives during a trip to the US in February to attend the Local Seafood Summit in Virginia.

Glen and Tracy Hill from the Lakes and Coorong Fishery, South Australia, fisher and fisheries researcher Andrew Tobin from Townsville, Queensland, and Suzie McEnallay from the Wallis Lake Fisherman's Co-operative, New South Wales, were selected and sponsored by the FRDC to attend the summit and meet local fishers there.

The Local Seafood Summit was organised by LocalCatch.org, a network of small-scale harvesters and community-supported fisheries (CSFs). It ran over two days and was attended by 110 seafood direct marketing advocates.

Suzie McEnallay says the main focus of the event was to facilitate knowledge exchange and networking. "It was great to see a seafood community so connected or trying hard to connect with one another for the shared value. The CSFs model seems to work well in the US; they've had similar models set up for many years in the agriculture sector."

At their core, CSF models seek to reconnect coastal communities to their food system, encourage sustainable fishing practices and strengthen relationships between fishers and communities. There are several different models; however, a conventional CSF is where the marketing and distribution channel buys from fishers and delivers to consumers. Seafood cooperatives across Australia largely follow this path.

Alternatively, some models empower fishers to handle their own marketing and distribution by selling directly "off the boat" to consumers. Again there are various methods of doing this, including offering customers shares in the catch, or prepaying for a season of fresh, local, low-impact seafood. In return, customers receive a weekly or biweekly share of fish or shellfish.

"As we learned during the summit," Tracy Hill says, "the money paid upfront to the fishers helps them fund plant repairs or equipment that they may not have been able to afford otherwise." This means that while the weekly cashflow is less, because repairs and improvements have been made at the start of the season, fishers are more efficient and productive. Any surplus catch can be marketed or sold to restaurants and retail outlets.

Andrew Tobin says the CSFs and similar networks also provide for individual business advice, support, networking and sharing of ideas. The conference included sessions on business planning, financial planning and advertising.

The Australian delegates also note some clear challenges that US CSFs face, such as bureaucracy, food regulations and the importance of maintaining community support. They say these issues could be obstacles to establishing a similar model in Australia.

"The CSF model has great potential but the fact that many fishers are already selling direct for reasonable fish prices most of the time, and a tenuous definition of 'local' are some of the obstacles that may make it difficult to establish such a system in Australia," Tracy

PHOTO: ANDREW TOBIN

Hill says (for example, how far from the port is deemed local). Nonetheless, she and her husband, Glen Hill, are considering starting the first Australian CSF after their US trip.

Suzie McEnallay is not sure the idea of paying up-front for a random type of seafood throughout the year would work in her area. "Customers have such a huge range of species to pick from and can be fussy to which type they like or dislike. Whereas in the US people do not seem to mind what species they are eating," she says. "But it is a great way to get the species that are less known or not marketed well to be turned into a valuable fish."

Andrew Tobin says he was surprised to learn that it was only recently that a study had begun to understand the views of consumers who support CSFs, their values, expectations and concerns.

Before arriving in Virginia for the summit, the Australians enjoyed some US adventures starting in Port Orford, Oregon, where they met Aaron Longton, a member of the local CSF. This fishery launches its boats by crane over the side of the wharf on high tide due to the shallowness of the harbour – a more challenging approach to launching and retrieving boats compared with

"It was great to see a seafood community so connected or trying hard to connect with one another for the shared value. The CSFs model seems to work well in the US; they've had similar models set up for many years in the agriculture sector".

– SUZY MCENALLAY

Commercial fishing vessel lining up for launch via gantry crane at sunrise at Port Orford, Oregon.

PHOTO: LEESA COBB

Above: (from left) Tracy Hill, Suzie McEnallay, Andrew Tobin and Glenn Hill in front of Dungeness crab pots.

PHOTO: JOE FALCONE

Above: The public line at the wharf at Pillar Point Harbor in Half Moon Bay, California, supporting local fisheries and fishers by buying live fresh Dungeness crab directly from those who catch it.

Australian fisheries. "The thing that amazed me was that most fishers seemed to catch only a minimal number of species," Suzie McEnallay says. "Some fishers I spoke to only caught one species all year round, for example Alaska Whitefish. This is despite the region's catch including Chinook Salmon, Rockfish, Albacore Tuna, Pacific Halibut, Lingcod, Black Cod, Dungeness Crab and Clams."

She noticed that the fish shops did not have the variety of species that we see in Australia. At the Wallis Lake Fisherman's Co-operative, where Suzie McEnallay is operations manager, the retail shop sells about 30 species at any given time. The lack of variety seemed consistent through most US outlets they visited. Frozen and canned local fish was also everywhere, alongside fresh and some live product, which was held in the hope of bringing higher prices.

During a welcome reception, Glen and Tracey Hill provided a presentation about their fishing and processing business and the Lakes and Coorong Fishery, the challenges and opportunities. "The group was very interested and asked lots of questions," Tracy Hill says.

The following day, the Australian visitors travelled north with Aaron Longton to visit several retail outlets and to explore some of the scenery along the coast, including the Rogue River bar. Two of the retail outlets they visited were run by fishers – Pacific Ocean Harvesters and Chuck's Seafood, a seafood shop in Coos Bay. What interested the travellers was that most shops had canned salmon with their own label, which was produced under contract by the cannery.

The Australians also had an opportunity to speak with Craig Good, a south coast port research biologist from the Oregon Department of Fish and Wildlife at the Brookings field office. With seals an issue for fishers in the Coorong fishery, the Hills were particularly interested in Craig Good's overview of his work and insights into what is done with seals that become a nuisance around salmon spawning areas. Suzie McEnallay summed up the trip by highlighting the value of experiencing a different perspective on fishing in another country: "In some areas Australia is well ahead, and in others we can learn some things," she says. F

US LOCAL CATCH

Alaska Salmon CSF – www.alaskasalmoncsf.com
Bestcatch Seattle – www.bestcatchseattle.com
Alaska Sustainable Fisheries Trust – www.thealaskatrust.org
Cape Ann Fresh Catch – www.capeannfreshcatch.org
Real Good Fish – www.realgoodfish.com
Sunrise Fish Company – www.sunrisefish.com

UK LOCAL CATCH

Faircatch – www.faircatch.co.uk
Local Catch – www.localcatch.co.uk
Point Clear Bay Fish Company – www.tonysfreshfish.co.uk

FROM MASSACHUSETTS TO MENINGIE

One of the contacts the Australians made at the US Local Seafood Summit is Amy Sheehan and her family, who run the Gulf of Maine, in Pembroke, Massachusetts. Tim and Amy Sheehan and their children buy and sell shellfish from local fishers and harvesters as well as collecting 600 species of seaweeds, invertebrates and fishes fresh for seafood, scientific, aquarium and research markets across North America and beyond.

They met Glen and Tracy Hill at the Local Seafood Summit and have arranged for their 18-year-old son, Tucker Sheehan, to travel to Australia during the US summer (the Australian winter) to work with them as an unpaid intern in the Hills' business in the Lakes and Coorong Fishery. They also hope to learn more during his visit about the Sheehans' family business and its challenges.

More species to expand key fish stocks reports

COMMUNICATION AND REPORTING

More accessible, up-to-date information on the sustainability of fish stocks that aims to boost community confidence in Australian fisheries is on its way

By Ilaria Catizone

The *Status of Australian Fish Stocks* (*SAFS*) *Reports* has become widely recognised as a key source of information on the sustainability of key commercial fish species, and the third edition of the reports, to be published in December 2016, will include an additional 15 species.

This will bring to 83 the total number of species or species complexes included. The reports collate available biological, catch and effort information to determine the status of Australia's key wild-catch fish stocks against a nationally agreed reporting framework.

The aim is to make up-to-date information about key commercial stocks easily accessible to the general public as well as policymakers and industry.

The FRDC has taken on the management of the third edition of the *SAFS Reports*. The FRDC's project manager, Carolyn Stewardson, is coordinating the project. She says the reports underpin the FRDC's national priority of ensuring that Australian fishing and aquaculture products are sustainable and acknowledged to be so.

Performance targets

The FRDC's Research, Development and Extension (RD&E) Plan 2015–2020 also includes several specific performance targets to further improve the reports, as part of its strategy to ensure information on the performance and value of Australia's fisheries is readily available.

These include increasing the number of species reported on to more than 200 by 2020. The RD&E Plan also aims to reduce the number of species classified as 'undefined' from 30 per cent of those in the 2014 edition to less than 10 per cent of stocks reported on by 2020. Undefined stocks are those for which there is limited or possibly conflicting information, which makes an assessment of sustainability difficult, although these stocks are not necessarily 'at risk'.

Vongole (Mud Cockle) (*Katelysia* spp.), one of the new species listed in the 2016 *Status of Fish Stocks Reports*.

The *SAFS Reports* are also expected to contribute to the FRDC's target of increasing positive perceptions of commercial fishing from 28 per cent in 2016 to 40 per cent by 2020 as measured through independently commissioned FRDC stakeholder surveys.

Ongoing consultation

The *SAFS Reports* advisory group held its first meeting under the FRDC's new management structure in December 2015 and FRDC staff met with the *SAFS Reports* author teams in each fishery jurisdiction in February 2016 to discuss the production process.

Approximately 90 authors are involved in producing the reports. It has been a priority for the FRDC to meet and discuss this year's production process.

In March and April the *SAFS Reports* advisory group held workshops in Melbourne to discuss future reports. Key topics included how to address the issue of undefined stocks, and the possibility of incorporating 'equivalence' recognition with other sustainability classification systems.

To increase the efficiency of the *SAFS Reports* production and publication process, the FRDC is developing a dynamic web platform. A long-term aim of the web platform is to allow for ongoing updates of stock status information as they becomes available in different jurisdictions.

Ensuring accountability

An important aspect of the *SAFS Reports* is the use of robust evidence-based science.

Each species chapter undergoes independent peer review. PDFs of references or links to the relevant journals will be publicly available to demonstrate the credentials of the agreed stock status for each species.

A scientific paper has also been published in the journal *Fisheries Research* entitled 'Multijurisdictional fisheries performance reporting: how Australia's nationally standardised approach to assessing stock status compares'. All jurisdictions have contributed to the paper. F

NEW ENTRIES

Fifteen additional species in the 2016 *Status of Fish Stocks Reports*:

- Patagonian Toothfish (*Dissostichus eleginoides*)
- Mackerel Icefish (*Champsocephalus gunnari*)
- Orange Roughy (*Hoplostethus atlanticus*)
- Albacore (*Thunnus alalunga*)
- Blue-eye Trevalla (*Hyperoglyphe antarctica*)
- West Australian Dhufish (*Glaucosoma hebraicum*)
- Spotted Mackerel (*Scomberomorus munroi*)
- King Threadfin (*Polydactylus macrochir*)
- Silver Trevally (*Pseudocaranx dentex*)
- Luderick (*Girella tricuspidata*)
- Blue Mackerel (*Scomber australasicus*)
- Snook (*Sphyraena novaehollandiae*)
- Venus Clam (*Venerupis* spp.)
- Silverlip Pearl Oyster (*Pinctada maxima*)
- Vongole (Mud Cockle) (*Katelysia* spp.)

MORE INFORMATION: **www.oysterhealthsydney.org**
FRDC RESEARCH CODE: **2011/053, 2012/032, 2015/406**

National impact from Tasmanian POMS outbreak

ANIMAL HEALTH

A combination of research and proactivity provides hope in the wake of the latest outbreak of Pacific Oyster Mortality Syndrome

By Ilaria Catizone

Since Pacific Oyster Mortality Syndrome (POMS) first entered Australia in 2010, Tasmanian Pacific Oyster (*Crassostrea gigas*) growers have been watching the outbreaks along the New South Wales coast, preparing for the inevitable southward journey of the virus across Bass Strait. But when the first Tasmanian outbreak finally occurred in February 2016, it still came as a shock.

The recent Tasmanian outbreak of POMS has killed more than five million dozen Pacific Oysters valued in excess of $12 million.

The Tasmanian oyster industry accounts for 37 per cent of Australian Pacific Oyster production with an estimated farm-gate value of $25 million per year. In Tasmania, the Pacific Oyster industry supports more than 700 jobs, and the POMS outbreak has already caused the loss of at least 80 of these.

Although this POMS outbreak is localised in the south of Tasmania, it has a national impact as Tasmania's hatcheries located in the infected region supply 90 per cent of Pacific Oyster spat (juvenile oysters) to farmers in South Australia and NSW. Following the outbreak, the movement of spat from Tasmania has been banned and will be restricted in the foreseeable future. This will also significantly reduce production in SA and NSW, representing a further loss of livelihood for about 300 farms with a gross value of production of $60 million a year.

The virus that causes POMS in Australia is the Ostreid herpes virus 1 (OsHV-1). It is the same virus that has devastated Pacific Oyster aquaculture in France, other European countries and New Zealand. Researchers are still unsure how it entered Australia, but more details are being gathered on its biology.

POMS only affects the Pacific Oyster, which makes up 60 per cent of oysters produced in Australia. The virus infects Pacific Oysters of all ages, although juveniles are particularly vulnerable. It is thought that Pacific Oysters can be infected for some time without showing symptoms of the disease, until environmental factors such as high water temperatures trigger an outbreak. Husbandry practices that stress the animals, such as grading or moving them within or between farms, can also increase the susceptibility to the disease.

It is important to note that while POMS is devastating for the oyster it has no affect on human health.

The outbreak

Once POMS strikes, it causes devastating mass mortality within days. Josh Poke grows Pacific Oysters in Pitt Water, near Hobart, and was assessing the damage in early April. "We had 2.4 million Pacific Oysters bigger than 50 millimetres in length in the water when the outbreak hit," he says. "We are in the process of removing all the dead ones and seeing what's left. We expect about 50 to 60 per cent losses."

Josh Poke explains that because of the outbreak his company has been forced to reduce staff to decrease costs. Pacific Oyster supply in the region will likely be low for the next couple of years. In spite of this, he remains positive as the Pacific Oyster farming community in the region is working closely together to cope. "It is good to know you

> "It is good to know you are not alone. We will be helping each other out even more than usual during this crisis."
>
> – JOSH POKE

PHOTO: UNIVERSITY OF SYDNEY

University of Sydney's Paul Hick (left) and oyster farmer Scott Brooks inspecting hanging baskets in lower Pitt Water, Tasmania.

are not alone," he says. "We will be helping each other out even more than usual during this crisis."

To help his farm continue, Josh Poke also has about 1.2 million half-grown Pacific Oysters coming from unaffected areas in northern Tasmania to grow-out and sell. The movement of Pacific Oysters from one area to another for growing to market size is a standard practice that now has the potential to save businesses in the south of the state.

Oyster farming locations in northern Tasmania, such as the Circular Head region, have excellent growing conditions, but the large number of dairy farms in the area limits when oysters can be sold directly to market. To overcome this issue, the region routinely grows Pacific Oysters to 40 to 50 millimetres in size then sells them to oyster farms in the southern regions, such as Blackmans Bay and Pitt Water, for grow-out.

The north of Tasmania, fortunately, remains free from POMS so far, so farmers are looking at transferring more Pacific Oysters to the POMS-affected southern areas once water temperatures drop below 16°C, for harvest in the spring before the temperature reaches 20°C. This is working with the hypothesis that as POMS is active in warmer water temperatures, this approach should help protect the Pacific Oysters from infection. This practice is known as 'window farming', where the Pacific Oysters are moved to an infected area during a time when the virus is less active.

Executive officer of Oysters Tasmania Neil Stump has been working tirelessly with the industry to mitigate the effects of this outbreak and has had a pivotal role in coordinating activity and briefings with key stakeholders during this crisis.

"We are checking if there are any Pacific Oysters in the north that have not yet been pre-sold to farmers in the south and could be allocated to the worst affected southern growers," he says.

Although helpful, the practice of growing Pacific Oysters in one area and finishing them elsewhere will only provide short-term relief from POMS. Another short-term solution is to overstock

farms with spat to compensate for the expected high mortality. This is a method adopted overseas but it is very costly and few growers are likely to be able to benefit from it in Tasmania. To help manage the Tasmanian crisis and provide assistance, the Australian and Tasmanian governments announced an assistance package of $7.6 million on 4 April 2016 to assist affected farmers and support recovery of the industry. This comes in the form of concessional loans, contribution towards clean-up costs, waive of licence and other fees for 24 months, and employment of biosecurity officers to assist with recovery arrangements.

Environment and management

Understanding the virus causing POMS and how it spreads as well as what conditions inhibit or assist infection will help Pacific Oyster growers to reduce the impact of POMS in the short term.

Richard Whittington is chair of Farm Animal Health at the University of Sydney and has been involved in POMS research since the virus first appeared in NSW in late 2010. At that time there was no information about how it spread, which oysters were affected and whether environmental conditions would influence it, he says. "With FRDC funding, we set out to research these questions to eventually provide Pacific Oyster growers with scientifically sound information on which to base their management decisions."

Paul Hick (left) and oyster farmer Josh Poke assessing mortality in the shed, lower Pitt Water, Tasmania.

PHOTO: UNIVERSITY OF SYDNEY

> "By the time the Pacific Oysters reach the breeding age of two years old, some show resistance to POMS. But the challenge is to breed Pacific Oysters that show a high resistance rate at a much younger age."
>
> – MATT CUNNINGHAM

After two years of intensive research, Richard Whittington and his team have a hypothesis that the virus spreads in seawater attached to plankton. The Pacific Oysters are infected when eating this plankton, but older Pacific Oysters seem to have better resistance to infection. This resistance is further enhanced when growing racks or longlines are raised higher in the water column, which means less time immersed in water.

As the outbreaks in NSW continued beyond 2010, the team also discovered a clear seasonal pattern to the infection. The first outbreak in the Georges River region of NSW has occurred again every year after 2010, followed by a new outbreak in the Hawkesbury River region of NSW in January 2013, which has also happened again in the following years. While these events are devastating for growers, having made the regions unsuitable for growing Pacific Oysters commercially, they do provide opportunities to better understand how the virus works with a goal of finding a solution.

Researchers now have outbreak maps spanning four years and these show a strong correlation between water temperature and disease activity. This work offers valuable insights for growers, helping to support management decisions about when to bring Pacific Oysters onto their farms and when to harvest.

Hatchery protection

Another important aspect of Richard Whittington's work has been on how to protect hatcheries from outbreaks. As younger Pacific Oysters are particularly vulnerable to the virus, hatcheries are at very high risk of having their entire production wiped out by the introduction of POMS.

In a 2014 FRDC project, the University of Sydney team tested two commercially applicable methods of protecting spat in hatcheries. After extensive testing, the methods are now being used by Pacific Oyster hatcheries in Australia and in New Zealand and are proving very successful.

One Tasmanian hatchery has recently been declared POMS free thanks to its application of Richard Whittington's recommendations on how to protect spat from the virus. These include holding water for 48 hours to settle the sediments prior to running it through the Pacific Oysters and/or filtering the water through a five-micrometre filter.

Both these methods are aimed at removing the plankton from the water, thus also removing the virus that may be attached to it. Most hatcheries also run the water under ultraviolet light to kill the virus as an extra precaution in case any is left after sedimentation and filtration. The water is then replenished with plankton specifically grown under sterile conditions to feed the young Pacific Oysters as they grow.

"What happened in Tasmania is tragic," Richard Whittington says. "But we knew it may happen, so we were able to prepare the growers by telling them what to expect and how to react to an outbreak." The team had fact sheets ready about disinfecting equipment, advice for farmers about how the infection would move through their farm, when it was best to harvest and more. A website (www.oysterhealthsydney.org) is also available for more detailed information. With the experience acquired in NSW over the past four years, Richard Whittington's team had already been working intensively with growers in Tasmania and SA to gather data specific to their locations that would inform tailored advice for the most effective husbandry practices.

"During an outbreak, we get a lot of anecdotal information about how different practices increase or slow the spread of the virus," Richard Whittington says. "We value this information and use it to prompt scientifically accurate surveys of the affected farms."

Researcher and veterinary virologist Paul Hick and PhD student Max de Kantzow, from Richard Whittington's group, are working on Tasmanian farms to sample Pacific Oysters and assess which practices are best to reduce the impact of an outbreak. Paul Hick's research has already led to more effective disinfection practices for industry, while Max de Kantzow has confirmed the important role of water temperature through experimental infection trials in the laboratory.

Long-term solution

In 2000 the national Pacific Oyster industry and the FRDC showed remarkable foresight by

PHOTO: UNIVERSITY OF SYDNEY

University of Sydney's Max de Kantzow (left) and oyster farmer Josh Poke collecting tubes from longlines for an audit of mortality in lower Pitt Water, Tasmania.

establishing the national Pacific Oyster breeding company, Australian Seafood Industries Pty Ltd (ASI). With POMS arrival, breeding disease-resistant Pacific Oysters is the most important element of the fight against POMS. Industry introduced a levy in 2015 to fund research aimed at fast-tracking the search for Pacific Oysters with high POMS resistance at a young age.

"By the time the Pacific Oysters reach the breeding age of two years old, some show resistance to POMS," says Matt Cunningham, general manager of ASI. "But the challenge is to breed Pacific Oysters that show a high resistance rate at a much younger age."

A selective breeding program for Pacific Oysters has been underway in Australia for more than 10 years. Since the disease entered Australia this breeding has mostly focused on breeding for POMS resistance. This means that the industry is well on the way to having resistant Pacific Oysters available for growers.

Unfortunately, the operation of this vital breeding program is entirely funded by the levy collected through sales of oyster spat, which has now stopped because of bans on translocation of spat to unaffected Pacific Oyster growing areas in Tasmania, SA and NSW.

To continue this essential research for the recovery of the industry, Oysters Australia, a national body formed in 2011 by Australia's community of oyster growers, is looking at other funding options and is investigating how to address the long-term flow-on effects from the outbreak.

The first step is the development of a National Response Plan funded by a $25,000 contribution from the FRDC. This plan will guide all levels of government to provide ongoing support and R&D needed during the recovery of the Pacific Oyster farming industry. The plan will also identify measures to create greater resilience needed for the industry to expand in the future.

Resistant lines

Meanwhile, ASI's 2014 class of Pacific Oysters shows great promise, with some selected families recording 90 per cent survival for one-year-old Pacific Oysters exposed to the virus. More trials are on the way with animals as small as five millimetres from the 2015 group. None of these lines are on farms yet, as they are too young, but some ASI-bred stock is in the water at various Tasmanian farms in combination with other lines.

As ASI breeds new lines, these are provided free of charge to the commercial hatcheries so growers can purchase partially POMS-resistant spat produced from these ASI lines.

Breeding POMS-resistant Pacific Oysters and understanding the virus to provide best-practice husbandry advice to growers are important complementary approaches to beat POMS in the long term. Developing Pacific Oyster lines that are 100 per cent resistant to POMS will take several years and will be possible only with the continued operation of the ASI breeding program. In the meantime, growers have access to partially resistant Pacific Oysters and the survival rates of these lines can be further enhanced with the right husbandry practices.

ASI's Matt Cunningham says having the disease in Tasmania could speed up the development of POMS-resistant Pacific Oysters.

"Previously, we would send a sample from our most promising lines to NSW to be infected by POMS and test their response. We would then breed from the siblings of the ones that faired best, as bringing infected Pacific Oysters back to Tasmania was too dangerous from a biosecurity point of view.

"This practice would delay our breeding program as the siblings of Pacific Oysters that proved resistant did not always exhibit the same ability to withstand infection," Matt Cunningham says. "Now we can infect Pacific Oysters in Tasmania and breed from the actual ones that have proved resistant – a much more accurate breeding strategy." F

MORE INFORMATION: Wayne Hutchinson, wayne.hutchinson@frdc.com.au
FRDC RESEARCH CODES: 2016/200, 2014/246

Collaboration to maximise new aquaculture opportunities

RESEARCH PRIORITIES

Yellowtail Kingfish and tropical white-fleshed fish species are frontrunners in research priorities to develop new aquaculture opportunities for Australia

By Joshua Fielding

Several research projects already underway will link into a new FRDC subprogram to maximise new and emerging aquaculture opportunities. These include a $6 million project on nutrition, health and feeding strategies for Yellowtail Kingfish (*Seriola lalandi*), funded through the Rural Research and Development for Profit grants program, which was announced last year. This major project also links to other Yellowtail Kingfish research in New South Wales and Western Australia.

The New and Emerging Aquaculture Opportunities (NEAO) subprogram has been established as part of the FRDC's Research, Development and Extension (RD&E) Plan 2015–2020. One of its aims is to establish a project for Northern Australian fish species similar to the one underway for Yellowtail Kingfish. This could include Barramundi (*Lates calcarifer*), Cobia (*Rachycentron canadum*) or tropical Groupers (*Epinephelus* spp.), building on existing demand for white-fleshed fish. There has been a lot of work done previously on some of the species and further research is already underway in Queensland investigating the development of Cobia aquaculture.

Any new FRDC-funded research is expected to focus on functional aspects of animal husbandry, such as nutrition, feeding strategies and fish health. The subprogram committee will also consider how shellfish and Indigenous interests can be included in the northern development initiative. An interim 'establishment committee' is helping to set up the subprogram in line with the new RD&E Plan. It includes national representatives from the aquaculture industry, researchers and the FRDC's Indigenous Reference Group. The establishment committee is chaired by the FRDC and includes representatives from the Rural Industries Research and Development Corporation, the Australian Centre for International Agricultural Research and the Australian Fisheries Managers Forum aquaculture subcommittee. These groups all have a stake in new and emerging aquaculture. Collaboration will help prevent duplication and ensure the best value from the research.

The establishment committee held its first meeting in February 2016, following a broader planning meeting in November 2015.

The draft RD&E program for NEAO takes a three-pronged approach.

1 Facilitation:

- auditing past research on new and emerging species;
- planning and targeting other funding opportunities for new and emerging aquaculture work, such as the Cooperative Research Centre for Developing Northern Australia and the Rural Research and Development for Profit grants program;
- conducting science and technology workshops; and
- providing travel bursaries for research and further investigation.

2 Functional performance:

- conducting specific research on functional aspects such as animal health, nutrition and feeding strategies; and
- developing new business tools and models.

3 Species-specific research:

- supporting opportunities identified in the audit.

The audit of existing research is expected to be the first new task undertaken to direct the future research priorities and focus of the NEAO subprogram. It will review previously conducted RD&E on aquaculture for species that have not seen the growth in production that might have been expected. This will help to map the factors that contribute to the success or failure of new species in aquaculture.

The audit will have two phases. The first is a data summary of past projects including information on what was done and why, and the development of a risk matrix, including information such as markets, regulatory systems, access to farming areas and political support. The second phase will consist of several case studies to conduct detailed audits based on the data summary conducted in phase one.

The audit data will make it easier to identify what research has already been done for different aquaculture species in Australia and the decision matrix will help decide what research to fund through the subprogram. For example, the audit might identify that technological solutions have been pivotal in increasing production or efficiency of production for the more successful aquaculture sectors. Based on this, the subprogram may fund a technical workshop to specifically showcase these technologies.

The audit is expected to be completed in mid-2016. In the meantime, the establishment committee is developing a strategic plan for the subprogram. F

FRDC RD&E PLAN 2015–2020

The FRDC's vision is for Australia to have vibrant fishing and aquaculture sectors that adopt world-class research to achieve sustainability and prosperity.

PLAN PRIORITY 3: By 2020, deliver research, development and extension (RD&E) sufficient for the significant commercialisation of at least two emerging aquaculture growth opportunities with demonstrated potential for profitable business operations.

STRATEGY: Identify research constraints to industry growth – such as lack of potential markets, cost of production, survival, deformities and uniformity of growth – and invest in RD&E to determine successful and competitive commercial activity.

TARGET: Advance two or more emerging aquaculture opportunities/species for which RD&E has identified clear opportunities and technologies for good production and profitability growth, as measured by increases in harvest tonnage.

Year	Harvest target
2016	500 tonnes
2017	1000 tonnes
2018	1500 tonnes
2019	2000 tonnes
2020	2500 tonnes

Early parasite detection research wins science award

ANIMAL HEALTH

Molecular detection of parasites based on water sampling offers an early warning system for fish farmers


Giana Bastos Gomes

By Bianca Nogrady

Detecting disease in aquaculture is challenging. Fish cannot tell you when they are starting to feel unwell, even when they are seriously ill.

As a result, an outbreak of disease such as saltwater ich (also known as white spot disease) – caused by the ciliate protozoan parasite *Cryptocaryon irritans* – is often not detected until it is too late and infection has run rampant through a whole fish population. This is the challenge that veterinarian and PhD candidate Giana Bastos Gomes is hoping to meet. Her research recently won both the 2016 Minister and FRDC Science and Innovation Award for Young People in Agriculture, Fisheries and Forestry, presented by Deputy Prime Minister Barnaby Joyce.

Her PhD is focused on developing new molecular tools to detect ciliate protozoan parasites affecting Barramundi (*Lates calcarifer*). Her project includes the development of new genetic technologies that will help in early diagnosis of fish parasites. She is working to develop a DNA-based point-of-care device to be used by fish farmers for the early detection of waterborne parasites and prevent disease outbreaks. This device will help fill the existing knowledge gap on rapid and effective pathogen detection methods in aquaculture systems.

Originally trained in Brazil, Giana Bastos Gomes had always wanted to work in farming, but when she saw an advertisement for a job in a prawn hatchery, it captured her attention. "I realised there were not many vets working in this area, so it was the chance to do something different," says Giana Bastos Gomes, now with James Cook University. She also sees the opportunity to help tackle a global issue – food security – as aquaculture has the potential to become a major source of food. "I come from Brazil. We have some poverty and we have people without much access to food, but we also have so much water, so there is a chance to use that resource."

Molecular tools

About 40 per cent of global aquaculture production is lost each year to disease. Giana Bastos Gomes is interested in how to improve early detection of disease in aquaculture by using molecular tools that can pick up low levels of pathogens in the water before any infection begins to manifest in farmed fish. The initial focus of her research is white spot, an insidious saltwater fish disease that affects Barramundi. It presents as white dots on the fish's skin and gills. In its early stages animals demonstrate skin irritation and difficulty breathing but without any white dots visible. When the infection progresses, the white dots grow in size and spread across the fish's body. The animals stop eating and eventually they die.

"One of the problems when working in aquaculture is that we can't really see much sign of a problem until infections are in advanced stages; animals come to the surface, they stop eating and they show signs of sickness," Giana Bastos Gomes says. "But usually when this happens it is too late to save them, particularly when farms are located in remote areas, far from diagnostic laboratories."

Preventive action

"Instead of waiting until animals get sick, we can collect water from the farm and extract genetic material from that water," Giana Bastos Gomes says. She then uses molecular markers that help to tag and amplify DNA from the ciliate parasite in water samples. The amount of this parasite's genetic material present indicates the risk level for the farm. It can also be combined with other information about the conditions at the time of sampling, such as oxygen levels and water temperature, to provide clues about other factors influencing the risk of infection.

With early detection, aquaculture farms can implement interventions such as exchanging water, new diet protocols, or chemical or ultraviolet treatments to get rid of the parasite before it spreads through the entire fish farm. Giana Bastos Gomes is also keen to expand the approach to other aquaculture species, both freshwater and saltwater, and to other diseases caused by bacteria and viruses.

Executive officer of the Australian Barramundi Farmers Association Chris Calogeras says the possibilities that might arise from Giana Bastos Gomes's work would be a significant gain for farm management.

"Any tools that will allow fish farmers to better manage their stock, improve productivity and allow quicker responses to any problems is a great step forward for industry. We eagerly look forward to the commercialisation of her work and the benefits it will provide to industry," he says. F

MORE INFORMATION: Chris Calogeras, 0401 692 601, chris@c-aid.com.au
FRDC RESEARCH CODE: 2016/409, 2014/404, 2015/205, 2014/233, 2014/226, 2013/218

Bridge-building needed for Indigenous fisheries research

INDIGENOUS FISHERIES

Face-to-face relationships help build trust, engagement and improve research outcomes for Indigenous communities

By Annabel Boyer

Indigenous-focused fisheries research and the flow-on benefits to Indigenous communities was the subject of the third National Indigenous Fisheries Forum, supported by the FRDC. Held in Cairns, Queensland, in March, the forum brought together 50 people including fishers, community members, researchers and managers. About 35 Indigenous people representing communities from around the country attended the event.

Emma Lee is a Trawlwulwuy woman from Tasmania: "What I've seen with the forum," she said, "is an amazing group of people who are sitting down and putting an Indigenous world view at the centre of fisheries management."

Emma Lee is undertaking PhD research into joint management of Tasmania's national parks and other protected areas. After attending the National Indigenous Forum in Cairns she is enthusiastic about the potential to highlight regional growth in Tasmania through Indigenous fisheries. She said that after the forum she is interested in extending her work to the stewardship of fisheries and marine areas in Tasmania. "If this is good for Indigenous people, it is good for all Australians," she said.

The previous forum, held in 2012, identified priorities for Indigenous fisheries research. Since then, a range of projects has been underway. These involve research to develop resources on Indigenous customary fishing practices, deepen engagement between researchers and Indigenous fishing communities and identify the benefit in fisheries for Indigenous communities. At the forum, researchers had the opportunity to present their projects and Chris Calogeras, executive officer of the Indigenous Reference Group (IRG), said all presentations were well received.

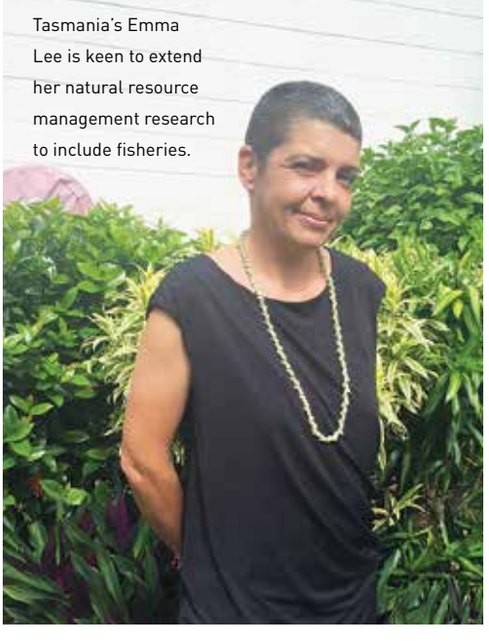
IRG chair Stan Lui said he was pleased to see participants continuing to support and provide input into the IRG's direction and priorities. "By showcasing the work that the IRG has undertaken since the last forum and reassessing the current priority areas, it gives the IRG and the FRDC confidence that we are heading in the right direction with this work," he said.

The forum also facilitated face-to-face meetings to help establish relationships, collaborations and understanding of the shared goals between community representatives and researchers. Developing these relationships is valuable to understanding shared priorities and to build capacity that can benefit Indigenous communities through fisheries development.

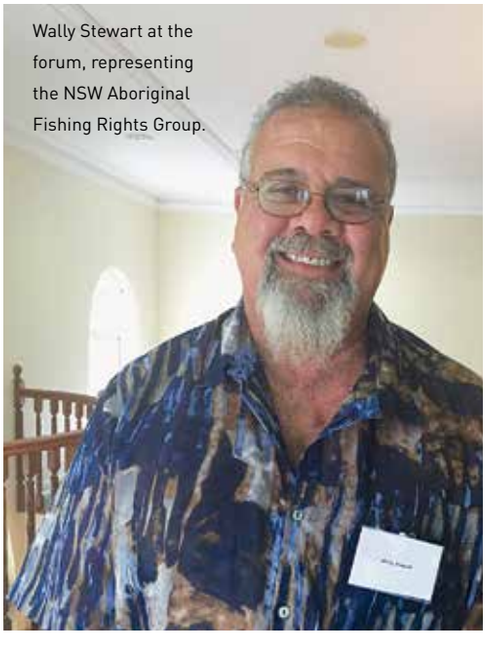
> "What I've seen with the forum is an amazing group of people who are sitting down and putting an Indigenous world view at the centre of fisheries management."
>
> EMMA LEE

Chris Calogeras said that while the IRG has been successful in communicating its intentions to the wider non-Indigenous research community and agencies, communicating IRG activities in Indigenous communities has been more challenging. This issue was workshopped at the forum and resulted in suggestions such as developing a website and YouTube videos, and engaging through Indigenous media and the Australian Broadcasting Corporation. The work done at the forum will now be used to develop a more formalised communication strategy.

Communication and engagement are also key to the research project presented by researchers Stephan Schnierer and Hayley Egan. Stephan Schnierer said that in the past a lack of true engagement has been a real issue, resulting in lost opportunities for capacity building and ultimately fuelling distrust of researchers in



Tasmania's Emma Lee is keen to extend her natural resource management research to include fisheries.



Wally Stewart at the forum, representing the NSW Aboriginal Fishing Rights Group.

PHOTOS: INDIGENOUS REFERENCE GROUP

PHOTOS: INDIGENOUS REFERENCE GROUP

Above: Stephan Schnierer (left) and Indigenous Reference Group member Dennis Ahkee.

Top: Researcher Rod Kennett gives a presentation. Above: Kenny Bedford (left) from the Torres Strait Regional Authority and Indigenous Reference Group chair Stan Lui.

Indigenous communities. While their project was examining Indigenous fisheries harvest, Stephan Schnierer said that a lot of project resources go into negotiating understanding and acceptance of a project before it has even begun. He said researchers needed to change how they engaged with Indigenous communities, in particular to allow research participants to have a say and in this way build capacity for the exchange of information.

Wally Stewart is a representative of the Yuin people from Narooma, New South Wales, who attended the forum. He agreed that having access to researchers is important for empowering Indigenous communities. For Wally Stewart, the value of an activity such as the forum is to create genuine connections with researchers. "If we meet them and understand what they are doing, we can believe them and that is important," he said. This will pave the way to partnerships with authorities in decision-making in areas where Indigenous people have previously been excluded.

Wally Stewart used to be a fisher, but he said conflict between traditional Indigenous fishing practices and authorities has resulted in a decline of Indigenous participation in fisheries in his community in Narooma. This means loss of protein in people's diet and the loss of activities that cement community cohesion and tradition. He now runs a group called the NSW Aboriginal Fishing Rights Group, which advocates for the rights of Indigenous fishers. The group hopes to help researchers and authorities better understand the needs of communities in relation to fishing.

Working to bring this to fruition is researcher Rod Kennett, who is investigating the value of fishing for Wally Stewart's community in Narooma, along with other studies for the Far West Coast Aboriginal Corporation in Western Australia and the Crocodile Islands off the coast of Arnhem Land, Northern Territory.

"If we are going to encourage Indigenous fishing we need to understand how it is valued," Rod Kennett said. For example, taking children along on a fishing trip can be important for intergenerational transfer of knowledge, but this is an area where licensing and safety requirements are in conflict with community values and traditions. The economic benefit of fisheries for Indigenous communities was the focus of several projects reviewed at the forum. Rangers and communities in the Crocodile Islands are looking to capitalise on the knowledge they already have. Rod Kennett said that rangers are often managing other people's activity on their country, so there is no reason why they cannot use the resources they have – particularly their knowledge of country – for their own benefit. Once identified, these values can then be embedded for economic profit in a product such as fish that is ecologically sourced, provides economic benefit for a remote community and preserves traditional practices.

Ewan Colquhoun, another researcher who presented to the forum, said there is a wide variety of aspirations, opportunities and issues in the eight Indigenous fisheries he is looking at as part of a project to build the capacity and performance of Indigenous fisheries around the country.

He said the key thing to understand is that there is a wide diversity of opportunities and many different situations.

These range from traditional pipi harvesting and eel aquaculture in western Victoria, to setting up tourism and recreational and commercial fishery businesses in far western South Australia. There are advanced enterprises such as the Garngirr Fishing Aboriginal Corporation in East Arnhem Land and the Yagbani Aboriginal Corporation at Warruwi, NT, which is working with Tasmanian Seafoods to develop an export business for sea cucumbers.

"The project is basically looking at what communities want to achieve, what works and what doesn't," Ewan Colquhoun said. "The project will frame a plan for each community based on where that community wishes to develop their fisheries." In line with these priorities the project is expected to advise the IRG and the FRDC in regard to the best governance and development models to achieve successful enterprises.

"It's not us working with them to get more Indigenous involvement in fishing but them working with Indigenous people – this is not turning things upside down, but right way up," said Terry Yumbulul, chair of the Garngirr Fishing Aboriginal Corporation, who attended the forum. "We need more acknowledgement of the Indigenous Australians who are working to maintain fishing for the community for future generations," he said. "Fishing: we have been doing it, we are doing it and we will be doing it."

Agriculture Victoria's project, in conjunction with the FRDC, is an acknowledgement of the continuity of those traditional fishing practices, expressed by Terry Yumbulul.

Michael Gilby, the Aboriginal project officer with Agriculture Victoria, gave a presentation about the project to document how Indigenous people have been fishing in their country for thousands of years and until the present day. A detailed understanding of the customary fishing practices of different Indigenous communities has been lost, so the project is working to fill that gap. This will help government agencies to improve the participation by traditional owners in the ongoing management of fisheries, making fisheries more sustainable and benefiting Indigenous fishers and the wider community.

A formal report from the National Indigenous Fisheries Forum will be available on the FRDC website (www.frdc.com.au) in the next couple of months. F

MORE INFORMATION: Matt Rutter, Geraldton Fishermen's Co-operative, mattr@brolos.com.au, www.brolos.com.au

China warehouse secures new route to market

MARKETING

Sustainability of Western Rock Lobsters bolsters confidence to expand marketing operations in China

By Gio Braidotti

More than 90 per cent of Australia's rock lobsters are exported to China and as one of Australia's leading suppliers, the Geraldton Fishermen's Co-operative (GFC) has developed a broad strategy to strengthen its position in this important market.

GFC represents about 60 per cent of processed Western Rock Lobster (*Panulirus cygnus*), which is Australia's most valuable single-species fishery, with an export value of more than $320 million a year and an annual catch of about 6000 tonnes.

With the China–Australia Free Trade Agreement now signed and significant tariff reduction coming into effect for rock lobsters and other species, there are compelling reasons not only to ensure chain of custody but also to build a strong brand recognition for Australian product in China.

GFC's general manager of marketing and business development Matt Rutter says the co-operative's members, who are all fishers or licence holders, expect the business to explore opportunities to further develop the China market. They also want to leverage scale in order to maximise returns and reduce risk related to the current trade routes.

In order to do this, GFC has secured a bonded warehouse for seafood storage at Baiyun Airport, Guangzhou, which opened on 8 January 2016 and is now receiving product.

"We believe these relatively modest strategic investments position our company at the forefront of the rapidly evolving China market," he says.

"GFC is both confident in, and committed to, the longevity and sustainability of the Western Rock Lobster Fishery. That confidence underpins our marketing strategy. Fishery research and management, including by the FRDC, have contributed to that process."

Sustainability of the fishery is closely monitored and managed by the Western Australian Department of Fisheries and it has also been continuously certified as sustainable by the Marine Stewardship Council since 2000, when it was the first fishery to achieve this certification.

PHOTO: CATHERINE NORWOOD

Packed Western Rock Lobster at the Geraldton Fishermen's Co-operative.

PHOTO: GERALDTON FISHERMEN'S CO-OPERATIVE

The bonded warehouse at Baiyun Airport, Guangzhou, decorated for the grand opening ceremony in the Geraldton Fishermen's Co-operative's Chinese branding. Chinese-style tiered tanks allow the co-op to store live Western Rock Lobster vertically, saving space.

Eventually, GFC will be able to ship live product from its new Welshpool facility in Perth directly into Baiyun Airport, landing in pristine condition, ready for sale and distribution anywhere in China. The critical time spent out of water will be less than half that of the current route into China. Baiyun Airport is within four hours' flying time of every city in China.

Warehouse investment

At its new secure bonded warehouse at Guangzhou, GFC can hold live and frozen product under bond, pre-duty and pre-customs clearance, for storage and distribution within China or for trans-shipment to another country. Duties are only payable once the product is moved out of bond for distribution or sale within China.

In support of this facility, GFC has registered a foreign-invested commercial enterprise (FICE) in Guangzhou and rented an office.

A FICE is a limited liability entity that does not require the involvement of a Chinese investor or partner. It will enable GFC to trade (buy and sell) within China. Setting up a FICE requires the establishment of a physical office in China.

"We have identified a suitably modest office space in central Guangzhou," Matt Rutter says.

"The office may in future be staffed for the purposes of conducting market research, identifying new market opportunities, providing a higher level of service and relationship management for existing and new clients, and monitoring our warehousing, sales and distribution activities on the ground."

GFC intends to hold live and frozen product in the warehouse and is working with Tigers China, a global logistics and transportation company based in Hong Kong.

The bonded warehouse's main features include:

- 700 square metres of warehouse plus office space;
- eight hours direct flight between Perth and Guangzhou;
- location 500 metres from the main airport runway;
- 20-tonne live-holding capacity; and
- 10-tonne frozen storage.

The decision to invest in a China-based facility allows GFC to access additional airspace in order to service existing clients better during peak demand periods. Another benefit is the ability to develop an alternative trade route as insurance against potential border closures and a base from which to explore the market and new trade opportunities.

Guangzhou was selected because it is China's traditional distribution point for perishable goods. It is China's third largest city and home to nearly 30 million people.

Guangzhou's Baiyun International Airport is China's second largest airport, located just eight hours' flying time, from Perth. It is the domestic headquarters and operational hub for China Southern Airlines, Asia's largest airline, with direct flights to more than 100 cities throughout China. F

Name change makes species' origin crystal clear

AUSTRALIAN STANDARDS

Market opportunities, international consistency and the identification of a new species can all trigger applications for a new or revised official fish name

By Catherine Norwood

PHOTO: LAUREN GLEADELL/DIFFERENT BRAND

Western Australian Crystal Crab, from Chaceon Pty Ltd.

Advances in scientific knowledge have prompted a review in the naming of Australia's Crystal Crab species and an application to the FRDC's Fish Names Committee that clarifies exactly which crab comes from where.

For more than a decade, Western Australian fishers have been catching and exporting Crystal Crabs (*Chaceon bicolor*), developing a high-value export market. However, researchers have since identified that WA's Crystal Crab is actually the species *C. albus*. A different, east-coast species is the real *C. bicolor* with the officially recognised common name of Crystal Crab.

The new information has meant there is no official common name for the WA species in the Australian Fish Names Standard, says Alan Snow, who is project manager for the FRDC's Fish Names Committee, which reviews changes to the Standard.

"As a different species, the WA crab needs a common name that differentiates it from the east-coast species," Alan Snow says. "It is the Western Australians who have developed the export fishery based on the name Crystal Crab, while there is no real commercial fishery in the east."

Recognising this, the Fish Names Committee proposed, and has given interim approval to, a name change assigning the common name Crystal Crab to WA's *C. albus* and renaming *C. bicolor* as the Eastern Crystal Crab.The interim approval agreed on at a meeting of the Fish Names Committee in April 2016 will be followed by a 10-week public consultation period before final approval is granted. Alan Snow says clarifying these kinds of details is sometimes simply good housekeeping for the Australian fisheries industry, but there are potentially significant commercial effects behind naming practices too. "The WA Crystal Crab is already well recognised in export markets and changing its name now would cause unnecessary confusion. That could be detrimental to industry," he says.

Also receiving interim approval in April was the name Antarctic Toothfish for the species *Dissostichus mawsoni*, as distinct from Patagonian Toothfish (*D. eleginoides*).

Although recognised internationally, there has been no official designation for Antarctic Toothfish in Australia. "That's probably because it's never landed in Australia," says the quality assurance officer with Petuna Seafoods, Rodney Brett, who has made the fish names database application on behalf of the Australian-based business Australian Longline. He says one of the Australian Longline vessels passed through Hobart and exported its catch aboard the same vessel to New Zealand. But as the species was not recognised in the Australian Fish Names Standard, the Australian Quarantine Inspection Service could not provide final health certification for the catch that identified the species as Antarctic Toothfish.

Rodney Brett says in this instance the cargo was taken to New Zealand and will be exported to the US, which does not require food certification. But an update to the Australian Fish Names Standard would prevent a similar issue, and also brings Australia into line with international market naming practices. International seafood supplier Pacific West Foods Australia has also been given interim approval for two new names. Managing director Michael Steele says the company has been importing *Sebastes alutus* and *S. melanops* from the US for the past two years as mid-priced white-fleshed fish. However, neither has an official name designation in Australia. Internationally, these species are widely recognised as Pacific Ocean Perch and Black Rockfish, respectively. Michael Steele says while there are no restrictions on selling these species in Australia using the international names, adding them to the fish names database will give them official recognition in the domestic market.

Another company, which is seeking to differentiate its rock lobster exports, has requested that the Australian Fish Names Standard recognise different members of the rock lobster *Panulirus* species. Many of these species have been grouped under the common name of Tropical Rock Lobster. The exception is *P. cygnus*, the Western Rock Lobster.

New rock lobster names receiving interim approval include Ornate Rock Lobster (*P. ornatus*), Scalloped Rock Lobster (*P. homarus*), Fourspine Rock Lobster (*P. penicillatus*), Painted Rock Lobster (*P. versicolor*), Longlegged Rock Lobster (*P. longipes*) and Mud Rock Lobster (*P. polyphagus*).

Alan Snow says there are already distinct commercial fisheries and markets for the Scalloped and the Painted Rock Lobster. There are already more than 5000 names in the Australian Fish Names Standard, including all significant Australian commercial species and many international commercial species. "But there is also still more work to be done, particularly with invertebrates," Alan Snow says. "And many of the species we consider bycatch today may well be the target species of the future, so it's important that we recognise them." F

MORE INFORMATION: Terri Albert, talbert@omega-3centre.com, www.omega-3centre.com; SafeFish, Alison Turnbull, alison.turnbull@sa.gov.au, safefish.com.au FRDC RESEARCH CODES: 2010/313; 2015/212

Health check to identify omega-3 gap

CONSUMER HEALTH

The newly developed Omega-3 Index can identify a nutritional shortfall that can be easily addressed – with seafood

By Catherine Norwood

The importance of omega-3s in our diets is poised for a major public awareness boost with the development of a simple blood test that can accurately determine the levels of long-chain omega-3s in the body – in a similar way that tests already identify iron deficiencies or high cholesterol.

The test will allow medical practitioners to recommend dietary changes, such as consuming more seafood, to correct any deficiencies.

For the newly appointed executive director of the Omega-3 Centre Inc., Terri Albert, the introduction into Australia of the Omega-3 Index and the related blood test is an exciting and scientifically grounded opportunity to promote omega-3 consumption.

The Omega-3 Index relates to the risk of heart disease, which research shows is lowered with regular long-term intake of long-chain omega-3s, specifically eicosapentaenoic acid and docosahexaenoic acids (EPA + DHA; 20:5ω3 + 22:6ω3).

Terri Albert says it is a simple, finger-prick blood test that individuals can do on their own or in conjunction with their doctor and send for analysis.

She says rather than just recommending two to three serves of oily fish a week, the Omega-3 Index puts scientific rigour into the process of identifying how much is enough.

Terri Albert joined the Omega-3 Centre in 2015, bringing significant international experience in senior roles in innovation and R&D within the natural health and pharmaceuticals sector with a specialised focus on omega-3 developments.

She says she is keen to strengthen connections with the seafood sector. "Supplements and fortified foods are good as an alternative for those who don't eat seafood, or who don't have access to it, but research continually shows that eating fresh seafood provides one of the best sources of omega-3s," she says.

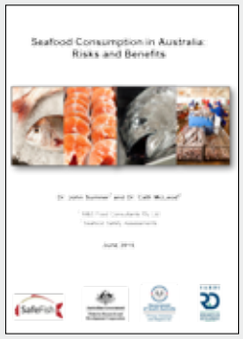
"We are actively supporting the seafood industry by sponsoring several key scientific gatherings, including the ANZ Marine Biotechnology Symposium held in April, and also the NZ Fats & Oils Seminar in November.

"We have also organised a joint Omega-3 Centre–Complementary Medicines Australia one-day symposium in Sydney on 14 September 2016, where William Harris, the professor who developed the omega-3 blood test, will

Balancing the benefits of seafood

FOOD SAFETY

A new SafeFish report highlights species selection for low-risk, high-benefit seafood



By Gio Braidotti

A flurry of recent media articles, particularly in the US, have highlighted concerns about mercury in seafood and potential risks for consumers. Yet aquatic seafood is well known to have health benefits, particularly for infants and pregnant women. How should consumers weigh up the health benefits of consuming aquatic seafood alongside the potential risks?

To help make sense of conflicting health recommendations and warnings, the Australian national advisory body SafeFish has brought together the best available evidence-based consumer advice. Supported by several government and seafood-sector partners, including the FRDC, SafeFish specialises in seafood safety and hygiene. Its report *Mercury and Omega-3 Oils in Australian Seafood* was released last year.

Overall, the data indicates that the levels of mercury in most seafood consumed in Australia are low and that seafood's heath benefits generally outweigh mercury risks. The report concluded that following the recommended national dietary guidelines is the best way to balance risks and benefits (Table 1).

The report included information from the 2010 Expert Consultation on the Risks and Benefits of Fish Consumption established by the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization that drew on experts in nutrition, toxicology, epidemiology, dietary exposure and risk assessment.

Species selection

Overall, SafeFish found that mercury levels in most Australian seafood are low (less than 0.5 milligrams per kilogram) and are not an issue for the general population.

Seafood with low mercury levels include finfish such as Atlantic Salmon, Bream, canned tuna, Snapper, Trevally, Whiting and Flathead, crustaceans and molluscs.

The highest levels of omega-3 fatty acids in Australian fish were found in farmed species – Atlantic Salmon, Rainbow Trout and Yellowtail Kingfish. That means options with low-risk and high-benefit ratios exist and these include mackerels and sardines. Collectively, Australians consume about 1.8 billion servings (150 grams) of this seafood a year.

Given that 72 per cent of seafood consumed in Australia is imported (2008–09 figures), imported seafood was also examined. SafeFish reports that the Australian Total Diet Study, conducted by Food Standards Australia New Zealand (FSANZ) in 2011, found low concentrations

present the benefits of his Omega-3 Index in detail," she says. Other international and Australian experts will present on the day.

Joint initiative

The Omega-3 Centre is a joint Australian and New Zealand initiative, established in 2006, with the vision to help people to optimise their health through a desirable intake of long-chain omega-3 (≥C20) polyunsaturated fatty acids, reducing overall healthcare costs. The FRDC is one of the founding members, with a particular interest in the long-chain fatty acids EPA and DHA most readily found in fish and considered essential in our diets.

Terri Albert says the centre focuses on the health benefits of long-chain omega-3 regardless of the source, but predominantly from fresh oily fish, with the Heart Foundation restating the benefits of consuming seafood in 2015.

Long-chain omega-3s are widely researched for many specific medical and general health benefits. Some of the most broadly understood benefits to consumers are cognitive function, joint health, heart health including cholesterol management, and the importance of DHA in infant development, from pre-conception through to breastfeeding in maternal health.

The Omega-3 Centre published *Realising the Public Health Benefits of Long Chain Omega-3s* in 2011, which summarises the Omega-3 Centre Scientific Consensus Meeting held in 2010. The booklet contains important messages including how to meet daily intake targets. The National Health and Medical Research Council suggests dietary intakes of 610 milligrams per day for men and 430 milligrams per day for women older than 14 years.

To achieve these levels via food, the target is two to three serves of good-quality oily fish per week, such as (but not limited to) salmon, trout, barramundi and canned sardines.

Members of the Omega-3 Centre encompass government organisations, such as the FRDC and CSIRO, seafood researchers and producers, raw material manufacturers and distributors, branded food marketers, infant formulation producers, dietary supplementation manufacturers and brand marketers. Universities and research bodies are also heavily involved.

Terri Albert says the centre aims to address the confusion that consumers face, especially given negative messages often raised in the media. She says in the US, articles warning of fresh fish "contaminated" with heavy metals such as mercury and pesticides resulted in a decline in seafood consumption. Pregnant women especially avoided eating fresh seafood, but the impact has flowed through to the dietary supplement markets as well.

Consumer concerns also exist in Australia, although there have been no reported cases of mercury poisoning from seafood consumption in Australia. These concerns have led the government advisory agency SafeFish to review the potential mercury risks for consumers, compared to the benefits of omega-3s in seafood (see below). F

of mercury in battered fish fillets, frozen fish portions, tuna canned in brine and cooked prawns, which are some of the most commonly consumed seafood products in Australia.

Mercury, however, does accumulate in aquatic food chains; certain species do pose a higher risk and need to be consumed in lower amounts. These are predominantly predatory fish and long-lived fish, such as Gemfish, Ling, Orange Roughy, sharks and some tuna species.

Australian predatory fish with low mercury levels are Southern Bluefin Tuna and Barramundi.

Individual sharks, particularly warm-water sharks (from the *Carcharhinus* genus) and large game fish, such as Swordfish and Marlin, can have mercury levels much higher than the Food Standards Code-prescribed mean maximum level (one milligram per kilogram).

Why is mercury an issue?

Low levels of mercury are naturally present in the environment and in all foods, but are generally not a problem to human health since the heavy metal exists in an inorganic form that is poorly absorbed by the human body.

However, mercury in aquatic environments is converted by bacteria to a readily absorbed form called methylmercury and makes its way up the food chain.

Once absorbed by humans, methylmercury enters the brain of adults and fetuses where it converts back into inorganic mercury, accumulates and is highly toxic.

Exposure to high levels of mercury can result in severe developmental disorders. Chronic, low-dose exposure is associated with impaired performance in neurobiological tests that measure attention, language, memory and fine-motor function. In adults, exposure causes sensory and motor impairment.

Omega-3 benefits

While the report concluded that the average seafood consumption of Australians is not likely to put them at risk, it notes the need for pregnant women and mothers from groups who are frequent consumers of seafood to be provided with information about fish and mercury.

There is a clear call to protect brains – especially a child's developing brain – from mercury toxicity. But infant brains and adult hearts are both known to benefit enormously from the long-chain omega-3 three fatty acids found almost exclusively in seafood. F

TABLE 1 SEAFOOD ADVICE FOR SAFE MERCURY CONSUMPTION

FISH SPECIES	PREGNANT WOMEN (1 serve = 150 grams)	CHILDREN 0 TO 6 YRS (1 serve = 75 grams)
Any fish and seafood other than: Orange Roughy, Catfish, shark, billfish (Swordfish, Broadbill, Marlin)	2–3 serves per week	2–3 serves per week
Orange Roughy or Catfish and no other fish that week	1 serve per week	1 serve per week
Shark or billfish (Swordfish, Broadbill, Marlin) and no other fish that fortnight	1 serve per fortnight	1 serve per fortnight
Rest of the population (1 serve = 150 grams)		
Any fish and seafood other than: shark, billfish (Swordfish, Broadbill, Marlin)	2–3 serves per week	
Shark or billfish (Swordfish, Broadbill, Marlin) and no other fish that week	1 serve per week	

SOURCE: PROVIDED TO AUSTRALIAN CONSUMERS BY FSANZ.

Model master

PROFILE

Creating models to test choices and consequences, Tony Smith AM has provided new tools for better fisheries management

By Catherine Norwood

Mathematics and ecology may have been what first brought CSIRO chief research scientist Tony Smith to the seafood sector, but the human dimensions of his work are the ones to make the most lasting impression.

This includes the value of collaboration with other scientists within CSIRO, around Australia and internationally, as well as work with industry groups and managers, who have used his modelling tools to improve the sustainability of their fisheries.

For the past 27 years Tony Smith has worked in marine resource assessment and modelling as part of what is now CSIRO Oceans and Atmosphere in Hobart. His research has underpinned the development of ecosystem-based management and harvest strategies for Australian and international fisheries. Methods and tools he developed are now routinely used to evaluate the effectiveness and trade-offs involved in different management strategies.

He began his career with a science degree at the University of Adelaide, with a strong marine science bent, followed by a PhD at the University of British Columbia in Canada, focusing on adaptive management of fisheries. A 10-year "diversion" took his mathematical and research skills to various other fields, including agriculture, epidemiology and entomology. Then in 1989 he returned to the fisheries fold, as a resource assessment modeller at CSIRO.

Fish stocks

"The focus of virtually all of my research over the years has been to support better decision-making and management," Tony Smith says. In the case of fisheries, this began with the need to better understand specific fisheries and their dynamics.

One of his first challenges on joining CSIRO was modelling the newly discovered Orange Roughy fishery. "It was a bit of a gold rush at the time. There was very little understanding of the resource – either its productivity or stock size. We actually got on top of that quite quickly, but it was hard for managers to implement an orderly development of the fishery."

From fish and their environment, his research has evolved over the years to incorporate more human factors. "We need to see fisheries as complex socioeconomic systems and try to understand the interplay between the human players, management processes, governance, ecosystems and stocks," he says. "It is a major challenge, and it's really important for getting better management in the long term."

The first project to really bring home the 'people factor' to him was an evaluation of management options for the Southern and Eastern Scalefish and Shark Fishery more than a decade ago. The fishery had already undergone considerable change, he says. Individual transferable quotas had been introduced in the early 1990s and other traditional management tools, such as fishing zones, gear limitations and effort limitations, had been downplayed. Despite the introduction of quotas, by 2004 the fishery was in quite bad shape ecologically and economically. "So we set out to understand what was going wrong," Tony Smith says.

Ecosystems approach

This study was one of the first to adopt a management strategy evaluation approach at an ecosystem or whole-of-fishery level. The project team included researchers, managers, the fishing industry and environmental groups.

"In the South East Fishery we started evaluating a range of possible alternatives to manage this large, complicated fishery, which has about 30 quota-managed species. At the start of the study we labelled some options 'blue sky' as a kind of intellectual exercise, which we never dreamed would be implemented. But the eventual transformation of the fishery was not much different from that initial blue-sky scenario. It goes to show that sometimes looking outside the box can be fruitful.

"The big change was really coming up with a management system that took an integrated view of the whole fishery and not being afraid to bring back some of the traditional management tools."

Today, management strategy evaluation is commonly used to analyse the effectiveness of everything from simple harvest strategies to complex ecosystem-based fisheries management. Tony Smith has been part of a small team of international scientists who have developed the concepts, tools and ideas around such evaluations for the fisheries sector.

Values and trade-offs

He says fisheries management always involves trade-offs between multiple, and often conflicting, objectives. Modelling helps to assess the potential effects of different management strategies – by playing 'what-if' scenarios using a model before trying out the changes on a real fishery.

"One of the key outputs of a management strategy evaluation is a trade-off table that says: 'You can't fully meet all your objectives, but here are the strategies that do a reasonable job of meeting as many as possible, without falling over entirely on any of them'. It highlights the trade-offs, so that the decision-makers are well informed."

He says the management evaluation process brings home the interplay between all the actors – scientists, managers, environmental non-government organisations and fishers – and just how the outcomes are determined by that interplay of actors and forces. Transparency and real stakeholder engagement are crucial, he says, in identifying the objectives, and

PHOTO: CSIRO

Tony Smith

in showing how different ways of managing a fishery might meet those objectives.

"There are a lot of motivating forces that drive people. We talk a lot about science-based management and evidence-based management, but values come into it as well, and people's motivations. It's not up to scientists to make those trade-offs, that is up to the people charged with management, but we can inform those decisions by providing these analyses and this information in a suitable way."

Risk assessment

Another major project Tony Smith helped lead over many years has been the ongoing ecological risk assessments for species in Commonwealth fisheries for the Australian Fisheries Management Authority (AFMA).

"We comprehensively reviewed the impacts of fishing on bycatch species and threatened species, and ecosystems for all of AFMA's fisheries. That was a huge and very demanding project over five years, developing and improving tools and techniques, testing them out, and applying them. Some elements have continued and we have revisited fisheries we have assessed before – that's part of the ongoing adaptive approach to fisheries management."

From this work, the risk-assessment methods developed for AFMA have also been picked up internationally. The Marine Stewardship Council (MSC) has adopted a risk-based framework to assess fisheries as sustainable, building on the methods developed for AFMA.

In 2008 Tony Smith was appointed to the MSC's technical advisory board, which provides advice on the chain of custody and scientific issues for seafood sustainability certification. He says one of the challenges for the MSC is trying to assess fisheries globally to the same standard while allowing for huge variation in the types of fisheries, the level of sophistication of the assessments, and the governance structures in different countries and in regional management bodies.

Future directions

While he remains involved with the MSC, Tony Smith is also a contributor to a new national initiative, the Centre for Marine Socioecology. The centre is a collaboration between the University of Tasmania, CSIRO and the Australian Antarctic Division focusing on current and future uses of Australia's coasts and oceans.

It brings together expertise in physics, law, economics, biology, sociology and governance to consider the complex marine management issues that are developing, including the use of marine resources to underpin food security. "It is in the process of getting underway, and I do think it is an interesting program of work, and one with a big future," Tony Smith says.

Reflecting on his own career, he says his best advice for young fisheries scientists is to get the training and skills they need, and then to pick projects that interest them, and collaborate with others, including the fishing industry.

"Science really is a collaborative process, and it works best when you are working in teams. I have been fortunate to work with some fantastic people over the years. Forming those relationships has been part of the pleasure and the productivity of my work. There used to be a kind of divide between pure and applied science, and I have always seen myself in the applied science camp. The science is just as interesting and the opportunities to see it influence things and to see it put into practice also brings a lot of rewards." F

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DEVELOPMENT OF OCTOPUS AQUACULTURE 2009/206

During this study new and innovative systems and protocols were developed for ranching the Gloomy Octopus (*Octopus tetricus*). These systems and protocols have eliminated the need to use shelters in tanks, which has significantly reduced cannibalism and territorialism, subsequently making tanks extremely easy to clean and harvest. They have allowed the 'ranching' of octopus juveniles from as little as 50 grams at a biomass upwards of 54 kilograms per square metre in specifically designed tanks, which is the highest biomass reported achieved anywhere in the world to date.

Return on investment modelling based on these systems and methods predicted a growth period of 18 weeks for a juvenile octopus to reach market weight (800 grams). These predictions were confirmed in a series of grow-out trials with different juvenile weights and biomass densities.

With limited studies on Gloomy Octopus and no attempts at paralarvae rearing made in the past, this research was aimed at determining the most appropriate rearing conditions with regard to system design, nutrition and environmental parameters.

Trials during the project tested various nutritional parameters, some of which include various live feeds to partially supplement feeding of *Artemia*, such as crabs *Portunus pelagicus zoeae*, *Copepod* species and Western Rock Lobster *Panulirus cygnus* phyllosoma. Various tank systems and designs were also considered with regards to hydrodynamic factors. Environmental parameters such as water temperature, light intensity and photoperiod, as well as green water culture, were also considered integral to paralarvae success and were trialled over the duration of this project.

MORE INFORMATION: **Sagiv Kolkovski, Department of Fisheries, Western Australia, 08 9203 0220**

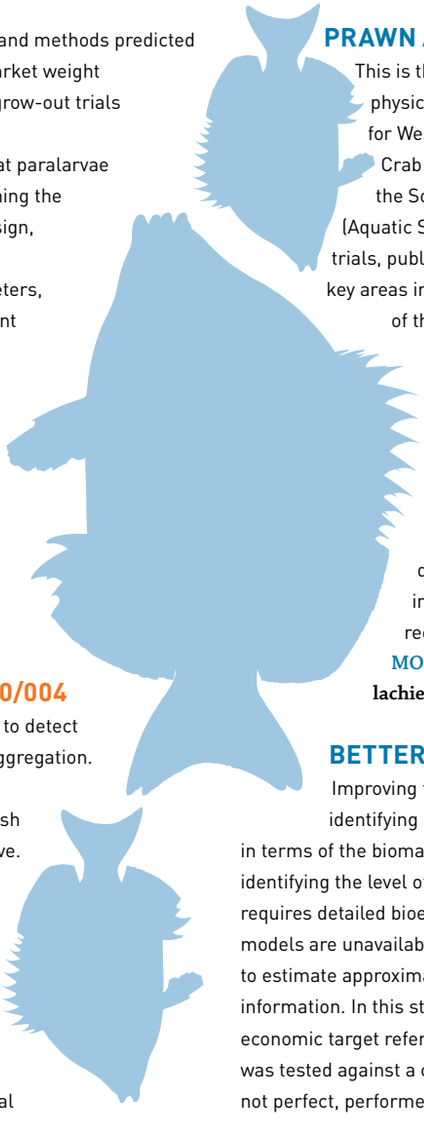
LISTENING FOR THE FISH CHORUS 2010/004

This project has expanded the application of passive acoustics to detect variations in relative numbers of sound-producing fish in an aggregation. This increases our understanding and appreciation of the information provided by passive acoustic monitoring of vocal fish species from an ecological and fisheries monitoring perspective. Moreover, a greater public awareness of the use of sound by marine animals to communicate, particularly fishes, has been achieved with the work conducted during this project leading to segments on internationally broadcasted television programs, radio interviews and a permanent interactive display in a marine discovery centre. This study has focused on two demersal marine species, one estuarine opportunist and one estuarine species of fish, all of commercial and recreational importance in Western Australia: West Australian Dhufish (*Glaucosoma hebraicum*); Snapper (*Pagrus auratus*); Mulloway (*Argyrosomus japonicus*); and Black Bream (*Acanthopagrus butcheri*), respectively.

Another key result is the developing of standardised methods for monitoring vocal species with passive acoustic techniques as an extension of the work conducted in FRDC project 2004/051. This project has helped develop and standardise methods for confirming sound production by vocal fish, the identification of call and long-term monitoring of fish choruses, all of which are important steps in monitoring the spatial and temporal presence and abundance of vocal fish species.

Finally, techniques, programs and equipment developed and manufactured during this project are to be applied and further developed during planned FRDC and Department of Fisheries, WA projects. Not only will this aid monitoring of vocal fish species, but also the monitoring of species that use soundscapes as a cue for behavioural patterns (for example, the use of particular sounds as a cue for orientation or timing to begin migration). A review of the techniques developed here and used elsewhere in the world has highlighted some of the areas where passive acoustic monitoring of vocal fish can aid management and monitoring practices.

MORE INFORMATION: **Miles Parsons, Curtin University, 08 9266 9252**



PRAWN AND CRAB HARVEST OPTIMISATION 2008/011

This is the first comprehensive study to model the interaction between physical oceanographic processes and patterns of larval settlement for Western King Prawn (*Melicertus latisulcatus*) and Blue Swimmer Crab (*Portunus armatus*) in South Australia. Research conducted by the South Australian Research and Development Institute (SARDI) (Aquatic Sciences) combined data from stock assessment surveys, tank trials, published research, and climate and ocean sensors to identify the key areas in the Spencer Gulf that contribute to larval settlement success of these two commercially important species. Information relevant to the Western King Prawn was used to assess how different harvest strategies may maximise catch while minimising the potential threat of recruitment overfishing during pre-Christmas fishing periods that coincide with spawning. The study provides stakeholders with additional information to enhance harvest strategies and maximise production opportunities for these species. The biophysical models developed in the project have also provided some insights into the potential effects of climate change on stock recruitment relationships.

MORE INFORMATION: **Lachie McLeay, SARDI, lachie.mcleay@sa.gov.au**

BETTER ECONOMIC REFERENCE POINTS 2011/200

Improving the economic performance of Australian fisheries requires identifying appropriate target reference points, which are often measured in terms of the biomass level for each species. Within multispecies fisheries, identifying the level of biomass that is associated with maximum economic yield requires detailed bioeconomic models of the fisheries. For many fisheries, such models are unavailable, so some form of cost-effective proxy measure is required to estimate approximate target reference points based on, in some cases, limited information. In this study, a framework was developed for estimating appropriate economic target reference points for species within mixed fisheries. The framework was tested against a case study fishery and it was found that the framework, while not perfect, performed better than current default assumptions about the target reference points.

MORE INFORMATION: **Sean Pascoe, CSIRO Oceans and Atmosphere Flagship, 07 3833 5966**

SOUTHERN ROCKLOBSTER COMMUNICATION 2012/511

This project aimed to improve stakeholder and community knowledge of the Southern Rock Lobster (SRL) Fishery by disseminating consistent information to increase the awareness of R&D results that align with the SRL Industry Strategic Plan. This was done through an update of the SRL website, the creation of fact sheets and the reintroduction of the SRL news bulletin.

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This project has resulted in a better informed industry. Importantly, the production of the SRL news bulletin has enabled the fishery to provide the broader industry with a consistent message on developments concerning important issues, such as negotiations and outcomes of free-trade agreements, bio-toxin events and the dissemination of research, development and extension results of interest to the sector.

MORE INFORMATION: **Ross Hodge, Southern Rocklobster Limited, 03 9004 2729**

MORTALITY IN THE QUEENSLAND SHARK FISHERY 2010/006

This project investigated the fishing mortality rates on population persistence of shark species and modelled those effects using demographic analyses to predict future population trends. The Centre for Sustainable Tropical Fisheries and Aquaculture has completed this project in response to increasing interest and concern by stakeholders about the status of shark populations exposed to the fishing activities of the Queensland East Coast Inshore Fin Fish Fishery (ECIFFF). A large-scale tag-recapture project was completed across 2010 and 2011 and provided the relevant data to complete this exercise. A total of five tagged shark species made up a total of 324 recaptures.

This research found that fishing mortality rates in the ECIFFF appear sustainable. Robust fishing mortality estimates and subsequent demographic modelling outcomes were possible for four of the most dominant sharks harvested by the fishery: the undifferentiated Blacktip Shark (*Carcharhinus tilstoni/limbatus*) complex, Spot-Tail Shark (*C. sorrah*), Spinner Shark (*C. brevipinna*) and Pigeye Shark (*C. amboinensis*).

For all species except Pigeye Shark fishing mortality rates were found to be low to moderate, and likely within sustainable bounds. For the Pigeye Shark, fishing mortality estimates were relatively high with several methods indicating harvest rates may have been unsustainable. Less robust estimates of fishing mortality were achieved for an additional six species including Milk Shark (*Rhizoprionodon acutus*), Australian Sharpnose Shark (*R. taylori*), Creek Whaler (*C. fitzroyensis*), Bull Shark (*C. leucas*), Scalloped Hammerhead (*Sphyrna lewini*) and Great Hammerhead (*S. mokarran*). For these species estimates are likely to be highly imprecise and should be used cautiously.

MORE INFORMATION: **Andrew Tobin, James Cook University, 07 4781 5113**

BREEDING STRONGER PACIFIC OYSTERS 2012/052

Scientists have developed a laboratory infection model to rapidly measure the level of resistance that new generations of Pacific Oysters (*Crassostrea gigas*) might have against Ostreid herpesvirus 1 (OsHV-1), the virus causing Pacific Oyster Mortality Syndrome (POMS).

Between 2010 and 2013 there were devastating outbreaks of OsHV-1 that caused the almost entire loss of commercially farmed and wild populations of Pacific Oysters in the Georges River estuary and later in the Hawkesbury River in New South Wales. Scientists have now developed a well-characterised laboratory infection model to rapidly measure the level of resistance that new generations of Pacific Oysters might have against this virus. This will allow oyster geneticists and breeders to select Pacific Oyster lines that are resistant to infection with OsHV-1. When genetically resistant Pacific Oysters become available to farmers this should form a firm foundation on which to develop strategies to minimise the impact of this highly contagious disease. This may allow farmers in affected areas of Australia to eventually resume Pacific Oyster production and reduce the risk of major outbreaks in areas that are free of infection.

As well as applying the infection model to assess the genetic basis of resistance in Pacific Oyster family lines, the system was later used to assess the susceptibility of the Australian Native Oyster (*Ostrea angasi*). No disease was observed and no evidence of virus infection was detected. The confirmation of resistance of the Native Oyster provides an alternative species that can be farmed in waters where OsHV-1 is present.

MORE INFORMATION: **Peter Kirkland, NSW Department of Primary Industries, 02 4640 6331**

BENTHIC PELAGIC INTERACTIONS 2012/047

This report describes the approach and results of a Salmon-farming field study as well as the subsequent modelling, and discusses the outcomes in the context of ecological sustainable development of the salmonid industry in Macquarie Harbour.

The strategic growth of the Tasmanian Salmonid industry over the next decade is contingent upon ecologically sustainable development in Macquarie Harbour. In coastal bays and estuaries, sediment/water column interactions are a major driver of ecosystem condition and health.

A key knowledge gap in Macquarie Harbour was a lack of ecological data on the capacity of sediments to process organic matter and nutrients, and the influence of these on bottom waters, particularly given the expectation of increased localised organic loads associated with expanded farming. This report describes the work conducted to address this knowledge gap.

The results from the field incubations were used to recalibrate and validate the sediment/water column interaction terms in the environmental model used in the Macquarie Harbour Environmental Impact Statement.

MORE INFORMATION: **Ross Jeffery, University of Tasmania, 03 6227 7281**

NSW ANGLER ACCESS FORUM AND WORKSHOP 2008/093

The aim of this project was to examine the issues around the ever-changing environment relating to angler access across New South Wales. This project sought to bring together a wide range of participants with varied backgrounds to discuss the future of recreational fishing access. The project provided several clear objectives of what it hoped to achieve that revolved around a shared vision for the future of recreational fishing access in NSW and Australia, being: responsible access to public natural resources for recreational enjoyment and sustainable use in all waters.

MORE INFORMATION: **Malcolm Poole, Recreational Fishing Alliance of NSW, 02 4362 1687**

SCALLOP SPATIAL MANAGEMENT AND HARVEST 2008/022

The results of this study have significant implications for the sustainable management of south-east Australian commercial scallop fisheries and greater continuity between jurisdictional harvest strategies. Spatial management of the scallop fishery requires adequate information on the stock to ensure the implementation of appropriate management decisions. In addition to abundance

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and population data used for management decisions, more information is needed to improve management of the Commercial Scallop (*Pecten fumatus*) resource.

With a view to ensuring the ecological sustainability of the scallop fishery, this study explored the effect of dredging activities on the benthic community within the fishing grounds of the Bass Strait Central Zone Scallop Fishery (BSCZSF). Abundance of all species (Commercial Scallop and all bycatch) comprising the communities did not differ significantly between fished and non-fished areas in the regions examined. The total number of species and species richness did not differ significantly either. This suggests that scallop dredging has a relatively low short-to-medium-term impact on the benthic communities within the fishing grounds of the BSCZSF.

The density of adult spawners does have an impact on the level of synchronicity between spawning adults. This study showed a difference in spawning intensity and synchronisation between sites of high and low densities, and suggests that maintaining dense areas of adult scallops may increase the chances of recruitment, through increased spawning intensity.

MORE INFORMATION: **Jayson Semmens, University of Tasmania, 03 6227 7275**

INTEGRATING DATA FOR IMPROVED SUSTAINABILITY 2008/004

This research was required to determine the most suitable and reliable sampling strategies to provide data for sustainable 'ecosystem-based' management of the estuarine fisheries resources of New South Wales. Ecosystem-based management requires data across all components of the environment, not just harvested species, so that effects on biodiversity can be examined. The project results have applicability to other systems and jurisdictions in Australia and elsewhere. This study successfully tested a standardised fishery-independent sampling strategy against typical fishery-dependent strategies for assessing aquatic biodiversity and fisheries resources across estuaries. In doing so it identified strengths and weaknesses in each of the sampling strategies.

MORE INFORMATION: **Charles Gray, WildFish Research, charles.gray@wildfishresearch.com.au**

INDUSTRY SELF-MANAGEMENT: SCALLOPS 2005/027

The principal outcome of this project has been the adoption and incorporation of the industry-based survey data collection strategy into the spatial management framework of the Tasmanian Scallop Fishery.

This project, combined with the results of the preceding FRDC scallop project (2003/017), has resulted in a clear vision for the future of Bass Strait scallops. It is hoped that all scallops within south-east Australia can be managed under a rotational closed-area spatial management regime, which sees the majority of the available fishing grounds closed to fishing and only relatively small areas of known stocks being opened.

MORE INFORMATION: **Malcolm Haddon, CSIRO Marine and Atmospheric Research, 03 6232 5097**

COMMONWEALTH SMALL PELAGIC HARVEST 2013/028

This study undertook ecosystem and population modelling to evaluate and provide advice on the reference points (for example, biomass depletion levels) and settings (for example, exploitation rates) for the four main target species in the harvest strategy of the Commonwealth Small Pelagic Fishery (SPF) – Common Jack Mackerel (*Trachurus declivis*), Redbait (*Emmelichthys nitidus*), Blue Mackerel (*Scomber australasicus*) and Australian Sardine (*Sardinops sagax*).

The findings have implications for the target and limit reference points that should be selected for the main commercial species in the SPF.

Population modelling suggests that target exploitation rates (ERs) for the SPF should be species specific and possibly even stock specific. The current average Tier 1 harvest rate of 15 per cent appears to be too high for eastern Redbait. Taking account of some of the sensitivity scenarios, the report states that it may also be too high for western Redbait and Common Jack Mackerel. The results will help inform the choice of suitable ERs for each of the species and stocks.

MORE INFORMATION: **Beth Fulton, CSIRO Marine and Atmospheric Research, 03 6232 5018**

HISTORICAL CATCH RATES FOR SNAPPER 2013/018

Long-term commercial and recreational fishers along the coast of Queensland, from Cooktown to Tweed Heads, were interviewed about their observations of change in Queensland's east-coast Snapper (*Chrysophrys auratus*), Spanish Mackerel (*Scomberomorus commerson*) and Coral Trout (*Plectropomus* spp.) fisheries. The aim of the project was to use fisher knowledge and archival information to provide a longer-term perspective on perceptions and trends witnessed in these fish stocks and the fisheries over time, and thus help fill knowledge gaps in the understanding of past trends.

MORE INFORMATION: **Ruth Thurstan, University of Queensland, r.thurstan@uq.edu.au**

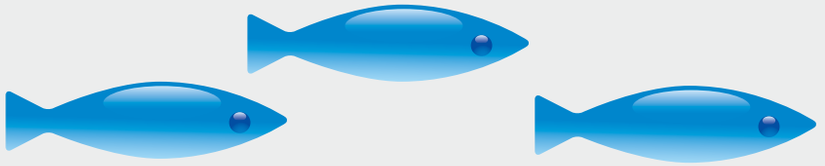
IMPROVING CATCH DATA 2008/002

Management of the South Eastern Scalefish and Shark Fishery is still heavily driven by the Commonwealth Trawl Sector's (CTS) catch per unit effort (CPUE) data, even though this data is acknowledged to have the potential to fail to detect either overexploitation or recovery. CPUE is currently standardised on a species-by-species basis. However, this raises questions at a species level about appropriate data subsetting or selection of components of data, and whether long-term changes in fishing behaviour have distorted the trends in the CPUE. These factors can have an impact on total allowable catch. There is no purely statistical method that can be used at a species-by-species level to resolve these issues.

This project explores whether it is possible to answer these questions more systematically by taking a multispecies viewpoint on each shot, to somehow take account of 'targeting' (that is, fisher-controlled specifics of each trawl shot that affects what is likely to be caught, but is not recorded in logbook data that inform the estimation of CPUE). While there are several published approaches to multispecies CPUE, none are statistically satisfactory in a fishery as complex as the CTS, so a new approach is needed. The project developed a model of economic drivers to generate prior probabilities of what each shot would target in the various different scenarios, and this model was linked to a CPUE standardisation carried out simultaneously for all the main quota species.

MORE INFORMATION: **Mark V. Bravington, CSIRO, 03 6232 5118, mark.bravington@csiro.au; Scott D. Foster, CSIRO, 03 6232 5178, scott.foster@csiro.au**

Movers and ...



CHRISTOPHER IZZO, SKYE BARRET, LEAH FERGUSSON, NICOLE STUBING and ALISON CONNELLY joined WAYNE HUTCHINSON in the new FRDC Adelaide office. ANNABEL BOYER also joined the FRDC recently as communications officer, based in the Canberra office (see page 17).

STEVE JEFFERIES has been appointed as the GRDC's new managing director. He is currently the chief executive officer of the Adelaide-based Australian Grain Technologies and will take up his appointment at the GRDC in July. Steve Jefferies takes over from JOHN HARVEY, who has now moved to the Rural Industries Research and Development Corporation as managing director, after CRAIG BURNS retired earlier this year.

DAVID HEAD is the new CEO at Cleanseas, taking over from CRAIG FOSTER.

MATTHEW OSBORNE has been appointed as manager of Indigenous business development, fisheries, at the Northern Territory Department of Primary Industry and Fisheries.

NATALIE MOLTSCHANIWSKYJ is the new director of fisheries research at the New South Wales Department of Primary Industries, taking over from BOB CREESE, who is now the director of Fisheries Science.

JODIE DEAN replaced JIM GELTCH as CEO of Nuffield Australia, as Jim Geltch has been appointed as the first full-time CEO of Nuffield International. Jodie Dean was previously operations manager at Grain Trade Australia.

JAMES FINDLAY has been reappointed as CEO of the Australian Fisheries Management Authority for a further three years.

FRDC science writer and deputy editor of *FISH* ILARIA CATIZONE has gone on maternity leave for one year.

NICK AUSTIN has stepped down from the role of CEO at the Australian Centre for International Agricultural Research. ANDREW CAMPBELL has been appointed the new CEO.

FEEDBACK

FRDC WELCOMES YOUR COMMENTS

frdc@frdc.com.au

MOVERS WE'VE MISSED?

INFO PLEASE TO

Annabel Boyer, 02 6285 0415, annabel.boyer@frdc.com.au

Calendar of events

DATE	EVENT	MORE INFORMATION
2016		
4 to 7 July	**New Zealand Marine Sciences Society and Australian Marine Sciences Association Sharing Ocean Resources Joint Conference, Victoria University of Wellington, Wellington, New Zealand**	www.amsa.asn.au
11 to 13 July	**2nd Global Summit on Aquaculture & Fisheries, Kuala Lumpur, Malaysia**	www.aquaculture.global-summit.com
11 to 15 July	**International Institute of Fisheries Economics and Trade Conference, Aberdeen, Scotland**	www.iifet-2016.org
4 to 6 August	**ASEAN Fisheries and Aquaculture Conference and Exposition 2016, Bangkok International Trade & Exhibition Centre, Bangkok, Thailand**	www.aseanfishexpo2016.com
14 August	**Hervey Bay Seafood Festival, Hervey Bay, Queensland**	https://herveybayseafoodfestival.com.au
24 to 25 August	**FRDC Board meeting, Canberra**	02 6285 0400
31 August	**New Zealand Seafood Industry Association, Wellington, New Zealand**	www.seafoodconference.org.nz
5 to 8 September	**Australian Society of Fish Biology Conference, Hobart**	www.asfb.org.au
6 to 8 September	**2016 Seafood Expo Asia, Hong Kong Convention & Exhibition Centre, Wanchai, Hong Kong**	www.seafoodexpo.com/asia
29 September to 2 October	**Ceduna Oysterfest, Ceduna, South Australia**	www.ceduna.sa.gov.au/oysterfest
1 to 2 October	**Narooma Oyster Festival, Narooma, New South Wales**	www.naroomaoysterfestival.com
6 to 9 October	**Palm Cove Reef Feast, Palm Cove, Queensland**	www.reeffeast.com.au
22 to 23 November	**FRDC Board meeting, Canberra**	02 6285 0400

FRDC
FISHERIES RESEARCH & DEVELOPMENT CORPORATION

fishfiles

Discover
the latest information on fish species

Catch of the day

King Prawns
King Prawns are the most popular species of prawn in Australia, due no doubt to their rich flavour and moist flesh. They are extremely versatile and excellent for display purposes. Suggested coatings include batters (regular or tempura) with a touch of saffron.

Recipe of the day

Lime and Lemongrass BBQ Skewered Prawns
The combined flavours of lemongrass, chillies, ginger, sugar and fish sauce will certainly entice you and your guests to more than one of these skewers at your next lunch or dinner event.

Find
delicious recipes, chef tips, events, fisher profiles and more!

Knowing
Trouble deciding on which fish? Look here for some help

Buying
What you need to know about handling and storing seafood

Handling
What you need to know about handling and storing seafood

Cooking
Everything you need to know about seafood

www.fishfiles.com.au