FISH

FISHERIES RESEARCH & DEVELOPMENT CORPORATION **NEWS**

VOLUME 29
NUMBER 4
DECEMBER 2021

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AQUAFEED INNOVATIONS

COUNTING CRABS

The art of filleting

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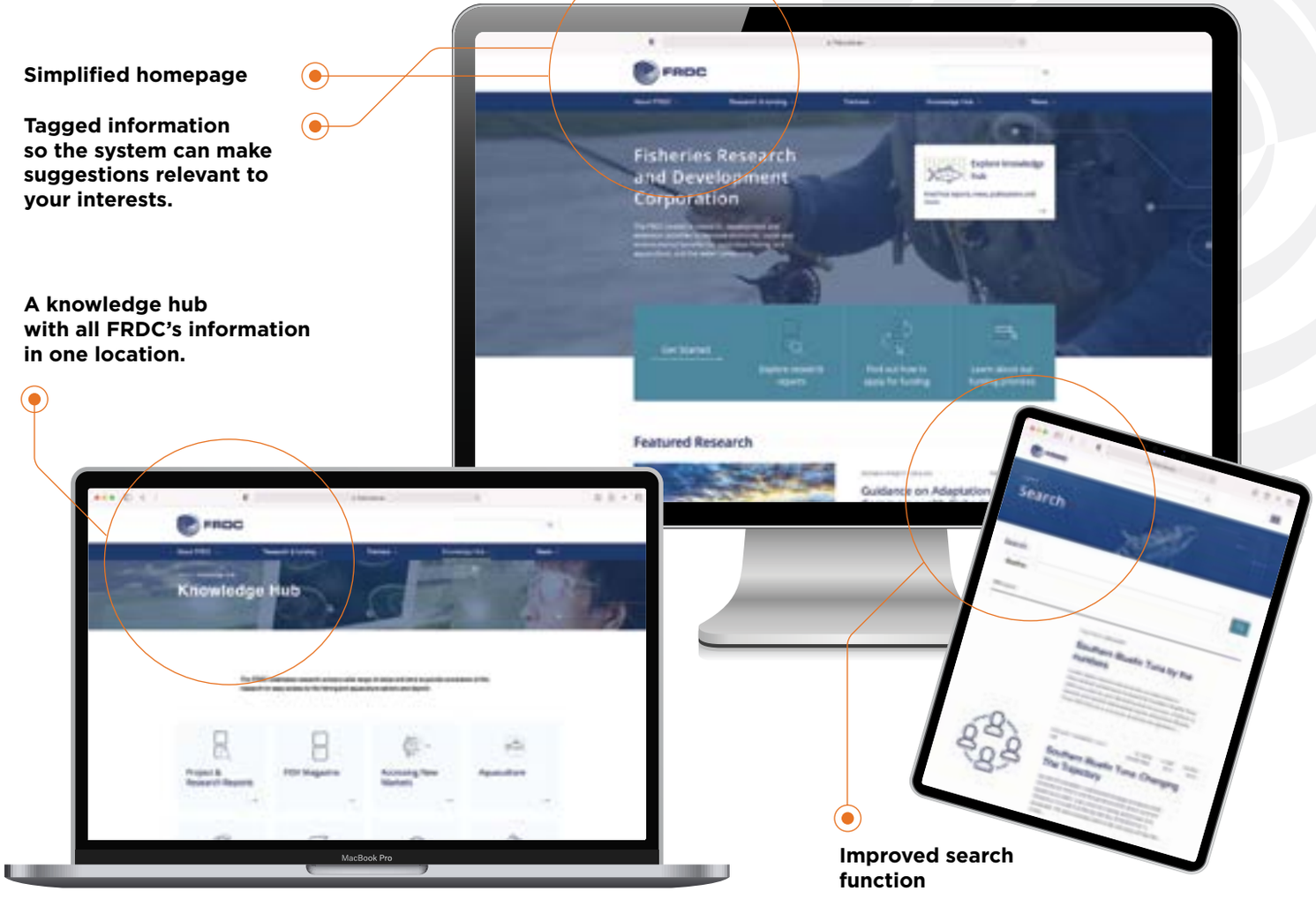

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REGULAR

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The **FRDC** plans, invests in and manages fisheries research, development and extension activities throughout Australia. It is a statutory authority within the portfolio of the Federal Minister for Agriculture, jointly funded by the Australian Government and the fishing industry.

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ISSN: 1833-4784 (Print)
ISSN: 2202-7122 (Digital)
Cover: Konway Challis
Photo: Evan Collis

The FRDC acknowledges the traditional custodians of the lands on which *FISH* magazine is produced, and pay our respects to their Elders past and present. We acknowledge the special relationship that Indigenous Australians have with their traditional lands and waters.

Industry actions to build trust

The actions industry players take, including speaking up about difficult issues, can enhance the growing community trust in fisheries and other rural industries

By **Anne Crawford**

The second year (2021) of a national survey shows that Australians have high trust in and acceptance of rural industries, including commercial fisheries and aquaculture.

The 'Community Trust in Rural Industries' (CTRI) program survey investigated how the public views people working in fishing industries. It found that more than four out of five people think fishers play an important role in Australian society.

Year two of the CTRI program built on baseline findings into what drives trust in primary producers, adding a fourth measure. It found that trust in and acceptance of rural industries depends on:

- the industry demonstrating environmental responsibility;
- the industry being responsive to community concerns;
- the quality of the products produced and their importance to community members; and
- the benefits of rural industries being shared fairly, especially with regional communities (distributional fairness).

The three-year program is an Australian first as it seeks to explore broadscale drivers of community trust of fishers and farmers. This initiative involves 11 different rural industries and industry bodies, including the FRDC, Seafood Industry Australia and Australian Council of Prawn Fisheries (ACPF), as well as the National Farmers' Federation and the New South Wales Department of Primary Industries. It ultimately aims to help rural industries develop a shared approach to long-term engagement with the community to further improve trust.

Lead researcher Kieren Moffat from Voconiq says trust is important because it allows the community to give industry the benefit of the doubt if something goes wrong. It provides the space to "make it right". It also gives industry the room to innovate and fosters confidence in the products fishers, farmers and foresters produce.

Below
Lead researcher, Kieren Moffat.
Photo: The World Bank Group

"We found that, when industries are silent on issues like welfare or the environment, community members don't assume the best."

Kieren Moffat, lead researcher

Value in speaking up

Moffat says a key finding is that people appreciate it when industries speak up on important issues. "This was a new addition to the year two [2021] testing. We found that, when industries are silent on issues like welfare or the environment, community members don't assume the best. When there are issues that community members care about, they expect industries to be on the front foot and be speaking up about those things," Moffat says.

Rachel King, Executive Officer ACPF, agrees.

"The standout for me was that the survey confirmed what we had always suspected – that silence on contentious topics breeds mistrust," she says. "If you know there's a social license risk and you are dealing with it, it's much better to be vocal about what you're doing," she says.

King says the results of the national survey on trust act as a proxy for the underlying sentiment the community has for the prawn fishing industry, identifying some of the triggers driving mistrust and pointing to what the industry needs to do to improve it.

The survey also shows that the community considers it important that industry is interested in, listens to and responds to its concerns.

"The survey is a really good way of demonstrating that industries are listening and wanting to do something with the information gained to help them align with community expectations," Moffat says.

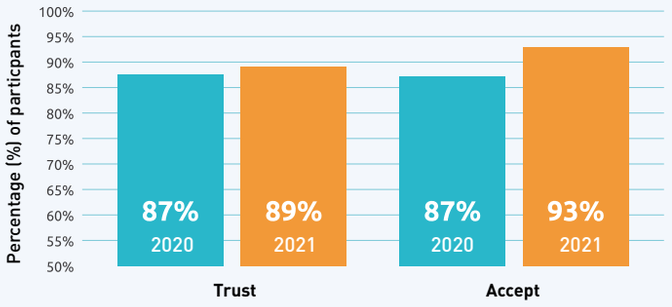
Environmental stewardship

In another main finding, most people (61.3 per cent) think Australian fishers, farmers and foresters are 'responsible stewards of the land and sea'. This is an increase from 56 per cent the previous year. As in the first survey, around 50 per cent of people agreed with the statement that Australian farmers, fishers and foresters managed their environmental impacts effectively.

Many of the survey's findings are about primary industries as a whole because research suggests the community thinks about them collectively; however, some findings relate specifically to the fishing and aquaculture industry.

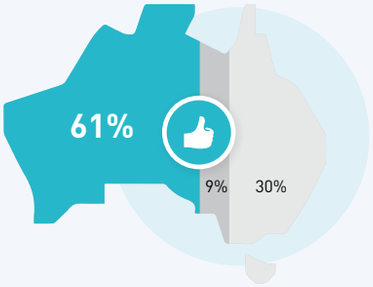
THE COMMUNITY TRUSTS AND ACCEPTS FISHERS, FARMERS AND FORESTERS

Trust in and acceptance of Australia's rural industries remains strong.
Both trust and acceptance have increased since year one (2021) of the program.#



#Percentages represent the proportion of participants that selected 3 ('moderately'), 4 ('very much'), and 5 ('extremely') on each question, on a five-point scale.

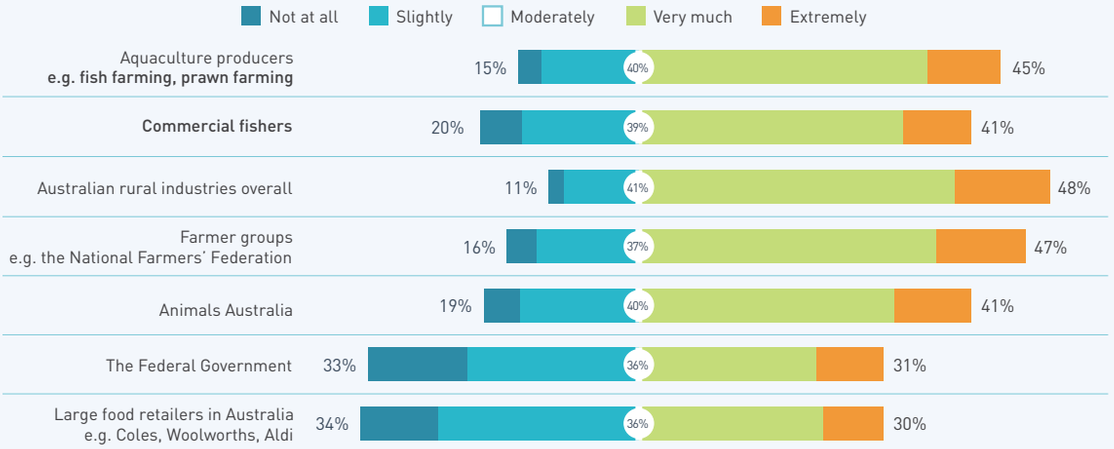
AUSTRALIANS SEE RURAL INDUSTRIES AS RESPONSIBLE STEWARDS OF THE LAND AND THE SEA



61%
of Australians agree that farmers, fishers and foresters are responsible stewards of the land and the sea.

(up from 56% in year one),
30% responded with 'neutral' and 9% disagreed.

OVERALL TRUST IN RURAL INDUSTRIES, COMPARED WITH OTHER GROUPS



Moffat says the finding that 82 per cent of people think fishers play an important role in Australian society was "a very strong endorsement".

Forty-two per cent of participants agree that Australia's oceans are sustainably managed, up from 36 per cent a year ago. "A good move in the right direction," he says. In other findings:

- 41 per cent of people strongly agree that commercial fishers act responsibly, while 44 per cent think aquaculture producers do.
- 85 per cent agree that fish provides important nutrition in the Australian diet.
- 86 per cent agree that rural industries play an important role in regional communities.

Moffat says there is a strong underlying message in this data that, across the country, Australians really care about rural industries, including fishing and aquaculture, and want to see them thrive.

The survey found the primary products themselves allow community members to feel a deeper connection to the people producing them.

"The products are the touchstone in the relationship – that's why quality is important, food safety is important and transparent labelling is important, because it is connected to trust," he says.

COVID response

An interim or 'pulse' survey of 2000 people undertaken in May 2020 to test the effect of the COVID-19 pandemic found a big leap in trust and a correspondingly large improvement in acceptance of rural industries.

"It's almost like community members saw rural industries in a different light in these uncertain times, that having fresh produce on shelves was incredibly comforting to Australians," he says.

More than 5300 people were surveyed in 2020, with a total of more than 14,000 Australians across the two years of the program sharing their views on a

➔

wide range of topics and issues related to rural industries. A workshop with 70 people representing almost every part of Australian rural industry was held in August 2021 to present data from year two of the program.

The third year of the project is concentrating on particular industries, including cotton, horticulture and sugar, to find ways to work on aspects such as community trust for these industries, and then for rural industries collectively.

The wildcatch prawn industry is also a focal group. "It's great for the ACPF that we're involved," says King.

Prawn engagement program

The focus of the ACPF's role is to observe the effect that the 'Australian Wild Prawns' community engagement program is having on both the industry and its identified stakeholders.

The community engagement program is being run with support from the FRDC. It was launched in 2018 after concerns the wild prawn industry needed to urgently lift its profile and improve community trust. "There was an underlying mistrust that the industry was aware of, a rift between themselves and the community," King says.

"These misunderstandings can result in loss of fishing grounds. We knew of underlying and often outdated misconceptions about bycatch, whether trawling is sustainable, how fishing grounds are managed and whether we leave fish for other people.

"To remedy misconceptions, we knew we couldn't talk at people, we needed to show them what we were doing and have others vouch for this."

'Australian Wild Prawns' is the largest single program delivered to address social license for the Australian seafood sector. In the program, people tell stories about their fisheries and investment in research and innovation. It won the Western Australian Fishing Industry Council (WAFIC) Seafood Industry Promotion Award in 2021.

The program has reached more than five million people to date. The ACPF is using the findings of the 2021 community trust survey in evaluating the program's effectiveness, which King says is in the final stage of reporting. **F**

To view the *Community Trust in Australia's Rural Industries: Year 2 national survey 2021* visit www.agrifutures.com.au/national-rural-issues/community-trust/

MORE INFORMATION
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www.agrifutures.com.au/national-rural-issues/community-trust/

FRDC RESEARCH CODE
2019-042

Below The 'Australian Wild Prawns' program will be included in year three of the national community trust survey. Photo: Australian Council of Prawn Fisheries

NEW INSIGHTS FOR YEAR TWO

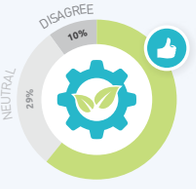
Rural industries in the spotlight during COVID-19

85% agree
community confidence in Australia's rural industries to supply fresh food is extremely high.

88% agree
having a safe and reliable supply of fresh food is comforting.

79% agree
they are more of the importance of food security for Australia.

However, increased support for rural industries has not led to a greater willingness to compromise on key concerns.



61% of community members agree economic sustainability of Australia's rural industries should not come at the expense of environmental management.

WHAT DO THESE RESULTS MEAN FOR INDUSTRY?

There is opportunity for rural industries to build on this already strong position by being proactive around the key drivers of trust.

Australians want industries to hold their own members to account when they do the wrong thing.

Rural industries must ensure that the significant benefits they generate are shared back to the regional communities in which they operate.

Knowing someone who works in a rural industry has an important effect on attitudes toward rural industries – facilitating more of these connections will grow trust.

PRIORITIES FOR INDUSTRY

Be responsive to community attitudes and communicate any changes.

Proactively engage in areas of community concern and, in turn, respond to breaking issues and crises quickly.

Demonstrate responsiveness through action.

Respond productively and consistently.

Use popular channels to communicate action and engage directly with the community, particularly on issues of uncertainty.

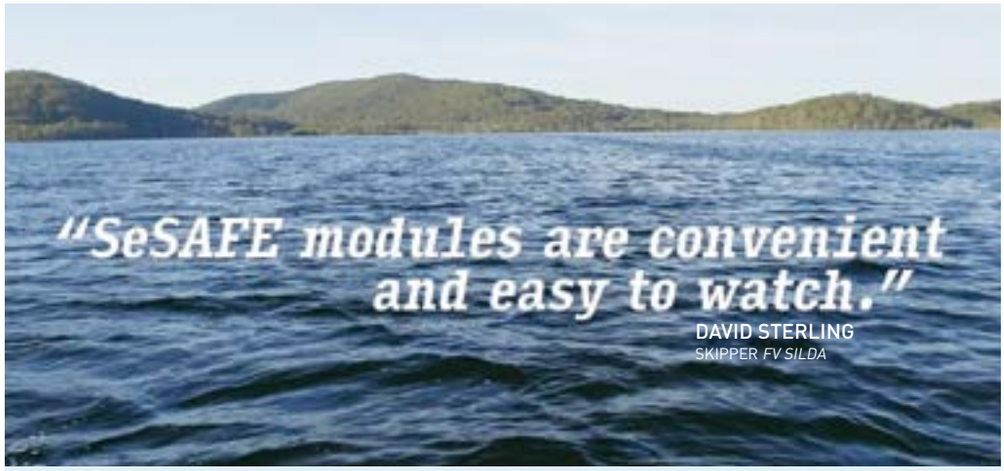
In brief

National Fisheries Plan

Australia's first National Fisheries Plan is expected to be released in February 2022 after extensive public consultation on the draft plan in September and October 2021.

The Department of Agriculture, Water and the Environment received 73 responses, including 23 formal submissions, to the public consultation process. Development of the plan is part of a 2019 Australian Government commitment to work with the Indigenous, commercial, recreational, aquaculture and post-harvest sectors.

The National Fisheries Plan aims to provide a shared vision and strategic framework to prioritise actions and enhance collaboration among Australian governments to drive sustainable growth of the Australian fishing and seafood community. It incorporates eight focus areas including employment and health, Indigenous opportunity, sustainability and adaptation to a changing environment. F



WHAT IF YOU DON'T COME HOME?

On World Fisheries Day on 21 November 2021, SeSAFE took the opportunity to shine the spotlight on safety on the water with a promotional video and a number of social media and industry messages highlighting how a well-trained crew is a safe crew who will come home.

The video powerfully conveys how every skipper's main responsibility is the safety of their crew and how everyone working on the water must be knowledgeable about safety.

The SeSAFE project is partially funded by the FRDC and has been running since 2018, delivering readily accessible and convenient safety training. This makes it easy to learn safety best practices and implement them daily, massively improving the safety of one of Australia's most dangerous occupations. Watch the video 'Safety is no accident – a message from Australian fishers and SeSAFE' on Vimeo F

SHARE YOUR FAVOURITE APPS

Members of the 'National Seafood Industry Leadership Program' (NSILP) are keen to hear about your favourite fisheries-related apps and what makes them work well. The survey is part of an NSILP team project for members of the NSILP's Port Lincoln cohort: Jaime McAllister, Luke Cordwell and Cassandra Pert.

Early suggestions of favourite apps include those for sea forecasts used before heading out fishing (RipCharts), logging commercial catches (the FisherMobile app connected to NSW FishOnline system), or checking on the sustainability of a fish before buying dinner (SAFS Sustainable Fish Stocks).

The team says while the adoption of new digital tools, including apps, presents a significant opportunity for the seafood sector, it is concerned apps offering great benefits could be lost among competing programs.

It aims to shine a light on the range of apps available and suited to different parts of the seafood sector and how these apps can be integrated into everyday activities. The group also wants to learn what makes a good fishing app and why many apps remain 'on the shelf', despite the best intentions of their developers.

Scan the QR code below to take part in the NSILP app survey. F

GET IN QUICKLY TO VOTE FOR AUSTRALIA'S GREATEST FISH AND CHIPS

The Great Australian Fish and Chip Awards 2021, organised by Seafood Industry Australia (SIA), is underway, searching for the country's best fish and chip businesses.

"In every town, across every state and territory, people spruik their fish and chips as number one, so let's put them to the test and crown Australia's best fish and chipper," says SIA CEO Veronica Papacosta.

"Voting in the MasterFoods™ People's Choice Award opened on 19 October and closes on 12 December, so you need to be quick to vote for your favourite. The state and territory winners will be announced at a virtual event on 14 December.

"Consumers can visit www.fishandchipawards.com.au and vote for their favourite fish and chip shop to take out the title. If you can't pick just one store, don't worry, you can cast a vote each day. There's even a live leaderboard on the website so you can keep an eye on your favourite store's position." F

More information:
www.fishandchipawards.com.au

Yellowtail Scad are an example of the baitfish found in abundance around the artificial reefs surveyed by UNSW researchers.
Photo: John Turnbull

ECOLOGY

WHY FORAGE FISH LOVE ARTIFICIAL REEFS

Food and safety are the key factors that draw more small foraging fish to artificial reefs than to natural reefs in the Sydney region. Researchers from the University of New South Wales (UNSW) have identified these drawcards in a comparison of five natural and three artificial reefs in Sydney. They found the vertical structures of artificial reefs allowed smaller fish to spread out and feed much higher above the seafloor than they can on natural reefs, while still remaining close to the safety of a physical structure. The fish also had access to more plankton to feed on than they would on a low-lying natural reef; good quantities of plankton are delivered higher in the water column by the East Australian Current. The greater number of small fish has flow-on benefits for their predators, such as the Bluespotted Flathead (*Platycephalus caeruleopunctatus*), one of NSW's most iconic commercial and recreational fish. NSW has eight artificial reefs, at South Head in Sydney, Port Hacking in South Sydney, Shoalhaven, Port Macquarie, Merimbula, Newcastle, Wollongong and Tweed Heads. The study, which has been published in *Marine Ecology Progress Series*, has implications for future reef design and recreational fishing initiatives. F

GENETICS

Fish names changes

Genetic testing has led to the reclassification of some well-known seafood species and changes to their scientific names, which have been updated in the Australian Fish Names Standard. These include Pacific Oysters, which have changed from *Crassostrea gigas* to *Magallana gigas*, and Striped Marlin, which has changed from *Tetrapturus audax* to *Kajikia audax*.

The scientific name for Baby Octopuses has also changed from *Octopus aegina* and *Octopus sp. A* to *Amphioctopus* spp. Periwinkles will change from *Trochidae*, *Margaritidae*, *Solariellidae* and *Tegulidae* spp. to Littorinidae, Neritidae, Trochidae, Margaritidae, Solariellidae, Tegulidae, Liotiidae, Areneidae and Turbinidae – these are families of undifferentiated genera (groups of related species), hence no italics.

New additions being considered for inclusion in the Fish Names Standard are Akoya Pearl Oyster (*Pinctada imbricata fucata*) and Blacklip Rock Oyster (*Saccostrea echinata*).

Visit the Seafood Standards website to request a change to a fish name, or an addition to the database, **http://seafoodstandards.com.au**

You can also find the approved common and scientific names on the searchable fish names database at **www.fishnames.com.au**

To receive regular updates about the Fish Names Standard or Aquatic Plant Names Standard, email **FNC@frdc.com.au** or **APNC@frdc.com.au**, respectively. F

ENVIRONMENT

PLASTIC DOMINATES BEACH RUBBISH

Ten years of data from citizen scientists have contributed to a University of New South Wales (UNSW) study that found plastic makes up to 84 per cent of all rubbish found across Australian beaches.

The UNSW-led study is based on one of the largest marine debris databases in the Southern Hemisphere, the Australian Marine Debris Initiative (AMDI), which was set up by the not-for-profit Tangaroa Blue Foundation in 2004. More than 2000 organisations and 150,000 citizen scientists have participated in the AMDI by sorting and tallying the marine debris they have collected. The study filtered and analysed 10 years of the AMDI Database and created a national map of patterns in marine debris. It found almost half of all debris could be related to land-based sources, such as litter and dumping on land, and seven per cent to dumping at sea.

But 42 per cent of the debris could not be related definitively to a source due to the debris breaking down into small fragments. The researchers say this highlights the legacy of plastic in our environment: microplastics formed by the plastic continually fragmenting into smaller pieces.

Results were collated nationally and also by the six 'bioregions' used to manage oceans and coasts: North (Northern Territory to Cape York); North-west (Western Australia); South-west (lower WA and South Australia); South-east (including Victoria and Tasmania); Temperate East (mainly New South Wales); and Coral Sea/Great Barrier Reef Marine Park (Queensland).

The South-east and South-west regions had larger numbers of fishing items, and the proportion of cigarette butts in the Temperate East was three times the national average, which shows a problem with local litter, the study suggested.

The findings have been published in the journal *Science of The Total Environment*. F

WORD-WISE

The **total allowable catch (TAC)** refers to the combined catch permitted in a fishery by all sectors: commercial, Indigenous and recreational.
The **total allowable commercial catch (TACC)** refers only to the share of the permitted catch that commercial fishers are allowed to harvest.
Quota is the volume of a species that can be harvested in a fishery, which may equate to the TAC for the whole fishery, or the TACC for the commercial sector, or for other specified stakeholders, such as a recreational fishing, or cultural fishing quota.
An **individual transferable quota (ITQ)** is the share of catch owned by individual fishers or businesses, and it can be bought, sold or leased. TACs, TACCs and quotas are generally measured in tonnes.
A **bag limit** is the maximum number of fish or animals of a particular species (or species group) that a recreational fisher can retain on a given calendar day. F

Aquaculture value, production rising

The increasing value of aquaculture and a larger market share for domestic seafood are highlights of the latest fisheries and aquaculture statistics

By **Catherine Norwood**

Aquaculture has overtaken commercial wildcatch as Australia's leading provider of fish and seafood by value, reaching 51 per cent of gross value of production (GVP) or $1.6 billion, compared to $1.58 billion for wildcatch in 2019–20.

The volume of aquaculture production increased by 11 per cent during the year, although commercial wildcatch continued to provide the bulk of product by weight – 62 per cent compared to aquaculture's 38 per cent, or 179,261 tonnes compared to 106,139 tonnes.

However, the total value of Australia's production dropped two per cent to $3.11 billion in 2019–20, from $3.18 billion the year before.

In the FRDC-funded annual *Australian fisheries and aquaculture statistics 2020*, the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) attributes the decline in total value to a combination of factors. These include reduced rock lobster exports, as a result of COVID-19 restrictions and lower export demand, and reduced catch of several other wild species.

The value of exports dropped by eight per cent (to $1.4 billion) and imports fell by four per cent (to $2.2 billion). The market share for imports also continued to decline, continuing a consistent trend since 2013–14 when it peaked at 68.9 per cent of seafood consumed in Australia. In 2019–20, the market share of imports was 61.9 per cent, a decline of one percentage point from the previous year.

Overall, seafood consumption in Australia is continuing to decline. ABARES says the total apparent seafood consumption was 12.4 kilograms per person in 2019–20, compared to a peak of 14.9 kilograms in 2012–13.

Projections

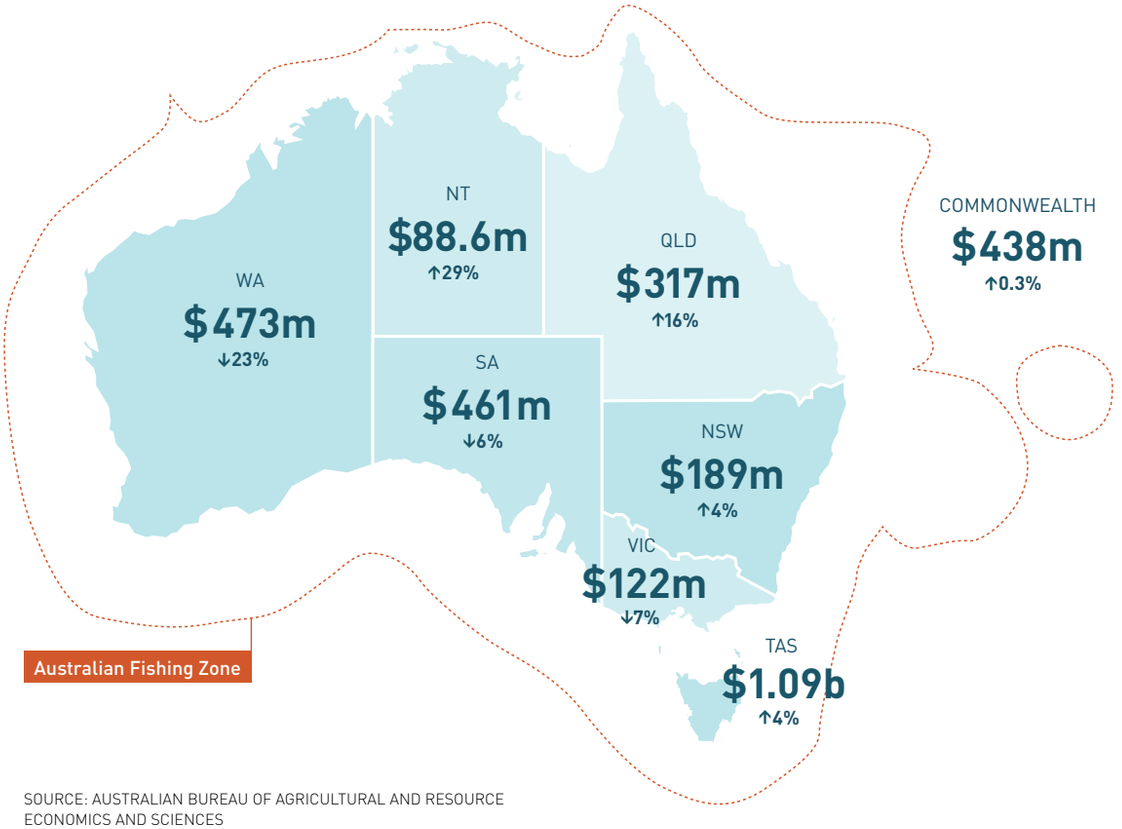
ABARES predicts the value of production will have continued to fall in 2020–21, caused largely by disruptions to domestic and international market conditions, including measures to address the spread of COVID-19.

These include demand-side disruptions to domestic and international markets and supply-side disruptions from social distancing measures across fishing and aquaculture activities, and difficulties in crewing vessels and sourcing inputs in some sectors. Industry initiatives such as moving from food service to retail sales have helped to mitigate some impacts.

However, the lower demand across much of the sector, which reduced GVP to $3.11 billion in 2019–20, is expected to continue. A further decline in GVP of six per cent in real dollars to $2.94 billion GVP is projected in 2020–21, before value begins to recover slowly.

Projections over the medium term (2021–22 to 2025–26) are highly uncertain, and the value of production is expected to remain below pre-COVID-19 levels during this period. While these are ABARES predictions, the commercial fishing and aquaculture sectors have shown remarkable resistance and capacity to grow that has confounded predictions. **F**

FISHERIES AND AQUACULTURE 2019–20 GVP BY FISHERY JURISDICTION



SOURCE: AUSTRALIAN BUREAU OF AGRICULTURAL AND RESOURCE ECONOMICS AND SCIENCES

MORE INFORMATION
Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), www.awe.gov.au/abares

FRDC RESEARCH CODE
2020-124

Konway Challis filleting a Banded Wobbegong.

Master the art of filleting and make the most of your catch

A new online guide provides the techniques and species knowledge to help recreational fishers (and others) produce restaurant-quality fillets from their catch in no time

Words **Brad Collis**
Photos **Evan Collis**

A plate stacked with deboned full-flesh fillets ready for the pan or grill is the goal of many fishers. And to help upskill the nation's recreational fishers, two enterprising Western Australians, Konway Challis and his brother-in-law Rick Knight, have created an extensive online library of filleting tutorials.

The pair has created Fillet Fish Australia (www.filletfish.com.au) to show people how to fillet Australian species quickly and efficiently and with minimal or no waste.

Challis and Knight both grew up in professional fishing families and have worked extensively as professional filleters for WA seafood processors. Challis is still involved in the seafood industry, running his own seafood business, and Knight is now a software developer.

Their video tutorials are free to view and range from beginner to advanced techniques and styles. The pair say their objective is to make filleting an enjoyable, more productive finale to a day's fishing. They want to improve people's understanding of how to do it well, and the importance of 'recovery rates'.

Weighing up recovery rates

Recovery rate refers to the weight of fillets as a percentage of the weight of the original whole fish.

For example, their website explains that if you were to fillet 50 kilograms of whole Snapper you would end up with 18 kilograms of fillets; the recovery rate is 36 per cent. The formula is 'weight out' (after processing) divided by 'weight in' (before processing), multiplied by 100; for example, 18/50 × 100 = 36 per cent. For professional fishers and processors, even a two per cent difference in the recovery rate per fish can be the difference between a marginal or profitable business.

The Fillet Fish Australia website features a chart listing the optimum recovery rates for different species and a calculator for estimating how many servings a whole fish of a particular species and size should produce, if filleted properly.

Challis and Knight say the key factors affecting recovery rates are:

- the condition of the seafood;
- the sharpness of the knife; and
- the skill of the filleter.

Maximise value

Challis is keen to point out that recovery rates are not the full picture; the rest of the fish still has use and value.

"While Aussies tend to prefer fillets, a lot of cultures cook the whole fish, especially if it is baked. The wings are good to barbecue, and the heads and frame can be boiled to make fish stock, fed to pets or used as bait to catch other seafood such as crabs." Challis says he sells the pieces he removes in filleting to a restaurant supplier for use in Asian cooking.

In addition to the filleting videos, the Fillet Fish Australia website has short articles covering knives, safety, optional styles and techniques for people's different needs and preferences. It discusses the advantages of catching, or buying, whole fish and filleting them yourself – especially if you can make use of the rest of the fish – as well as how to pack and store fillets.

The filleting styles covered by the tutorials are widely used in the seafood industry as they are suited to a range of species, have good recovery rates and are safe for the user.

Sharing skills

For Challis, the website has been a labour of love born from his observations of poor and wasteful filleting practices and the wide skills gap between the average fisher and professionals in the seafood processing sector, which he sees as unnecessary.

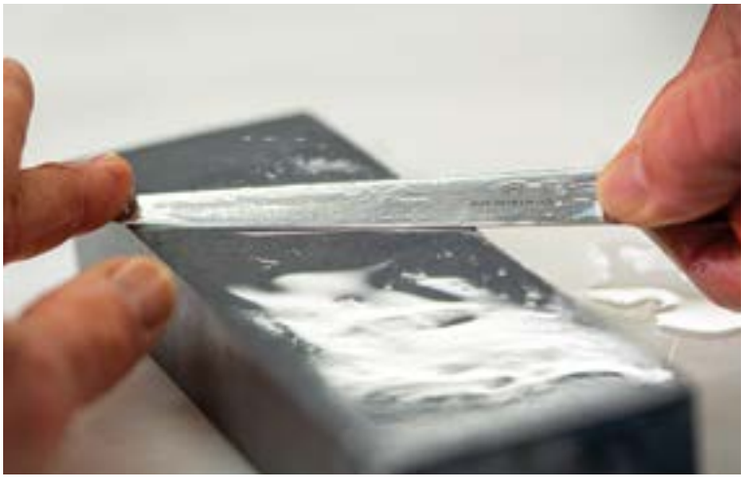
"I'd look in boat ramp bins at the end of a day and see so many usable pieces of fish and think what a shame that people have spent all that money on boats and gear, learning knots and other boating skills, but not learnt how to properly treat their catch."

This sparked the idea for Challis and Knight.

"We could both see the need and were thinking about a website for quite a while before finally doing something," says Challis.

He explains how they were initially put off by the seemingly large number of online filleting videos. "But they were mostly amateurs who didn't really know what they were doing; just videoing what they do and sometimes passing on bad techniques.

Below Konway Challis sharpening his 16cm Swibo stiff-bladed boning knife on a Japanese water stone. Once stoning is complete the edge will then be honed and maintained with an F. Dick sharpening steel.



Below Trimming out the bloodline of a Banded Wobbegong; the next stage is to remove the very tough sandpaper-like skin and further trim the fillet of blood.

Above Konway Challis filleting an Atlantic Salmon; first fillet being removed and placed on the filleting bench.

Right Filleting a Red Emperor with an over-the-rib technique. The first fillet is about to be removed by running the knife along the ribcage and then cutting out at the belly.

Right Halfway through filleting the first side of a Red Emperor, about to cut over the raised section of spine and continue cutting the other side, following the frame closely with his knife.

Right Pin boning an Atlantic Salmon. Industrial tweezers are used to remove all the individual bones that run approximately halfway down the fillet.

Right Dry-filleted Atlantic Salmon portions ready to be packaged and vacuum sealed for sale at Challis's business Red Gill Fish.

"So, a few years ago, after seeing what was out there and realising something better was needed, especially for local species, we bought a good quality video camera and teamed up … I did the filleting and Rick did the videoing and website development."

Local content

"So far we've made 103 videos, concentrating on WA species, but the website analytics show that our audience is worldwide," says Challis. "We cover filleting, skinning and pin boning, and all the skills you need to produce completely boneless fillets."

In the videos, he discusses the importance of knowing a species' bone structure, and the appropriate techniques and specificity of knife cuts for that species.

"Because we cover all of the most popular West Australian and Australian species, you can watch a video for the actual fish you have caught."

The value of the Fillet Fish Australia tutorials is becoming increasingly recognised by bodies such as Recfishwest. It comes at a time when reducing food waste has become a global concern and a key component of making food industries more sustainable.

Recreational fishing is one of the great Australian outdoor activities – estimated to be worth $2.56 billion to the economy – but the value of the actual seafood caught could be increased considerably if more amateur anglers take the challenge to improve their filleting skills. **F**

MORE INFORMATION
www.filletfish.com.au

Chasing giants

Diverse approaches are being trialled to gather more data about two of Australia's giant crab fisheries, reflecting the differences in the species and the way they are fished

By **Corrina Ridgway**

Deep on the continental shelf line in the cold waters off southern Australia, brilliantly patterned giants of the crustacean kingdom wander.

These enigmatic goliaths are *Pseudocarcinus gigas*, or the Giant Crab, and they form part of commercial fisheries across Tasmania, Victoria, South Australia and southern Western Australia.

Oceans away, in the warm, shallow waters along the mangrove coasts and gulfs of the Northern Territory, Queensland and New South Wales, another giant swims: *Scylla serrata*, the Giant Mud Crab.

Both are high-value species that form part of state fisheries and they have potential for stable, sustainable futures. But there is a frustrating lack of data about them, and two new FRDC-funded projects were launched last year to address the gaps.

There are significant differences between the species, their life cycles, the size of the fisheries and how fishers operate. These differences are reflected in the approaches researchers are using in their quest for better data, which will be used to improve stock assessments and inform catch limits in the respective fisheries.

A key consideration is to create data-collection processes that are both economical and practical. Collaborations with fishers are critical to both projects.

Deepwater giants

Giant Crabs are currently seen as a single population across southern Australia, and they are caught in traps and pots along the continental shelf in depths of about 200 metres. Slow growing, they live for more than 30 years, can weigh over 10 kilograms, and take four to seven years to reach legal size.

All state fisheries have limited entry and are managed by quota, and by spatial and temporal closures. From 2010 to 2019, the annual catch ranged between 43 and 89 tonnes, with the largest volumes harvested from Tasmania.

At the Victorian Fisheries Authority (VFA), Fishery Manager Toby Jeavons is leading the multi-jurisdictional project to fill knowledge gaps in Giant Crab population data.

He says crab size frequency is critical data for current stock assessment models. But the remote, deepwater habitat of the species and the boutique nature of the fisheries make getting enough data difficult.

The data that are available are also "highly volatile" as a result of equally variable fishing efforts. The limited data, and their volatility, make it challenging to detect changes in the stock levels. The 2020 Status of Australian Fish Stocks (SAFS) Reports (www.fish.gov.au) identifies the species as sustainable in South Australia, Victoria and Western Australia, but depleted in Tasmania.

The FRDC Giant Crab project is co-funded by a University of Tasmania (UTAS) College of Sciences and Engineering incentive grant. It is trialling an innovative tech-driven

→

approach using software and onboard cameras to gather data needed to improve the accuracy of stock assessments.

The project team includes the UTAS Institute for Marine and Antarctic Studies (IMAS) and its School of Information and Communication Technology, the South Australian Research and Development Institute (SARDI) and the VFA. Giant Crab fishers will work with researchers to trial new technology to capture carapace images onboard their vessels once the project advances beyond land-based trials.

Carapace images

To take carapace images, crabs are placed on a pressure-sensitive pad marked with a grid to record size. Initially, the crab's weight will trigger image capture, but there are plans to head towards auto-detection. The customised software program being developed then automatically analyses the image taken, recording the crab's carapace length, sex and a 'unique ID'. This ID will use images of the crab's mottled carapace as a 'fingerprint', which will be collated in a central database. The recapture and re-recording of previously released undersize crabs will help measure growth rates, when old and new carapace images are matched.

Careful design of the system is ensuring it will be economical, efficient and robust enough to deal with the demands of open ocean fisheries.

The project team is working closely with fishers in all jurisdictions to ensure equipment will be safely and easily integrated into the working areas and processes on various vessels. Tech issues created by low light, vessel vibration, crab angle to camera, and rough conditions mean researchers must trial their new system extensively to avoid poor data quality.

Progress has been rapid, and onshore tests of the system on Giant Crabs held at IMAS have already achieved 95 per cent software accuracy for sex determination.

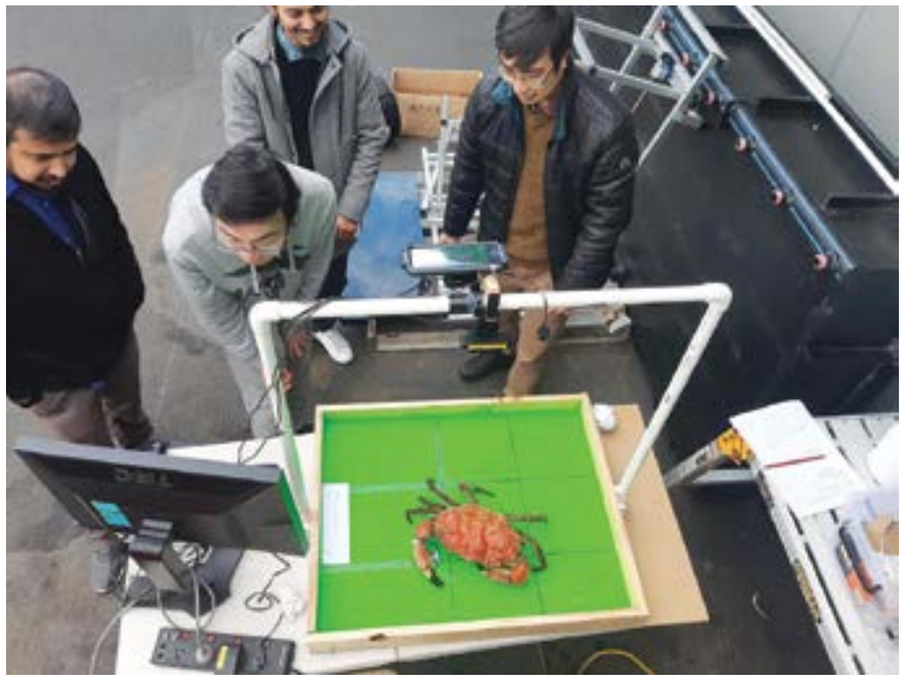
Initial onboard trials to refine the system are expected to start before the end of 2021, and a larger trial across the jurisdictions will start in April 2022. The project is due to report in 2023.

If the technology is successful, there is the potential to use it with other species that also have limited data.

"The Crystal Crab (*Chaceon albus*) fishery provides a good extension opportunity where clear benefits could be delivered, and we could examine the transferability of the technology to other fisheries," explains Jeavons. "Crystal Crab live in a similar environment, have the same data-collection challenges and are targeted with similar fishing methods to those of Giant Crabs."

Queensland initiative

At the Queensland Department of Agriculture and Fisheries (DAF), Principal Fisheries Scientist Julie Robins has been watching the Giant Crab project with interest, although she says the onboard, high-tech solution from the south is not well suited to her fishery.



Above IMAS ICT research team members (L to R) Ananda Maiti, Rui Lyu, Bijaya Bhattarai and Son Tran testing the image-capture software and device at UTAS facilities.
Photo: Ben Quigley

Robins is leading the Giant Mud Crab assessment project, which takes in fisheries along more than 7000 kilometres of the NSW and Queensland coasts. The four-year project kicked off last year and aims to provide data to support a harvest strategy and future stock assessments while also trying to determine where berried females go to hatch eggs.

Giant Mud Crabs are a rapid-growing, short-lived and abundant species. They have a lifespan of about three years, and males reach legal size in Queensland, where the bulk of the catch comes from, at 18 to 24 months old. Queensland does not permit the harvesting of female Giant Mud Crabs.

The species provides a high-volume fishery with heavy recreational and commercial pressure, but is classified as sustainable according to the latest SAFS Reports. The combined Queensland and NSW harvest from both commercial and recreational catch was estimated at more than 1300 tonnes in 2019. About 86 per cent of the catch is from the east coast of Queensland, which has averaged an annual harvest of 1000 tonnes during the past decade.

Robins says a major catch failure in 2016 in areas of the Northern Territory coincided with droughts and high temperatures, providing evidence that stocks are susceptible to climatic events. With increasing climate variability and rising temperatures, this makes understanding stocks and identifying population changes increasingly urgent.

Giant Mud Crab data gaps

The ban on harvesting females and minimum size regulations in Queensland have unwittingly contributed to a lack of information on female abundance, sex ratios, growth rates and mortality.

Robins says the main data used to assess stocks are commercial catch rates. But these do not always represent changes in population abundance, partially due to passive trapping methods.

The FRDC Giant Crab project ... is trialling an innovative tech-driven approach using software and onboard cameras to gather data needed to improve the accuracy of stock assessments.

With Queensland's Giant Mud Crab fisheries recently moving to quota, she highlights the paramount importance of having confidence in the total allowable catch limits for quota in ensuring a stable future for the species, and for fishers.

The research will provide data on crab growth, movement and mortality. It will also develop and assess a method to monitor biological information of regional crab populations, examine genetic mixing of regional crab populations, and trial ways to understand the migration of females.

Data will be sourced through a combination of citizen science, commercial collaboration, modified gear trials and tagging techniques.

Robins admits the project has its challenges.

"Giant Mud Crabs are a simple crab with complex behaviours and life history," she says. "This includes migration of berried females and regular moulting. Egg-laden females migrate offshore to lay their eggs, which are then dispersed by tides and currents. But we don't know much about their movements."

Above Julie Robins collecting material for genetic analysis.
Photo: Department of Agriculture and Fisheries, Queensland

Top Legal male crab, Queensland east coast.
Photo: Department of Agriculture and Fisheries, Queensland

Tracking female crabs

The remote nature of the migration, often more than 90 kilometres offshore, coupled with seasonal moulting issues, means researchers must be innovative in tracking. Tag attachment trials are underway to ensure tags do not interfere with the crab's moulting or movement. Both acoustic and satellite tags are being considered.

"Satellite tags rely on females surfacing, which is not guaranteed. Due to Queensland's extensive network of acoustic receivers, we are looking at trialling acoustic tags that transmit underwater, but the crab still needs to pass within about one kilometre of a receiver," Robins says.

Citizen science is an important component of the research into females. Robins is asking commercial and recreational fishers to report sightings of berried females with a photo, location and date. This information can be reported via email to info@daf.qld.gov.au or phone to 13 25 23.

Tags will also be used for tag recapture work on about 5000 undersized animals. This information will feed into movement, natural mortality and growth estimates, which are important in stock assessments.

Survey pots will be trialled to collect data about the abundance of undersized crabs, sex ratios and size frequencies over time.

Robins says the data-gathering technique that will be the simplest to roll out is, surprisingly, the genetic analysis of samples to track gene flow between populations in Queensland and NSW.

Giant Mud Crab populations along the east coast are recognised as part of a single connected stock; however, they are managed by the states as separate populations. The finer-scale genetic data analysis will uncover the importance of gene flow, with potential implications for management arrangements.

Robins notes that, due to fishing practices and the life history traits of the species, using image-recognition software and annual recapture methods would be more difficult in the Giant Mud Crab fishery than in the southern Giant Crab fishery.

"Giant Mud Crab fishers work in small boats usually open to the environment. They are often restricted by tides when checking their pots and need to operate efficiently," she says.

Although it may be possible to use unique photo ID, the short lifespan of mud crabs and sheer numbers create new complications with recapturing the same animal. The possible volume of camera data may also prove overwhelming.

That is not to say different techniques used on different stocks cannot be adapted; Robins is positive about such opportunities. "That's the good thing about the FRDC. It is great at facilitating different approaches to stock assessment and it promotes collaboration and idea transfer across its projects," she says. The Giant Mud Crab project is due to report in 2024. F

MORE INFORMATION
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FRDC RESEARCH CODES
2019-114, 2019-062

Collaborations key to sharing fisheries resources

World Fisheries Congress delegates identified collaboration and communication as key to the urgent action needed to address fisheries issues and equitable access to aquatic resources

Photo: Shutterstock

By **Catherine Norwood**

What a difference 20 years makes. When Australia hosted the 2nd World Fisheries Congress (WFC) in Brisbane in 1996, many were predicting the demise of marine fisheries. Two decades later, the status of Australia's fisheries is far more positive.

For eight consecutive years, Commonwealth fisheries have not been subject to overfishing. Internationally, the depleted Southern Bluefin Tuna (SBT, *Thunnus maccoyii*) stock is rebuilding. Australia has led the stock monitoring and assessment science and partnered in the regional fisheries management to make this possible. SBT in Commonwealth waters are now classified as "recovering".

With successes such as these proving that science, management and stakeholders working together can result in sustainable harvest of fish stocks, many new challenges have emerged that were not even considered 20 years ago.

Guide to new issues

The 8th WFC in September 2021 provided a guide to many of these emerging issues, with conference organisers providing public access to the keynote presentations. The WFC speaker videos are a must-watch resource to help the public understand these challenges and what can be done to make a difference.

Hosted from Adelaide in South Australia, the virtual congress saw more than 1200 delegates from over 60 countries come together online to discuss the future of the world's fisheries, with more than 800 presentations and posters.

Several speakers identified the coming decade as critical to establishing new or adaptive management to help fisheries respond to the changes in oceans and distribution of marine life that are already underway.

These included the opening keynote speaker, Ambassador Peter Thomson, the United Nations Secretary-General's Special Envoy for the Ocean. He said despite the climate "red alert" in August 2021 from the United Nations Intergovernmental Panel on Climate Change, there were significant opportunities for international action at a government level in the next 12 months to support the future of fisheries globally.

Innovation was a prominent theme in many sessions, with discussion about offshore platforms producing clean energy, carbon-sequestering seaweed and satellite technologies for precision harvesting in capture fisheries.

The congress identified common challenges and opportunities for the sector such as communication, community trust and the need for collaborative effort to achieve common goals.

Congress Chair Gavin Begg said it was clear from the more than 800 presentations and posters at the congress that there has been significant and ongoing progress in fisheries science and management, and industry innovation since the first congress was held almost 30 years ago.

This was despite some familiar challenges remaining, such as overfishing. Although these issues persist, the thinking around them and the strategies used to address them have advanced. New issues have also emerged, such as climate impacts and plastic pollution.

Key challenges highlighted during the congress included:

- understanding and managing the complexity of whole systems;
- sharing oceans and rivers with multiple users;
- improving workforce safety, gender equality and recognising the significant role women play in the seafood sector;
- recognising the importance of traditional customary fishers and their participation in decision-making processes;
- preventing overfishing and recovering overfished stocks;
- addressing and responding to climate change;
- stopping plastics from getting into aquatic systems and other pollution;

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Growth for enduring prosperity

- developing the resilience to recover from COVID-19 pandemic impacts and preparedness for similar future challenges; and
- securing sustainable small-scale fisheries and equitable access to resources.

Common solutions included:

- developing and applying new and emerging technologies;
- promoting coastal and inland fisheries in food security and economic development;
- co-managing fisheries to provide stewardship of resources, with participatory decision-making involving scientists, fishers, managers and other stakeholders (doing it together);
- co-designing solutions across scientific disciplines and stakeholder groups to develop innovative, locally tailored solutions to industry issues, such as bycatch; and
- building capacity across all sectors – commercial, Indigenous, recreational and research and management.

Begg says a clear message is that communication is key to all work being done.

"It needs to be open and transparent, knowing that stakeholder engagement takes effort and trust, and it is an ongoing dialogue. As noted in a number of presentations, fisheries are about people; the importance of building relationships is critical."

He says recognising the importance of stakeholders in fisheries, organisers made a concerted effort in the design of the congress to ensure those who depend on fisheries – commercial, Indigenous and recreational fishers, as well as their communities – were included as a key part of the event.

"I think their involvement and contribution to discussions has made the event richer," Begg commented. There were also more than 200 students who joined sessions from around the world.

Despite planning for an in-person event, Begg says the move to the virtual format in response to the COVID-19 pandemic and restrictions proved a success.

"The live Q&A and discussion forums available in the portal for each session encouraged broad and active participation, which lead to in-depth debate and discussion of key topics. These were a highlight for many.

"One of the biggest benefits of the virtual platform is that all sessions and presentations were recorded, providing a valuable resource that is available to all delegates until March 2022. The virtual format also allowed those who were previously unable to travel to participate in the congress, and it was great to see delegates from many countries attending the event."

The Government of South Australia, and the Australian Government, through the FRDC, were major sponsors of this international event.

FRDC Managing Director Patrick Hone is optimistic about the future of Australia's aquatic fisheries and aquaculture sectors. He points to the Fish Forever 2030 sector strategy developed in conjunction with fisheries stakeholders as showing a broad commitment to having healthy aquatic habitats supporting healthy community renewable use.

FISH BIOLOGY RESEARCH AWARDS

As part of the 2021 World Fisheries Congress in September, the Australian Society for Fish Biology (ASFB) celebrated its 50th anniversary with several virtual events, including a student networking night and its annual general meeting.

The ASFB was an official host of the congress, along with the World Council of Fisheries Societies, and the event took the place of the society's annual conference. Therefore, the ASFB announced its annual award winners during the congress, including congress-related student awards.

The ASFB's major award winner for 2021 is Tasmania's Gretta Pecl, who won the K. Radway Allen Award for outstanding contribution to fisheries science. Hall of Fame awards for career contributions to fisheries and the society were presented to Anthony Fowler, Lindsay Marshall, Mark Lintermans, Jeff Johnson, John Koehn and Charles Todd. Todd was also presented with ASFB lifetime membership. Curtis Champion was presented with the Early Career Excellence Award for an outstanding early career contribution to fisheries research.

Graduate student research awards included:

- The **Barry Jonassen Award** for student research into freshwater fish biology or fisheries, won by Nur Un Nesa (James Cook University) with Patricia Koh the runner-up (University of Melbourne);
- The **Michael Hall Award** for student research into marine fish biology or fisheries, won by Molly Moustaka (University of Western Australia) with Elliott Schmidt the runner-up (James Cook University); and
- **The ASFB video competition in science communication**, won by Qiaz Hua (University of Adelaide).

Congress-related student awards sponsored by the FRDC included:

- The **John Lake Award** for best graphical abstract, won by Jessica Bolin (Senior Winner; University of the Sunshine Coast) and Clement Ng (Junior Winner; University of Melbourne); and
- The **Gilbert P. Whitley Memorial Student Award** for best oral presentation, won by Kynan Hartog-Burnett (Senior Winner; James Cook University) and Adrienne Gooden (Junior Winner; Flinders University).

Several additional student awards were presented as part of the congress, sponsored by the Harry Butler Institute including:

- **WFC Oral Presentation**, won by Patrick Nicolle (University of New South Wales);
- **WFC Speed Presentation**, won by Mary Grace Sedanza (Nagasaki University); and
- **WFC Video Competition**, won by Lola Coussau (Université du Québec à Rimouski).

Next congress

The 9th World Fisheries Congress will be hosted by the American Fisheries Society in Seattle, Washington, from 3 to 9 March 2024. The theme will be 'Fish and fisheries at the nexus of the food, water and energy debate'. **F**

MORE INFORMATION
www.wfc2021.com.au

FRDC RESEARCH CODE
2018-059

INDIGENOUS HERITAGE
The World Fisheries Congress was hosted on the lands of the Kaurna people of the Adelaide region.

The race to improve ocean outcomes

Photo: 123RF

From global initiatives to fishery-based strategies, two speakers at the World Fisheries Congress outlined action needed for healthy oceans and to help fisheries adapt to climate change

By **Catherine Norwood**

Warming temperatures and ocean acidification are already causing significant problems for the world's oceans. In his keynote presentation at the World Fisheries Congress in September 2021, Ambassador Peter Thomson, the United Nations Secretary-General's Special Envoy for the Ocean, outlined the dire scenario playing out.

"There is no healthy planet without a healthy ocean, and ocean health is measurably in decline," he told delegates in the opening session of the virtual event.

"The oceans are acidifying at the fastest rate in history, accompanied by accelerating deoxygenation and warming. With a warming atmosphere and ocean, the level of the ocean is on the rise, already threatening low-lying coastal lands, coral atolls and alluvial deltas."

Positive steps

Despite a bleak summary, Thomson remained positive that it was still possible to "heal much of the harm", and a series of major international policy decisions being discussed over the coming year could help.

These included the November 2021 UN global climate summit in Glasgow, a proposed international treaty to prevent marine plastic pollution, the UN Global Oceans Conference in 2022 and World Trade Organization talks to end harmful fishing subsidies.

Thomson said ending the subsidies would make a major contribution towards achieving the UN Sustainable Development Goal 14 by 2030, which is to "Conserve and sustainably use the oceans, seas and marine resources for sustainable development".

Other actions he said will make a difference include greater investment in a sustainable blue economy for energy production from offshore winds, currents and tides, and increasing marine protected areas from the existing target of 10 per cent to 30 per cent (with multiple uses permitted). The current protected area totals eight per cent of oceans globally.

More countries signing the Agreement on Port State Measures would help end illegal, unreported and unregulated (IUU) fishing. The agreement prevents IUU fishers from landing their catch at ports in participating countries. Australia is one of 69 countries that are parties to the agreement.

Thomson also said the conservation and management measures that regional fisheries management authorities suspended during the COVID-19 pandemic needed to be restored, and increased surveillance of transhipping (transferring goods from one ship to another), which increased during the pandemic, is required.

He warned it was "dangerously negligent" not to consider the impacts of climate change on marine life and flow-on effects to the nutrition of billions of people. The next decade is seen as critical in limiting global warming to 1.5°C, a tipping point beyond which many ecosystems will no longer be able to adapt and survive, including marine environments.

For example, a 2018 report from the United Nations Intergovernmental Panel on Climate Change (IPCC) confirmed with a high degree of confidence that 70 to 90 per cent of tropical coral reefs will be lost at 1.5°C of global warming, with virtually all being lost at 2.0°C. F

R&D PLAN OUTCOME 1
Growth for enduring prosperity

Action to adapt: steps for fisheries managers

CSIRO Oceans and Atmosphere Research Director Alistair Hobday, who also presented at the World Fisheries Congress, outlined further steps he believes fisheries managers could take to help fisheries be better prepared for climate change, and why it matters.

"This decade of climate change is locked in," he said. "Whichever climate warming scenario we end up following, best case or worst case ... we see similar rates of warming over the next decade.

"[In 10 years' time] we are likely to cross the 1.5°C warming, which indicates dangerous climate change. For many habitats and environments on earth, crossing 1.5°C is the point of no return, with coral reef habitats being the example of where we will see really dramatic change."

But, Hobday said, it was not just long-term trends that mattered; extreme events are also important. Marine heatwaves, for example, represented increasing climatic variability and are a precursor to what the marine climate might look like in another 10 or 20 years. Hobday also noted the Australian south-east and south-west areas of ocean are temperature hotpots with average increases double the ocean average.

As a result of these environmental changes, species distributions and ranges were changing around the world, he said. Phenology was also changing – the timing of seasonal or periodic events such as migrations – and new diseases were emerging.

"For many fishers and managers, the evidence of climate change is right in front of them ... it has been an easy conversation, to say that distribution change is the evidence of climate change."

Management actions

Hobday offered five priorities for the decade ahead.

1 Incorporate climate change into fisheries assessment and management.
An assessment of current management documents across Australian fisheries jurisdictions found that fewer than half mentioned climate, which indicated a lack of guidance for managers. For documents related to multiple fisheries, only 30 per cent mentioned climate and 18 per cent referred to climate actions, but 40 per cent included environmental protection considerations and initiatives such as restoration, creating protected areas, restocking or plastics.

2 Help industry and management manage environmental risk, short and long-term, with adaptation options.
Hobday says there will not be a single winner in terms of the best options, and a new handbook is available to help fisheries stakeholders assess possible options. CSIRO researcher Beth Fulton officially launched the *Adaptation of fisheries management to climate change handbook* during the congress.

This publication, produced with FRDC funding, is designed to help fishers and fisheries managers identify effective responses to climate change by working through an evidence-based process. It was developed by CSIRO with the Australian Fisheries Management Authority and the Institute for Marine and Antarctic Studies at the University of Tasmania.

3 Test adaptation options.
This would require using models to explore new scenarios and unknown futures. Hobday highlighted that models that focused on single species would not be effective because of the complex interactions within ecosystems, and between species, in their own adaptative strategies to climate change.

Complex models would be needed, and these should link physical, ecosystem and human aspects.

4 Use new technologies to accelerate data gathering, improve its efficiency and reduce costs.
Developments such as cameras, remote sensing, radar harvesting and vessel monitoring were capable of producing near-real-time data, but also posed issues in terms of data management and handling the vast quantities of data produced. Genetic technologies are also contributing to improved data gathering, and image analysis via machine learning opened exciting opportunities for fisheries management, regulation and business operations.

5 Provide information to decision-makers and users as quickly as possible.
While recognising that speed is sometimes uncomfortable for the scientific process, efficient real-time delivery systems of forecasts for distribution and abundance of fish species would be needed to help fishers target their catch. Planning these systems with users, and involving them in the decision-making process from the beginning, would allow for the co-production of knowledge.

Discovery agencies would also need to support the adoption and impact phase of research, which often happens a year or two after research is finished, and this would require additional investment of resources.

Hobday said innovation would be needed over the next decade to develop forecasting and other tools, including enhanced monitoring. Differential management rules, non-static stock assessments and cross-jurisdictional management may all be needed. There would also be multiple objectives to manage including social, economic and trade issues; science and climate were not the only considerations for decision-makers. F

MORE INFORMATION
www.wfc2021.com.au

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INDIGENOUS HERITAGE
The World Fisheries Congress was hosted on the lands of the Kaurna people of the Adelaide region.

The green seaweed *Ulva* is a novel aquafeed ingredient being produced in Queensland by Pacific Biotechnologies. Photo: Pacific Biotechnologies

Global quest to reduce fish in aquafeeds

By **Gio Braidotti** and **Catherine Norwood**

The development of innovative feed ingredients is helping the aquaculture industry end its reliance on wild-caught fish in aquafeeds, with Australian research contributing to international efforts

Limits on the availability of forage fish as a key ingredient in many aquafeeds has long been recognised as a major impediment to the aquaculture sector's growth. Research globally has been driving innovation in feed formulations that continue to reduce the proportion of fishmeal and fish oil in feeds for cultured aquatic species. Aquaculture done well has the potential to be the most environmentally efficient of all food production systems and to provide the most sustainable source of high-value animal protein.

Historically, wild-caught small pelagic or forage fish have been an important ingredient in aquafeeds. They contribute to the health of farmed fish and to the nutritional value of the fish produced for human consumption, providing protein and healthy long-chain omega-3 fatty acids that both fish and people need.

Over the past two decades, innovation in feed and farming technologies has seen substantial improvements in feed efficiencies. For example, the quantities of fishmeal required to produce one kilogram of Atlantic Salmon – the fish in:fish out ratio – has improved from 4:1 to less than 1:1.

Growing demand for feed

Despite these improvements, the rise of aquaculture continues to place significant pressure on forage fish stocks, and continued reliance on these stocks restricts the sector's growth and creates a reputational risk around the sustainability of farmed product. This is the case even when fishmeal is sourced from sustainably certified fisheries, which is driving the search for alternative ingredients.

A research team from James Cook University in Queensland recently published a review of global demand and opportunities for new ingredients in the paper 'The Future of Aquatic Protein: Implications for Protein Sources in Aquaculture Diets'.

The researchers found the growth of demand for aquafeeds increased sixfold between 1995 and 2015, outstripping the growth of aquaculture itself, which increased fourfold over the same period. Aquafeed demand rose from 7.6 million tonnes globally in 1995 to 47.7 million tonnes in 2015. The review anticipates demand will reach 87.1 million tonnes by 2025.

The researchers concluded alternative sources will be crucial to meeting this demand because the supply of wild-caught forage fish remains uncertain.

"The availability of sustainably fished small pelagics for fishmeal and oil has not increased in 24 years, and their inclusion levels in aquafeeds must be decreased at a greater rate for aquaculture to provide an increasingly large proportion of healthy seafood to an expanding global population," the review says.

It identifies land-based plant proteins and animal by-products as important contributors in supplying the additional 37.4 million tonnes of aquafeeds needed, and these are already widely used. However, there are limits on the expansion of terrestrial plant and animal production without adding stress to land, water and phosphorus resources.

The report identifies five additional sources of essential ingredients that will be of increasing importance: fishery and aquaculture by-products; food waste; insects; microbial biomass; and macroalgae (seaweeds). Australia has already invested significantly in research and development targeting alternative feed ingredients.

Traditional plant proteins

Plants are commonly used as protein following suitable processing to render them digestible to fish and to neutralise antinutrients in grains that can actually harm fish. Plant materials used include soybean, corn gluten, lupin, faba beans and rapeseed meal.

AUSTRALIAN DEVELOPMENTS

Omega-3s from canola

Genetic technologies have been used to develop enhanced crops that could be used in aquafeeds. This includes a bioengineered variety of canola that produces the essential omega-3 fatty acids as a potential replacement for the fish oil components in aquafeeds.

CSIRO researchers developed this new canola in partnership with Nuseed Ltd and Australia's Grains Research and Development Corporation. Nuseed is coordinating the global commercialisation of the crop, which has been approved for use in animal feed and foods in Australia, New Zealand and the US.

Fishery and aquaculture by-products

These are the trimmings rejected for human consumption that include viscera, heads, skin, bones and blood. In 2019, fishery by-products provided 20 per cent of the volume of fishmeal, but aquaculture contributed just 10 per cent. This indicated there were opportunities to develop the processing capacity of aquaculture to intercept additional by-products and increase the proportion used for fishmeal.

AUSTRALIAN DEVELOPMENTS

Improved hydrolysates

Curtin University in Western Australia has been working with several industry partners and FRDC projects to refine the processes used to create protein-based hydrolysates from fish waste. This includes a project with SAMPI in South Australia, which processes the state's harvest of ranched Southern Bluefin Tuna (SBT, *Thunnus maccoyii)* that allowed the company to trial several different enzymes in its hydrolysis process to replace its previous acid-based formula. The final process developed by the project provides a more stable, higher-quality product, allowing 100 per cent of the SBT by-product to be reused.

The SBT hydrolysate is produced from more than 2000 tonnes of by-product from freshly harvested fish and provides both omega-3 fatty acids and proteins. SAMPI reports domestic use of the hydrolysate in aquafeeds has increased from nil five years ago to almost 50 per cent of its total production in 2021. The company is not currently exporting its product to Asia, which had accounted for 10 to 15 per cent of product pre-COVID-19.

Research at Curtin University is continuing to test the SBT hydrolysate in feed formulations as a replacement for wild fish ingredients, identifying improved disease resistance as a beneficial factor in one recent PhD project. Enzyme hydrolysates from carp and Yellowtail Kingfish (*Seriola lalandi*) have also been tested.

Food waste

Estimated globally at 1.3 billion tonnes a year, food waste is used by some countries (such as China) in freshwater polyculture systems, but is not widely used within aquaculture feed pellets.

An alternative processing strategy called 'bioconversion' uses food waste as a nutrient source for insects or algae that are then used as an aquafeed source. A process called 'biotransformation' achieves the same end using microorganisms and a fermentation technique.

Bioengineered varieties of canola will produce the essential omega-3 fatty acids as a potential replacement for fish oil components in aquafeeds. Photo: Michael Obeysekera

Insects

Using the process of biotransformation, insect meal as an aquafeed ingredient is receiving increasing attention in many countries due to its relatively good nutritional profiles. An increasing number of recent studies are reporting a 100 per cent replacement of fishmeal can be successful, even for carnivorous fish such as Atlantic Salmon (*Salmo salar*). Its potential to address waste issues and to support a circular economy approach to production is also a drawcard.

International aquafeed company Skretting uses insect meal in some of its feed formulations but acknowledges that it is not currently produced in quantities that make it a price-competitive raw material to replace traditional aquafeed proteins.

AUSTRALIAN DEVELOPMENTS

WA trials insect meal

Internationally, numerous companies are rapidly moving to scale up to commercial insect production. Australian scientists have been involved with some pioneering developments and work to adapt successful processes established overseas to local conditions. Two FRDC-funded projects underway in conjunction with the Western Australian Department of Primary Industries and Regional Development (DPIRD), the University of Western Australia, Curtin University, Future Green Solutions and Ridley Corporation are investigating the use of locally produced insect proteins in a range of aquaculture diets.

Initial trial results show defatted insect proteins can replace up to 50 per cent of fishmeal in the diet of Barramundi (*Lates calcarifer*), Rainbow Trout (*Oncorhynchus mykiss*), Yellowtail Kingfish (*Seriola lalandi*) and Marron (*Cherax cainii*). The insect meal is produced by Future Green Solutions from Black Soldier Flies grown using waste organic material (see story page 23).

Microbial biomass

Bacteria, yeasts and microalgae are generally regarded as having the highest potential for aquafeeds. To achieve this potential, a focus on improving the scale of production is essential, as is ensuring the process chain is environmentally sustainable and reduces the cost of production.

Algae is the original source of the omega-3s that accumulate in forage fish, and then in predator fish such as Atlantic Salmon, before being consumed by people. In the medium term, microalgae are seen as the most promising alternative to fishmeal in terms of technical production capabilities.

Veramaris, based in the Netherlands, produces commercial quantities of omega-3 algal oil that has been used by Skretting to develop feeds that include no wild fish ingredients. The Veramaris product is widely used by Atlantic Salmon producers in the Northern Hemisphere.

BioMar is another international feed manufacturer that has been leading the development of aquafeeds incorporating algal omega-3 oils, working in partnership with Corbion, which has developed AlgaPrime DHA. This is currently produced in Brazil by growing microalgae in closed fermentation tanks where sugarcane waste is transformed into algae containing omega-3-rich oil in a matter of days.

BioMar has produced more than one million tonnes of aquafeeds incorporating AlgaPrime DHA since production began in 2016. The algal product provides three times the level of omega-3s of fish oil. In 2020, BioMar opened a new feed mill in Tasmania, although locally produced feeds do not incorporate AlgaPrime DHA. However, it has been suggested Australia's sugarcane sector could provide the basis for a new algal feed production.

Premium prawn supplement

AUSTRALIAN DEVELOPMENTS

Australian research has already led to the commercialisation of Novacq, an aquafeed supplement produced from marine microbes that is used in prawn feeds and allows manufacturers to reduce fishmeal and oil content.

Novacq was developed by CSIRO and has been licensed for production in China and Vietnam, with Australian producer Ridley also licensed for production domestically and internationally since 2017. CSIRO and Ridley are continuing to research Novacq production technology to characterise the key bioactives in Novacq, and the product's suitability for other species.

Bacteria grown on methane

As part of an FRDC project investigating feed supplements for fish health, DPIRD is assessing the use of a single cell protein meal grown on methane. Results to date with both Yellowtail Kingfish and Barramundi are encouraging and the work is ongoing.

Macroalgae (seaweeds)

Seaweed production is an established industry and accounts for nearly 30 per cent of global aquaculture production, with an output volume of 30 million tonnes a year worth more than $6 billion. Opportunities exist to integrate production into nutrient-rich wastewater from agriculture, aquaculture, municipal wastewater treatment and power generation in a process called 'bioremediation'.

As these macroalgae grow they assimilate dissolved nutrients (particularly inorganic nitrogen and phosphorus) that would otherwise be wasted and convert them into a source of protein. The potential scale of this resource is impressive, with a demonstrated biomass production rate of 45 to 70 tonnes of dry weight per hectare per year and an average crude protein content of about 22 per cent.

Above Gavin Partridge prepares aquafeeds including insect meal ingredients for research at the Western Australian Department of Primary Industries and Regions. Photo: Peter Maloney

Clean, green and a feed

AUSTRALIAN DEVELOPMENTS

While the cultivation of seaweed is still in its infancy in Australia, Queensland-based Pacific Biotechnologies (Pacific Bio) is growing the green seaweed *Ulva* to both remediate wastewater and produce an animal feed ingredient.

Pacific Bio uses the *Ulva* to treat water from the ponds of its prawn farming business, Pacific Reef Fisheries at Ayr in northern Queensland. However, the seaweed produced is also finding markets as an ingredient in aquafeeds, particularly for abalone.

Research undertaken in 2020 by the South Australian Research and Development Institute (SARDI) for the Australian Abalone Growers Association showed the inclusion of *Ulva* in abalone diets improved growth. Pacific Bio says there is also interest in the seaweed as an ingredient for Whiteleg Shrimp (*Litopenaeus vannamei*) feed, which is farmed in Asia. Research shows *Ulva* improves the immune activity and survival of farmed prawns and is an ideal nutrient for other marine animals.

In other research, Deakin University is investigating whether *Ulva* in the diets of Barramundi could add some 'saltiness' to the flavour of fish raised in freshwater. Pacific Bio says there is such strong interest in *Ulva* as an aquafeed ingredient it is unable to supply the latent demand with its current production. **F**

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FRDC RESEARCH CODES
2013-711.40, 2016-180, 2017-030

R&D PLAN OUTCOME 1
Growth for enduring prosperity

Waste reborn shows promise in fish feed trials

The transformation of local waste products is providing quality protein ingredients that could help replace fishmeal as the protein source in aquafeeds

By **Catherine Norwood**

Insect meal and an enzyme hydrolysate, both produced using fish waste, have proven to be key components of new diets formulated to test whether juvenile Barramundi (*Lates calcarifer*) can survive and thrive without fishmeal in their feeds.

Trials undertaken at Curtin University in Western Australia used feeds incorporating both ingredients and found they produced a range of beneficial outcomes – from healthy fish with good disease resistance to superior-quality fillets with an extended shelf life.

The research is the work of PhD candidate Reaz Chaklader, who is examining potential uses for waste products and investigating substitutes for fishmeal proteins in aquafeeds.

Chaklader says identifying alternative, locally available ingredients may offer cost savings for feed production, improve the overall sustainability of the industry and even offer improved performance from farmed fish.

The protein ingredients for his trials included:

- poultry by-product meal (PBM);
- insect meal produced from the larvae of Black Soldier Flies that had been raised on whole fish waste (carp); and
- liquid fish hydrolysate from one of three sources – carp, mixed-species finned fish processing waste or Southern Bluefin Tuna (SBT, *Thunnus maccoyii*) processing waste.

The trials used 10-gram Barramundi fry, raised for 56 days, which grew to more than 100 grams.

PMB is the primary protein substitution for fishmeal, as the most readily available and cost-effective alternative. However, Chaklader's first trial quickly established that simply exchanging 100 per cent of fishmeal in a standard commercial feed formulation with 100 per cent PBM is not an adequate diet for Barramundi.

His second trial assessed 10 per cent insect meal with varying ratios of PBM and fishmeal: 10:45:45, 10:60:30 and 10:75:15. All diets provided a comparable performance for fish in terms of feed conversion and growth rates to the commercial control diet.

Reaz Chaklader preparing aquafeed ingredients. Photo: Sijda E Jannat

No fishmeal

A third trial eliminated fishmeal protein completely, replacing it with a combination of insect meal and PBM. The insect meal was added at rates of 10, 15, 25 and 30 per cent. All diets with insect meal of 15 per cent or more resulted in equivalent fish health and growth outcomes.

An expert panel also conducted sensory trials comparing fillets produced from fish fed the control diet and those raised with the insect meal and PBM diets. The panel found improved taste and quality in the insect-fed fillets at all feed ratios.

A fourth trial added liquid fish enzyme hydrolysates to the mix, produced either from whole carp, mixed finfish waste or SBT waste, added at a rate of 10 per cent hydrolysate to 90 per cent PBM. Again, fish performance was comparable to those fed a control diet, with some improvements in physiological measures, including gut health and blood markers.

The young Barramundi in the fourth trial were also challenged by exposing them to fish pathogen *Vibrio harveyi*, which has previously caused mass deaths among farmed Barramundi.

Chaklader says the fish in this fourth trial fed with the new diets appeared to show an enhanced resistance to the bacterium compared to fish fed with the control diet. The best performance was among those fed with 10 per cent SBT hydrolysate.

In the final trial, the tuna hydrolysate, insect meal and PBM were combined in differing ratios: 10:10:80, 10:5:85 and 5:5:90. All diets in this final feed trial produced comparable growth rates to the commercial diet with improvements in fish gut microbiome and immunity.

Food science findings

Fillets produced from the final trial were also tested for fillet quality and for long chain omega-3 fatty acids. Results were comparable to those fed the control diet.

"There are concerns that when you reduce the fishmeal ingredients in farmed fish you also reduce the beneficial omega-3s. But we found that

even with low levels of hydrolysate and insect meal, the levels were similar," explains Chaklader.

Shelf life testing over eight days was undertaken for fillets produced in the final trial. The results found fillets from the trial diets were in better condition at day eight than those produced from fish on the control diet. Chaklader says it appears that including insect meal helps reduce the lipid oxidation that is largely responsible for food spoilage.

Chaklader's PhD project is supervised by Ravi Fotedar and Janet Howieson at Curtin University's School of Molecular and Life Sciences, and was supported in part by the FRDC.

Howieson says assessing the end-use quality attributes of fish fillets produced as a result of the different diets has been an exciting extension of traditional aquafeed nutrition research, which is often conducted independently of work on the resulting food products.

"Bringing together animal nutrition and food science has been an innovative part of the project, identifying early in the sustainable aquafeed development how the new feeds influence the end product," she says.

Also underway is a project to evaluate similar feed formulations for Marron (*Cherax cainii*), a crustacean farmed in Western Australia and South Australia.

Building capacity

These projects are part of a collaborative push involving the state government, universities and industry partners to build research capacity in aquafeeds and novel feed ingredients in WA.

> "Bringing together animal nutrition and food science has been an innovative part of the project, identifying early in the sustainable aquafeed development how the new feeds influence the end product."
>
> Janet Howieson

Gavin Partridge is the principal research scientist for finfish within the aquaculture research and development division of the WA Department of Primary Industries and Regional Development (DPIRD). Increasingly his work is focused on new aquafeeds, with ingredients such as single cell proteins produced using methane as a feedstock, and insect meal produced locally by Future Green Solutions using Black Soldier Flies to upcycle nutrients from organic waste to produce insect protein.

These are among ingredients being assessed by his team as part of an FRDC-funded project evaluating dietary supplements to improve the health of farmed Yellowtail Kingfish (*Seriola lalandi*). Other ingredients include plant-based oils selected for specific beneficial properties. Project partners include Future Green Solutions, feed manufacturer Ridley Aquafeeds and Yellowtail Kingfish farmer Indian Ocean Fresh Australia.

Partridge is also involved in an FRDC-funded project looking specifically at the potential for insect meal as a replacement for fishmeal in feeds for a range of species. Project partners are Future Green Solutions, Ridley Aquafeeds and the University of Western Australia (UWA). PhD candidates Katrina Doherty and Isobel Sewell from

Above Gut microbiome and DNA samples are frozen in liquid nitrogen for later analysis as part of the aquafeeds research. Photo: Future Green Solutions

UWA have been undertaking the trials involved, looking at feeds for Barramundi, Rainbow Trout (*Oncorhynchus mykiss*) and Marron.

The results of these projects, while still being finalised, indicate the defatted insect meal can replace 50 per cent of fishmeal in diets for these species. For Future Green Solutions, the trial results have validated the company's expansion plans. Its current pilot plant in Perth will give way to a new commercial facility north of Perth, producing 20 tonnes of insect meal a day. This is based on daily consumption of 300 tonnes of organic waste as feedstock for the larvae. The new plant is expected to open in 2023.

Commenting on the research and collaborations underway, Partridge says they are about identifying replacement ingredients and supplements to boost fish performance and improve the sustainability of local aquaculture, with potential for local production of ingredients.

"If we can do that, then fishmeal-free diets become a realistic option. It's all about the balance between sustainability and fish performance," he says. **F**

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FRDC RESEARCH CODES
2016-114, 2016-180, 2017-030

Pandemic impacts, revisited

Strong demand for local seafood and the continued digital evolution of the fishing sector are among the positives emerging for the industry from the COVID-19 pandemic in Australia

By **Melissa Merino** and **Catherine Norwood**

In 2020, when COVID-19 first emerged in Australia, the FRDC's special editions of *FISH* magazine looked at some of the impacts the pandemic was having on the diverse stakeholders in the seafood sector. At the end of 2021, with vaccination rates up and even the hardest hit states reopening, *FISH* revisits some of those we spoke with last year to see how they have fared in year two of the pandemic.

Digital acceleration

At Sydney Fish Market (SFM) the pandemic has accelerated the move to digital trading in several ways. During restrictions in 2020, SFM first introduced remote bidding for its live fish auctions, a move that proved even more important in 2021, with lockdowns in Sydney.

Fewer buyers were able or willing to attend the market, with specific local government areas locked down and travel limits in place. Even those who did attend auctions in person used remote bidding because of restrictions on the auction floor.

SFM Executive Manager, Seafood Trading Gus Dannoun says the success of the remote-bidding system made buyers realise what was possible and has laid the groundwork for a new digital trading platform. SFM will integrate its operations with the agri-trading platform ShoreTrade, with an exclusive agreement for use of the platform for the fisheries sector in Australia and New Zealand.

It expects to launch its new digital trading platform in early 2022, providing a 24/7 business-to-business digital seafood marketplace in conjunction with its live auctions.

The platform functions will include presale ordering and supply, fixed-priced selling for fishers and availability alerts for targeted species for buyers.

SFM expects the platform to help stabilise the market and help the industry deal with the unexpected, such as COVID-19, by providing multiple trading opportunities without sole reliance on the physical auction.

COVID-19 was, in fact, responsible for the first ever cancellation of SFM's live auction in its 55-year history when a security guard tested positive. Dannoun says it was fortunate the guard had limited contact with other staff and only one day's auction was affected.

Above Retail sales for Australian seafood have remained strong during COVID-19 lockdowns. Photo: Sydney Fish Market

"A lot of people moved out of the industry and staffing levels have dropped away. If you have someone exposed to COVID-19, you can't get staff to replace them. If your filleter goes down, you can't just pluck another one from thin air. It's a specialty."

Barbara Konstas
CEO, Melbourne Seafood Centre

In response, SFM has introduced its own onsite tracking system for all staff and visitors taking part in auctions, to accelerate contact tracing, should a similar event occur. The Contact Harald tracing system will initially operate for six months, with all staff and visitors involved in the auction process wearing bluetooth-enabled lanyards while on site.

While cafés and restaurants at SFM have been closed, retailers have continued to operate with a significant growth in online ordering and home delivery services, such as GetFish, operated by De Costi Seafoods. Dannoun expects there will be an ongoing demand for these services following the lifting of restrictions.

He reports prices for seafood have continued to rise. In the first quarter of 2020–21, prices were six to 10 per cent higher than for the same period the previous year, an exceptional result. In the first quarter of 2021–22, prices were again two per cent higher than the same period the previous year.

Human dimensions

While domestic demand for seafood has held up, and businesses have adapted to new online markets, the people within the seafood industry have been feeling the pinch of COVID-19 in 2021, says Melbourne Seafood Centre CEO Barbara Konstas.

"A lot of people moved out of the industry and staffing levels have dropped away. If you have someone exposed to COVID-19, you can't get staff to replace them. If your filleter goes down, you can't just pluck another one from thin air. It's a specialty."

In Victoria, she says, 2021 has been personally harder for people in the seafood industry than 2020, even if business has remained strong.

Below While delivery services for seafood have boomed during lockdowns, there is still an appetite for face-to-face shopping. Photo: Sydney Fish Market

"Buyers are still making the sales but businesses are made up of people, and there's a malaise, an actual fatigue with COVID and the lockdown in Victoria.

"People are really thankful they are working, but they are tired. We're about to go onto our busiest period at Christmas and usually you've had a winter break, but that hasn't been possible."

While restaurant closures through 2020 and 2021 have seen a decline in demand for some top-end products, there is growing demand for other products, especially from domestic buyers.

"More people are wanting to eat local, Australian product," Konstas says. "This is what COVID has given back – that sense of nationalism. Local sales have picked up off the back of greater awareness of Australian produce."

While she says some new business models and online platforms will stick, she believes there is still a big appetite for personal contact.

Social strategies

Northern Territory Spanish Mackerel fisher Norm Hedditch is one of many who has turned to social media to help boost sales during the pandemic.

In 2020, his business Taroona Pty Ltd expanded its retail and freezer capacity in Darwin, selling only wild-caught NT product. Radio advertising paid off, but more recently he has increased his social media presence to communicate directly with customers.

"We've got a Facebook page and Instagram. My daughter runs it all and that's definitely helped to get the word out. As soon as we've got new product in, we'll do a post. She'll video me holding a new box of prawns saying 'here, straight off the boats, this week we've got these packs of banana prawns' or whatever has just come in, including our own cryovacked product."

In 2020, prices for Hedditch's premium, line-caught Spanish Mackerel dropped from $13 per kilogram to a "borderline" $9 following restaurant closures in his usual markets of Melbourne and Sydney.

But since then, he says the Melbourne market has staged a remarkable recovery, even as restaurants have remained closed for in-house dining – his product is selling for $2.50 per kilogram more than its previous highs. Hedditch credits his trading partner Mackay Reef Fish Supplies and the reputation of his premium quality produce.

He says the NT has been lucky to remain largely COVID-free through 2021, and 'grey nomads' travelling through have helped to boost the local economy. "Our tourism has survived quite well, although some industries, like charter boats, are struggling," Hedditch says.

Missing restaurant trade

While Tasmania has also remained comparatively free of COVID-19 in 2021, the impacts of outbreaks elsewhere continued to affect the state's seafood sector.

Tasmanian Seafood Industry Council (TSIC) Chief Executive Julian Harrington says the diversity of the industry has led to a similarly mixed bag of impacts for the state's commercial fishing and aquaculture sectors.

The closure of restaurants in Victoria and New South Wales continued to hit hard those who relied on the hospitality trade. Sales of live fish, such as Banded Morwong and wrasse sent to Chinese restaurants, were affected by both reductions in international visitors and the closure of restaurants.

"There are also questions around what the hospitality sector will actually look like in the future, as several high-profile Chinese restaurants have ceased trading during the year," says Harrington.

Sales of oysters, which predominantly go to restaurants, have also been highly variable, in response to the opening and closing of markets in NSW and Victoria. But fishers and processors with strong markets in other states have continued to do well.

He highlighted Tasmanian Government initiatives helping to support the industry, including grants for processors diversifying into new products and markets. He expects more frozen products with an extended shelf life will be part of value-adding initiatives.

TSIC is also working with the Tasmanian Department of State Growth to investigate potential markets and the appeal of Tasmanian-branded seafood to different consumer demographics in other states. This will help build an evidence-based approach to future marketing initiatives, to develop new markets and underpin the resilience of the industry in the future.

Strong local demand

In Western Australia, there is strong demand for local seafood and Western Australian Fishing Industry Council (WAFIC) CEO Darryl Hockey says everything being caught is selling well. The Western Rock Lobster industry has faced some export marketing challenges but has managed to keep its products moving through diversified trade channels.

The initial flood of product onto the local market following the COVID-19 trade impacts saw prices plummet and local demand surge, particularly through the innovative back-of-boats sales initiative. As export trade rebuilt and the prices strengthened, it has been encouraging to see ongoing loyalty displayed by local consumers.

WAFIC is working with local producers to promote some of the lesser known species, with growing demand for Akoya Pearl Oyster, Australian Sardine, Australian Salmon, Sea Mullet and Ocean Sand Crab.

Hockey says consumers seem to have become more willing to experiment with more diverse species and dining styles, which will help to take pressure off more popular species.

The pandemic has also generated greater awareness around food security and support for local seafood, strengthening calls for mandatory country-of-origin labelling in the WA food service industry – similar to the system operating in the NT – so consumers can be confident they are buying local products. While there is mandatory country-of-origin labelling in the retail sector, the NT is the only jurisdiction with similar regulations in the food service sector.

With international and many interstate borders closed, there has also been an unprecedented surge in recreational fishing and local tourism in WA. Shortages of fishing equipment, including boats, have been reported nationally. With so many people fishing, Hockey says it highlights the need to manage the recreational fishing levels, which are well above the recovery benchmarks required for the sustainability of prized high-profile indicator species such as West Australian Dhufish, Snapper and Baldchin Groper.

New markets

Eric Perez, CEO of the Queensland Seafood Industry Association, has also seen the rising demand for local seafood throughout the pandemic, which has helped to offset the fall in demand from interstate buyers.

Perez says there have been ongoing and significant impacts on the export of live seafood, such as live coral trout, as well as on sales in Sydney and Melbourne.

Some commercial fishing businesses moved to diversified direct-to-public sales channels, as well as finding new markets. These strategies are among many that have been adopted to engage with local communities, he says.

For those who have moved to direct sales to the public, using social media and the ability to establish some kind of outlet or 'presence' have proved to be critical factors in their success. F

Above Sydney Fish Market has implemented onsite control measures, including its own contact tracing system, to limit exposure to COVID-19.
Photo: Sydney Fish Market

"There are also questions around what the hospitality sector will actually look like in the future, as several high-profile Chinese restaurants have ceased trading during the year."

Julian Harrington
Chief Executive, Tasmanian Seafood Industry Council

Bringing recreational fishers into NSW fishery harvest strategies

Recreational fishers will help develop the NSW harvest strategy for Yellowtail Kingfish. Photo: Al McGlashan

Snapper, Mulloway and Yellowtail Kingfish are the focus of new research in NSW to integrate recreational fishing into harvest strategies as part of sustainable fisheries management

By **Barbara Adam**

While harvest strategies are recognised as world's best practice when it comes to sustainable fishery management, most focus exclusively on commercial fishing, even when the recreational catch is as large or larger than the commercial catch.

As the New South Wales Government rolls out the development of harvest strategies across the state's fisheries, it is keen to ensure recreational fishers are taken into account.

Ashley Fowler, a fisheries research scientist with NSW Department of Primary Industries (DPI), is leading an FRDC-funded research project looking at how to do this. His project is focused on the stocks of three species of fish that are popular with Indigenous, commercial and recreational fishers in NSW: Snapper (*Chrysophrys auratus*), Mulloway (*Argyrosomus japonicus*) and Yellowtail Kingfish (*Seriola lalandi*).

Harvest strategies are a proactive way of integrating the systems and processes for monitoring the stock of a defined fishery and identifying predefined actions to maintain sustainable stock levels when changes occur, such as changing catch quotas or bag limits.

"Harvest strategies work because they're built around achieving stakeholder objectives," says Fowler. "Over the last few decades, it's become clear that the recreational catch is high for several species including Snapper, Mulloway and Yellowtail Kingfish. That makes it important that we include recreational fishers in harvest strategies for these species.

"The first step in developing a harvest strategy is to have all stakeholders involved and work out what they want to achieve in terms of their fishing. Integrating all sectors is important because the recreational sector might have different objectives to the Aboriginal cultural sector or the commercial sector, depending on the species."

Gathering data

Commercial fishers provide catch data frequently, but data about the recreational fishing catch is more challenging to obtain. NSW DPI surveys the catch of the state's recreational fishers every two years.

Based on surveys conducted in 2017–18, the latest report estimates licensed recreational fishers caught 451,427 Snapper during the year, with 65 per cent released. The report also found the state-wide catch of Mulloway was 27,173 fish, with 50 per cent released. The Yellowtail Kingfish catch was 107,865 fish, with 58 per cent released.

When combined with commercial catch figures for 2017–18, the recreational fishing catch landed represented 38 per cent of Snapper caught, 56 per cent of Mulloway and 58 per cent of Yellowtail Kingfish.

The recreational catch is converted to a weight measurement using the average weight of fish caught multiplied by the number of fish caught. This is added to the commercial harvest to create a state total for each species.

According to the Status of Australian Fish Stocks Reports 2020, stocks of Snapper and Yellowtail Kingfish in NSW have been assessed as sustainable at the current level of fishing. However, Mulloway is classed as a depleted stock, and the harvest strategy will focus on stock recovery.

Stakeholder objectives

The first stage of the project reviewed existing data on recreational fishing in the state. The second stage gathered recreational fishing stakeholders together to identify their objectives for each of the three species.

Earlier this year, groups of experienced recreational fishers took part in workshops to identify their fishing objectives, and data from these events is being analysed. Fowler says the research team will conduct telephone surveys in 2022 with some of the state's 432,000 recreational fishing licence holders, seeking information about their fishing objectives.

These individuals will be randomly selected and there will also be a web-based survey open to all recreational fishers in NSW. Written material accompanying the survey will be translated into several languages, recognising that the state's recreational fishing community is culturally diverse.

FRDC General Manager for Strategy and Innovation Matt Barwick says even though commercial and recreational fisheries often target the same resource, they can differ in their objectives in important ways.

For example, recreational fishers are often motivated by a desire to socialise, relax and enjoy a nature-based experience. In contrast, commercial fishers are trying to make a living.

How the sectors are managed also differs in significant ways. Quotas are often used to control commercial catch, while bag and size limits are applied to recreational fishing. These differences make it challenging to integrate both sectors into a single framework for managing the overall harvest.

"But it's important that we find a way," says Barwick. "That way, managers can have an improved overall understanding of the resource they manage, how it is going, and they can act decisively and with the support of each sector to deliver the intended results for all users."

He says a key benefit of the harvest strategy development process is that it encourages managers and stakeholders to agree on the types of management intervention that might be required under different circumstances, before those circumstances present themselves.

"This tends to result in much more productive conversations than trying to agree on what must be done in the heat of the moment, when action must happen quickly, views can be diverse and tensions can be high."

International tools

The NSW project will contribute to an online harvest strategy development tool called FishPath that incorporates recreational fishing. FishPath, developed by US-based non-profit The Nature Conservancy together with partner organisations CSIRO and the US National Oceanic and Atmospheric Administration (NOAA), is an online decision-support tool for different stakeholders designed to identify viable harvest strategy options via an interactive stakeholder engagement process.

"We are in regular contact with the international FishPath development team and will provide research outputs to them to better capture the objectives and options for the recreational sector," Fowler explains.

Each element of the project will feed into a final report, which will include guidelines and recommendations on how to develop harvest strategies for multi-sector fisheries.

Fowler says they may find that the objectives of recreational fishers for all three fish species align with those of Aboriginal cultural and commercial fishers. Conversely, the objectives of all three groups may be entirely different for all species, or for a particular species.

The final report, due in 2023, will provide information that is nationally relevant. "NSW is a great test case because it has the largest number of recreational fishers, but the project has important outcomes for any state," says Fowler. **F**

Recreational fishers land more than half the NSW catch of Yellowtail Kingfish. Photo: Al McGlashan

Above A fish-attracting device (FAD) helps to boost recreational fishing experiences. Photo: NSW DPI

Below Restocking Yellowtail Kingfish to build populations in the wild. Photo: I. Osterloh

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FRDC RESEARCH CODES 2019-021, 2017-125
2015-215

R&D PLAN OUTCOME 4
Fair and secure access to aquatic resources

Sound impacts on lobsters

Research finds buffer zones can help mitigate damage to Southern Rock Lobsters caused by soundwaves used in oil and gas exploration

By **Gio Braidotti**

The drive to find additional sources of oil and gas to power commercial economies is contributing to noise pollution in the oceans, and fisheries are among the sectors affected. That is because 30 per cent of global oil and 27 per cent of global gas production come from offshore deposits (according to 2015 figures).

The way the offshore energy sector and fisheries intersect is the subject of research to monitor and improve practices to minimise ecological impacts.

A recent Commonwealth Senate Inquiry report recommended further research, funded by the Australian Government, to understand "the short-term, long-term and cumulative impacts of seismic testing on marine animals and the marine environment".

The need for improved science-based knowledge to mitigate seismic sound pollution underpins collaborations involving the FRDC, oil and gas industry partners, and the fisheries sectors, supporting significant research.

Among global leaders undertaking this work are researchers at the University of Tasmania (UTAS) and Curtin University in Western Australia, led by Jayson Semmens, Ryan Day and Rob McCauley.

Semmens is based at the UTAS Institute for Marine and Antarctic Studies, and his key focus as part of FRDC-funded research is understanding and mitigating impacts from seismic surveys.

He explains the seismic surveys produce images of underwater rock formations beneath the seafloor that are needed to find oil and gas deposits and to monitor known fields.

Obtaining these images, however, is far from straightforward.

The industry uses powerful air guns to create blasts of sound for its seismic surveys. "These guns expel air into the water that produces soundwaves that penetrate the seafloor rock. These sound waves bounce off geological structures and the return signals are used to generate images," Semmens explains.

The air guns have the capacity to expel highly compressed air (between 40 and 150 cubic inches of air), with arrays of different-sized guns used to conduct a survey. The air gun rapidly releases the compressed air, forming a bubble that produces a loud sound that travels through the water to the ocean floor. It is the equivalent of being in the front row of a rock concert.

When this technology was introduced in the 1980s, it replaced explosives and amounted to a gain for marine environments.

Nonetheless, the technology was noted for having two impacts: it generates soundwaves and disturbs seafloor particles, burying organisms or causing stress through limiting light availability.

Soundwave impacts

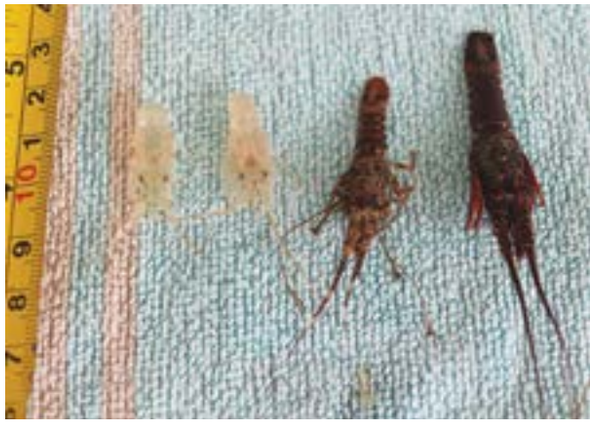
"There was work done to understand impacts of the sound waves on marine mammals since species of whales and dolphins use sound to communicate," Semmens says. "However, there was little work done on the impact on fish and invertebrate species. That's the knowledge gap we are now closing."

The FRDC has funded a series of projects to investigate impacts on rock lobster, finfish and octopus. The most recently completed project targeted impacts to Southern Rock Lobster (*Jasus edwardsii*).

That work has made important findings that are having a direct bearing on the way the industry operates and is regulated.

A key discovery is that larval and juvenile Southern Rock Lobsters can recover from soundwave-induced damage if there is a buffer of at least 500 metres to the air guns.

This work was undertaken using a commercial array



Southern Rock Lobster.
Photo: Antonia Cooper

The FRDC has funded a series of projects to investigate impacts on rock lobster, finfish and octopus. The most recently completed project targeted impacts to Southern Rock Lobster (*Jasus edwardsii*).

Left Junior rock lobsters lined up for testing.
Photo: University of Tasmania

Above Exposure to seismic testing can delay moulting in young rock lobsters.
Photo: University of Tasmania

deployed by exploration company CGG off Victoria's southern coast in the vicinity of Lakes Entrance. CGG contributed half the funding for this project, as well as a significant in-kind contribution.

The study involved placing captured larval and juvenile lobsters within two distances of the air gun array: zero and 500 metres.

Testing for damage was made possible by findings from a previous study. That work used a single air gun and identified damage to an organ in the rock lobsters that is equivalent to the inner ear cavity of humans. Called a statocyst, this organ contains hair cells that aid rock lobsters in equilibrium and coordination, just as the inner ear helps humans maintain a sense of balance.

"In an earlier project, we found that air guns shear off hair cells in adult rock lobsters," Semmens says. "That loss impairs the lobster's sense of coordination and we can measure this impact by testing the 'righting reflex' – a test in which the animal is flipped on its back and the time needed to right itself is measured."

The latest research found that lobsters do not recover from this loss of coordination if exposed directly to an air gun array.

A buffer of 500 metres, however, saw the animals recover once they had moulted their shells, something that juveniles especially do at regular intervals.

Implications for industry

The finding has several important implications.

First, evidenced-based findings are the key driver to improve industry practices and regulatory standards. In Australia, environmental management associated with offshore oil and gas activities in Commonwealth waters is independently regulated by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

"The need for a buffer zone is something that is likely to be picked up by both industry and the regulator," Semmens says.

Secondly, the study validated at a commercial scale the findings from earlier work made using a single air gun. Those earlier studies had been criticised for potentially lacking industry relevance. Those concerns have now been put to rest.

As a consequence, this experimental approach (based on a single air gun) can now be used with confidence in ongoing research to further explore impacts on lobsters and how to mitigate them.

The project made an additional finding that has important implications.

The researchers detected that the intervals between moulting increased in animals exposed to seismic signals, going from between 16 and 18 days to between 23 and 30 days, which may result in slower overall growth rates. Unlike the righting reflex, this effect did not reverse in those lobsters exposed 500 metres from the seismic source. The timing of moulting also normally occurs when predators are less likely to be in the environment; the delayed moulting exposes rock lobsters to a greater risk of predation as their new shells are hardening.

Semmens notes all the work of the UTAS and Curtin research team has focused on individual effects, but there is a broader understanding that still needs to be gained.

"Since all our work has examined impacts on individual animals, we don't yet know the population effects," he says. "That could be something we look at in the future." F

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FRDC RESEARCH CODE 2019-051

NEW WAYS TO INVESTIGATE BELOW THE SEABED

The FRDC is partnering with leading Australian research institutions and other fisheries organisations to fund a collaborative research project to trial emerging seismic survey technologies that will have a reduced impact on marine species.

Led by Beach Energy, the project will assess how eSource™ and distributed source technologies will perform in open oceanic waters. The technologies have shown promise in lakes and water tanks. The work will also research the potential impacts of these new surveys on scallop and lobster.

The trial of emerging technologies and marine species research aligns with the end of another Beach Energy project, the Prion Survey, a three-dimensional marine seismic survey to map the geology beneath the seabed, enabling the assessment of natural gas reservoirs. **beachenergy.com.au**

Talking oysters

Indigenous leadership and communication are integral to tropical rock oyster research, creating new ways to discuss the manageable "invisible risks" that *Vibrio* bacteria pose to an emerging industry

By **Catherine Norwood**

Scientific and commercial momentum is building to establish a tropical rock oyster industry, and Cynthia Coyne finds herself in a unique position at a critical time in the industry's development, communicating research to industry and community stakeholders.

Coyne is a communications, extension and adoption (CEA) project leader with Charles Darwin University, which is leading a new FRDC-funded project that aims to support food safety in this emerging industry across northern Australia.

Launched in March 2021, the project focuses on *Vibrio* bacteria that occur naturally in the marine environment. It aims to identify *Vibrio* species in tropical oysters, optimising bacterial tests for routine use and identifying the best storage, transport and shelf life conditions that ensure high food safety standards.

Coyne's appointment to the CEA role is part of the proactive approach the FRDC is taking to develop opportunities on two fronts. One is to provide the research needed to help establish new aquaculture industries. The other is to provide opportunities for Indigenous environmental graduates to work in fisheries research. Coyne's role is to produce plain language fact sheets and synthesis reports about the tropical rock oyster research project and to communicate the science to a range of stakeholders, especially Indigenous industry stakeholders such as the Warruwi Oyster farmers of the Yagbani Aboriginal Corporation.

Above Cynthia Coyne is the communications, extension and adoption project leader for an FRDC-funded project supporting tropical rock oyster aquaculture. Photo: Supplied

Coyne is a First Nations Australian woman who was born and grew up in the Northern Territory. She has sociocultural and kinship affiliations to the Jukun-Yawuru people of Broome and the Jaru people of the East Kimberley.

She brings to the project her training in anthropology, Indigenous art, environmental science and environmental management, as well as experience and leadership in Indigenous stakeholder engagement across northern Australia. This includes a new approach and perspectives on communication initiatives that expand on typical scientific views and objectives.

Project partners represent the diversity of interests in this emerging sector. They include Maxima Rock Oyster Company in Western Australia; Bowen Fresh Oysters, a family operation in Queensland; and Yagbani Aboriginal Corporation and its Indigenous oyster farmers on Goulburn Island, in the Northern Territory.

All are represented on the project steering committee, along with the FRDC and representatives from state and territory governments responsible for shellfish quality assurance.

Coyne says this project aligns with her own efforts to support Indigenous cultural and natural resource management on Country, providing livelihoods, benefit-sharing and economic stability for place-based local Indigenous people.

There is significant potential for Indigenous communities to become involved in tropical rock oyster aquaculture. This is highlighted by Yagbani Aboriginal Corporation's involvement in the project; it is nearing the launch of commercial farming on Goulburn Island.

In WA, the Murujuga Aboriginal Corporation is a partner with Maxima Rock Oyster Company, which has a pilot-scale rock oyster farm in the Dampier Archipelago in the Pilbara region. This pilot-scale farm was supported by the FRDC and it is now working with the Cooperative Research Centre for Developing Northern Australia (CRCNA), which is coordinating broader research and development needed to underpin the emerging industry.

Other research in the CRCNA project is identifying the best species for aquaculture in different regions. Native Blacklip Rock Oysters (*Saccostrea* spp.) are the primary focus for cultivation. The Darwin Aquaculture Centre is undertaking hatchery trials to optimise larval settlement procedures and improve nursery culture. The ultimate aim is to provide industry with a consistent, commercial supply of spat for growout.

Vibrio knowledge gaps

Indigenous communities have been dining on rock oysters for millennia; the establishment of farming for northern species is set to extend these delicacies to new audiences. However, collecting and eating fresh rock oysters with family and friends in local communities is not the same as farming them in bulk to harvest and transport long distances to market.

For Coyne, there is a balancing act in the communications, to have the "invisible" risk of naturally occurring *Vibrio* bacteria in the water understood clearly, without raising undue alarm with producers or consumers.

Her role with project stakeholders, particularly Indigenous partners, will support their participation as active contributors to the research. For instance, for the Warruwi people on Goulburn Island involved in the Yagbani commercial aquaculture initiative, this will involve collecting oysters and doing water quality

testing with support from the team at Charles Darwin University and the Darwin Aquaculture Centre.

The project's lead investigator, Karen Gibb, says *Vibrio* bacteria occur naturally in the marine environment. They can be present in harvested shellfish and some *Vibrio* species may cause illness if the shellfish are eaten uncooked, as is often the case with oysters.

The presence of *Vibrio* species is an emerging challenge for all oyster producers in Australia.

"We know there is a high diversity of species in the tropics. More than 40 have already been identified as commonly occurring in northern waters, but we think most pose no risk to people," explains Gibb.

"Tropical rock oysters have co-evolved with *vibrio*s. We are at the very early stages of understanding their relationship and we need more information about the baseline presence of *Vibrio* in these oysters and whether the *Vibrio* community changes with the season."

She says when it comes to quality control, it will be important that testing protocols are sophisticated enough to identify particular *Vibrio* species that may pose a health risk, rather than just registering the presence of any *Vibrio* species.

The three-year project will gather more detail on the *Vibrio* species found in northern oyster-growing areas and the potential toxicity of different species. Gibb and colleague Anna Padovan have been working with *Vibrio* bacteria for more than a decade, and their work has shown that more molluscs are positive for *Vibrio* in the wet season. Extending this knowledge to oysters and the *Vibrio* community will provide a clearer understanding of seasonal baselines, which will help producers make informed decisions.

Above Yagbani oyster farm manager Brando Westley (left), project leader Cynthia Coyne and Yagbani oyster farm worker Raymond Gelder holding oysters taken for grading at Fletchers Point, Warrawi Community.
Photo: Steve Westley, Yagbani Aboriginal Corporation

Right Cynthia Coyne presenting information on the *Vibrio* research project to Yagbani Aboriginal Corporation Directors and aquaculture staff in Warrawi community.
Photo: Brenda Westley

Quality control

Gibb's project will also better address the gaps in knowledge about how *Vibrio* species in tropical rock oysters respond to storage and transport temperatures. "We want to provide data and informed advice on the best post-harvest storage and transport temperatures and to assess shelf life of tropical rock oysters at realistic storage temperatures."

Gibb says this information will be crucial for managing supply chains to ensure tropical rock oyster are safe for consumers. And regionally relevant *Vibrio* risk strategies can be developed to support this new sector and ensure an "exemplary reputation", right from the start, giving access to premium markets.

In a related project, Sarah Ugalde at the University of Tasmania is working to address other food safety issues related to oyster aquaculture in northern Australia. As a high-risk food group, there are stringent regulations associated with risk management of oysters in Australia. Ugalde's project will look to adapt the successful strategies used by southern states, listed in the Australian Shellfish Quality Assurance Program Manual, to the context of northern Australia.

Both projects align with the work conducted by the FRDC's food safety platform, SafeFish, which is a joint project between the University of Tasmania and the South Australian Research and Development Institute (SARDI) led by Alison Turnbull.

SafeFish has been raising awareness and building capability in *Vibrio* risk management in Australia. A recent three-part *Vibrio* Webinar Series explains the science of *Vibrio* bacteria, outlines practical actions oyster farmers can take to reduce risk, and begins the discussion around the regulatory guidance needed in Australia. **F**

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SafeFish, www.safefish.com.au

FRDC RESEARCH CODES 2020-043, 2020-021

Vale Ted Loveday

The seafood sector mourns a big thinker who helped shape the professional practices underpinning the good reputation of Australian seafood, at home and internationally

On 7 October 2021, his family and the seafood industry farewelled Terence 'Ted' David Loveday, a fisher who made a huge contribution to the industry and whose legacy carries on.

Ted grew up in Burnett Heads (Queensland). He began his career in Bundaberg, working on local trawlers, before becoming the President of the Queensland Commercial Fishermen's Organisation (now the Queensland Seafood Industry Association) (SSA). His appointment as Managing Director of Seafood Services Australia followed.

His legacy to the sector includes important innovations such as:

- establishing SSA as a Standards Development Organisation and publishing the Australian Fish Names Standard AS 5300-2015;
- developing a Primary Production and Processing Standard for Seafood (Standard 4.2.1) based on risk and achieving food safety outcomes;
- contributing to the national seafood industry training package and being a passionate advocate for the package to be adopted and used;
- establishing an approach to environmental management that actively involves the fishers and respects their knowledge and expertise and publishing the seminal Green Chooser information and advisory support system to help industry adopt environmental management systems;
- identifying a prioritised set of trade and market access issues for government to negotiate; and
- implementing a process for engaging and participating in international food safety standards (Codex).

Many of these initiatives are now managed by different organisations including the FRDC, Seafood Industry Australia, OceanWatch, Seafood Trade Advisory Group, SafeFish and SeSAFE.

Ted's story intertwines with that of the FRDC from its very beginning.

Here are some memories and thoughts from Ted's friends and colleagues.

Ted was a member of the inaugural FRDC Board when I was appointed its first executive director in 1991. It was a formidable Board comprising Chairman (not Chair in those days!) Bill Widerberg – a corporate leader; three eminent scientists – Brian Hickman, Bob Kearney and Burke Hill; three industry leaders – Ted Loveday, Dale Bryan and George Kailis; and Bruce O'Meagher representing the Minister. These members were, and some remain, leaders in their fields, and Ted was amongst equals with respect to his intellect, analytical thinking, powers of persuasion and effectiveness as a Board member.

Ted was a highly regarded leader in the seafood industry without doubt, and others will praise him for the leadership he provided to the Queensland fishing industry throughout his time with the Queensland Commercial Fishermen's Organisation. However, where he stood out from other leaders was his innate foresight ability. He recognised future challenges for the industry and advocated mitigating action well before others.

Ted's appointment as Managing Director to the FRDC-owned company Seafood Services Australia in 1999 provided him with the opportunity to implement change across the whole seafood industry. He did this by building around him a team of like-minded experts and developing strong partnerships with other change agents such as OceanWatch Australia. Through these partnerships, Ted was instrumental in addressing actions relating to, for example, environmental management systems and certification, seafood quality and incident response planning, seafood health benefits, standards development, trade and market access, and many more actions vital to a sustainable seafood industry but not addressed to the same degree or at all by other organisations. Today, two decades on from when Ted was advocating environmental management systems, large fishing companies are promoting their recently achieved environmental credentials.

Understandably, with such strong leadership and advocacy came opposition, and Ted, who didn't suffer fools gladly, had his detractors. Hopefully, they will now join with his admirers and look back and acknowledge Ted's significant achievements throughout his working life.

Ted was larger than life. He was a man of intelligence, passion, energy, humour and loyalty.

Rest in peace, Ted.

Peter Dundas-Smith, a work colleague and friend for almost 30 years

Ted made a huge impact on me. I liked his blunt style and his willingness to change his mind in the face of evidence that contradicted his views. Passionately driven to support the fishing industry. Not always easy to deal with but always driven towards better outcomes for commercial fishing and open to debate issues.

Russell Reichelt, AO
Chair of the FRDC Board 1995–2001

Ted was a tireless and very effective advocate for the seafood industry. At the highest levels of government, Ted commanded respect for himself and his industry through the force of his argument and the power of his logic. He was a remarkable man.

The Hon Ron Boswell AO,
Chair of the FRDC Board 2016–19

I particularly admired his courage. He had this ability to get people in a room to have the often difficult conversations that had to be had. He was focused on ensuring a future for fishing businesses, their families and their communities. He was tenacious in his effort to have those conversations to focus on actions – not just talk.

Jayne Gallagher, Queensland

He was a fearless advocate for a sustainable, well-managed Australian seafood industry. A passionate leader. A very clever operator. And a loyal friend.

Kylie Dunstan, ACT and Queensland

Ted Loveday

Vale Noel Herbst, a prawn farming pioneer

Noel Herbst. Source APFA

Noel Reginald Herbst (20/10/1941–5/11/2021) was a founding father of the Australian prawn farming industry and a great man. His service to the Australian prawn farming industry and his local community was recognised with a Medal of the Order of Australia (OAM) in 2014.

In 1986, Noel founded Gold Coast Marine Aquaculture, which is one of Australia's largest Black Tiger Prawn farming companies. Originally, he farmed cattle and cane on land that had been in his family for more than a century. But his pioneering spirit and willingness to take risks saw him turn his northern Gold Coast property into a highly successful prawn farm, where he grew prawns with a focus on quality rather than quantity.

Long-time friend Nick Moore said that while the aquaculture and seafood industry has been full of larger-than-life figures, few could claim the same influence that Noel has. "He had amazing vision and was a very generous man with his knowledge."

Noel was a strong believer in the industry working together and he was instrumental in establishing the Australian Prawn Farmers Association (APFA) in 1993 for the benefit of its members. He always supported his key personnel to participate on the executive management committee and various other APFA sub-committees to support the industry and members.

He opened his mind, his heart and his farm to all those who wanted to learn or know anything about prawn farming. And he never gave up when faced with adversity, including the white spot incursion.

A true pioneer of Australian prawn farmers and, over the past 35 years, Noel significantly contributed to innovative farming techniques, sustainable practices, research to reduce pressure on wild- caught stocks and the education of key policymakers (including ministers) for the benefit of the industry and Australia's economy.

He was held in high esteem and respected by fellow farmers, key officials and stakeholders, his local community and the broader aquaculture sector.

Noel is survived by his children Debbie and Darrell. F

Casting for mental health

Driven to address high male suicide rates, Matt Tripet brings together fly-fishing, time in nature and supportive conversations to help men improve their mental health

By **Anne Crawford,** Photos **Shottobits**

High in the upper reaches of the Thredbo River, New South Wales, lifelong fisher Matt Tripet is teaching a group of men "stream craft"; everything from how to analyse a river system to catching and releasing a trout, which insects they eat, safe-handling practices and how to protect the trout from damage.

As he does, he is also guiding the men towards improving their mental wellbeing.

Tripet is the CEO and founder of the Fly Program, a scheme that takes groups of 10 men on a four-day fly-fishing retreat where they are helped with any mental health challenges. Participants include army personnel who saw combat in Afghanistan or Iraq, paramedics, police or firefighters with post-traumatic stress disorder, through to first-time fathers struggling to keep their job.

Not all have experienced trauma or mental health issues; some men just want to take time out to improve their state of mind. The program, with participants aged 18 to 78 years, is pitched at early intervention and prevention.

Engaging in nature

"It's all about using the power of the outdoors and of fishing to get people engaged with the environment and conversations," Tripet says. "The program creates an incredible support around people and really does characterise taking action on mental wellbeing rather than depressing problems with booze or just ignoring them, as so many guys do. It's about being aware of issues in our lives and being committed to taking action on those issues," he says.

"Fly-fishing gets us out there, puts the water around our legs and gets us into nature," Tripet says. "It gets us engaged with things that are really important, that we don't engage with very often anymore. That's probably one of the biggest reasons why I have this thing for being on water, for fishing up in the mountains."

Tripet has gone fly-fishing since he was a 10-year-old boy growing up in Tamworth, NSW. Every weekend he, his three brothers and his father would take their fly rods and head to the tablelands in north-east NSW around the small town of Walcha. Fly-fishing has been a strong part of his life ever since. He found the activity centred him, and helped to build positive relationships, including those with his family and other fly-fishers, who came to be a kind of extended family for him.

Tripet became a physical education teacher and worked jobs in education connected to the fly-fishing industry, including as a fly casting instructor. In 2010, he took on a management role at Lake Crackenback Resort on the banks of the Thredbo River, and had fly-fishing instruction among his duties.

"I saw the wonderful benefits of bringing people into the outdoors and, particularly, of putting a rod in their hand. I was always amazed at the calibre of conversation you'd have with a participant, who was essentially a stranger, when you're in the water and have the opportunity to talk and be ourselves."

Below Matt Tripet (third from left) leads a fly-fishing expedition designed to support the mental health of participants.

Purpose in action

In 2013, Tripet received the shattering news that his brother-in-law Justin had taken his own life. "I suppose that after the rawness of those first six months or so I just felt a great sense of purpose."

That sense of purpose led to a boardroom table in Canberra, where Tripet urged four others to put their skills to use on one of the biggest issues in Australian society: male suicide. Six Australian men take their lives every day, and help-seeking behaviour in adult males is "horrifically low".

Fishing seemed the perfect antidote. It is a popular pastime that attracts five million Australians a year. Most (70 per cent) of those who come to the Fly Program are already recreational anglers, and 20 per cent of those are trout anglers who may fly-fish, Tripet says.

A quarter of those who come may have fished as a child but do not get a chance to fish now and are keen to learn again and enjoy the health benefits of the program, he says. Of the new recreational anglers, 100 per cent have become converts who go home and fish

Matt Tripet
Photo: Shottobits

in their local waterways on a regular basis, largely using the fly-fishing method.

Feedback from the men and independent research from the University of Canberra suggest the program has been highly successful.

Hundreds of men across every state and territory (and one from overseas) have participated in the program since it started five years ago, going to retreats mainly in NSW's Snowy Mountains but also in Victoria and Tasmania.

"There's been an extraordinary amount of support to see this happen," says Tripet.

From starting with no money in 2016, more than $500,000 has been invested in the program. This includes $100,000 from the NSW Department of Primary Industries Recreational Fishing Trust, which reinvests funds gained through fishing licences into recreational fishing projects.

The wellbeing program, dubbed The Manifesto and developed by clinical psychologists, continues for seven weeks after the men return home, offering weekly activities such as mindfulness, exercise and nutrition, with the men supported by each other in a private forum. "If someone is having a bad day, someone else in the group or several people will give them a call."

Changing environment

Tripet, now aged 40, says recreational trout fishing has changed significantly over the years. "In the days pre-Rex Hunt, everyone caught and ate everything. After that Rex Hunt era, catch and release came into fruition – that was a major change.

"There's a lot of focus now around sustainability, and a lot more education around sustainable fishing practices. That's the major change since 25 or 30 years ago."

The Fly Program uses and teaches participants these practices, he says.

Another major change has been in social connectedness. "It's very easy to get info now about recreational fishing through social media – we can understand where the fish are biting and be reactive to that."

The rivers and streams of NSW's Snowy Mountains, recognised as a world-class trout fishery, are full of trout. Brown Trout (*Salmo trutta*) and Rainbow Trout (*Oncorhynchus mykiss*) are Tripet's target species. But he says the waterways he fished as a child no longer support trout as they once did.

Environmental impacts such as drought and warmer water have had a significant impact on marginal streams in this and other areas. "Trout can't live in water that's about 23 to 24 degrees in the middle of summer for any period of time – it would kill them. Those streams are getting well over those temperatures."

Tripet sits on the Recreational Fishing NSW Advisory Council, which is conducting a review of trout strategy in Australia and NSW. Tripet expects the review will lead to a re-evaluation of governance and management of the species in Australian waterways. **F**

If you know anyone in your community who could benefit from this program, please email info@fly.program.org.au or go to https://flyprogram.org.au

MORE INFORMATION
The Fly Program,
https://flyprogram.org.au

Managing $50.5 million in R&D to deliver value for stakeholders

A challenging year also marked the start of several new FRDC initiatives designed to improve stakeholder consultation and increase the use of research findings

The Fisheries Research and Development Corporation (FRDC) *Annual Report 2020–21* details the $50.5 million in research and development (R&D) the FRDC managed last year on behalf of its stakeholders in fishing and aquaculture, as well as the broader Australian community.

"In the first year of our new *Research and Development Plan 2020–2025* [R&D Plan], we actively managed 407 projects, including 80 new projects, and the results of 96 completed projects were shared through final reports," says FRDC Managing Director Patrick Hone.

"Our *Annual Report 2020–21* details how the FRDC has invested the contributions of the Australian Government, state and territory governments, the fishing and aquaculture industries and research providers in our sector's R&D priorities."

Five-year R&D Plan

The FRDC's new R&D Plan is ambitious, aiming to push boundaries and drive experimentation on new ways to take fishing and aquaculture into the future. It responds to a shared vision for fishing and aquaculture and aims to deliver impact in five outcome areas, facilitated through the implementation of five cross-cutting enabling strategies.

The plan aligns with key national targets and global commitments, including the shared industry and Australian Government target of building agriculture to $100 billion by 2030 and the United Nations Sustainable Development Goals.

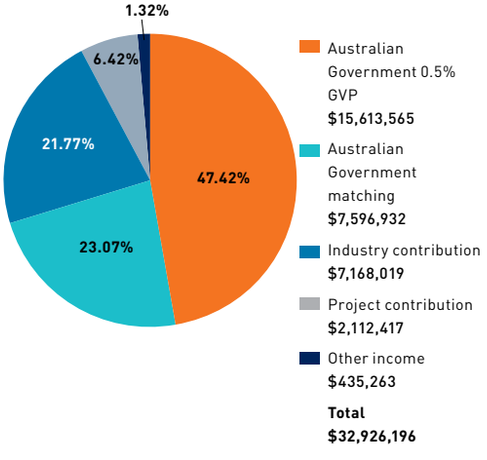
A greater focus on end users and an increased emphasis on collaboration with external partners have been central in the first year of the plan.

Improved consultation and priority setting

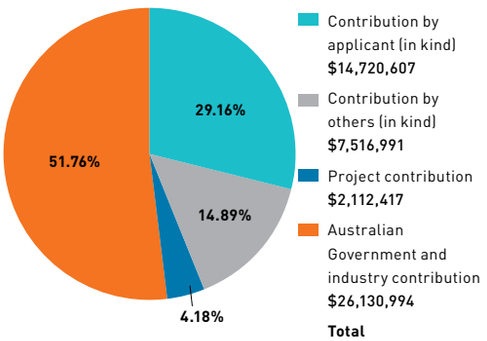
The FRDC's focus is delivering its core business: planning, investing in and managing research and development for fishing, aquaculture and the wider community, and ensuring the resulting knowledge and innovation are adopted for impact.

To improve engagement with stakeholders across fishing and aquaculture, the FRDC refined the role of its eight Research Advisory Committees to concentrate on identifying the R&D priorities in each jurisdiction and promoting the adoption of outcomes. Increasing stakeholder engagement and encouraging adoption will continue to be a focus in the coming year.

FRDC INCOME 2020–21



OVERALL INVESTMENT IN R&D MANAGED BY THE FRDC 2020–21



Navigating the COVID-19 pandemic

In 2020–21, the COVID-19 pandemic had a major but varied impact on fisheries and aquaculture. Researchers collected data to understand this impact and the industry's response and inform future adaptation responses. The report, *Impacts of COVID-19 on the Australian Seafood Industry, January-June 2020* is available on the FRDC website, **www.frdc.com.au**

In the past year, the FRDC implemented initiatives to increase communication with stakeholders to ensure they had the latest information available. These included publishing frequent advisory notes on the FRDC's website, publishing extra 'COVID' editions of *FISH* magazine and introducing the weekly 'Message in a Bottle' e-newsletter (now published fortnightly).

The FRDC's Research, Development and Investment team adapted to online consultation and meetings, including managing a road-mapping process in collaboration with the industry to guide implementation of the new R&D Plan.

"The last year was a challenging one for the fisheries and aquaculture industry and for the FRDC team and I'm impressed with how well the industry managed that challenge," Hone says.

"I would like to thank the FRDC Board for its guidance and support and the FRDC staff for their continued dedication and hard work." F

MORE INFORMATION
www.frdc.com.au

New projects

The FRDC board has recently approved the following research projects

Project number	Project	Applicant	R&D Plan outcome
2021-048	'Ready, set, go!' preparing for emergency disease outbreaks in aquatic animals	Department of Agriculture, Water and the Environment	1 2 3
2021-071	Minor use permit to sedate finfish using Australian Pesticides and Veterinary Medicines Authority-registered products containing isoeugenol	University of Adelaide	1 2 5
2021-072	Pushing the envelope: facilitating commercial performance in a changing climate	Tassal Group	2
2021-080	Australian Council of Prawn Fisheries Industry Partnership Agreement, Management and Community Engagement, People Development Programs	Australian Council of Prawn Fisheries Ltd	1 2 3 5
2021-053	Building capability in food safety in Australian shellfish	University of Tasmania	1
2021-042	Impacts of COVID-19 on the Australian Seafood Industry: extending the assessment to prepare for uncertain futures	Institute for Marine and Antarctic Studies	1
2021-046	Review of regulation and policy guiding use of artificial reefs and fish aggregating devices (FAD) in Australian waters	Bond University	1
2021-077	Development of 'guidance' for conducting stock assessments in Australia	Northern Territory Department of Industry, Tourism and Trade	2
2021-002	Investing in our future: stock assessment and the next generation	Cathy Dichmont Consulting	2
2021-030	Digital transformation of the Western Rock Lobster industry to help resolve challenges and leverage opportunities to grow gross value of production and maintain competitiveness	Western Rock Lobster Council Inc	1 2
2021-033	Aerial drones for unmanned use in Australian prawn farms	Nautilus Collaboration Pty Ltd	1 2
2021-032	Strategic advice to Oysters Australia on industry opportunities in Carbon Neutral Accreditation and Environmental Accounts	NineSquared	1
2021-051	Preliminary evaluation of electro-stunning technology for farmed Barramundi	Department of Agriculture and Fisheries, Brisbane	2 5
2021-076	Abalone Viral Ganglioneuritis R&D needs workshop	Abalone Council Victoria Inc	2
2021-024	Development of an Indigenous Engagement Strategy for fishing interests with a focus on Commonwealth fisheries	University of Technology Sydney	1 4

R&D Plan 2020–2025 outcomes

1 Growth for enduring prosperity
2 Best practices and production systems
3 A culture that is inclusive and forward thinking
4 Fair and secure access to aquatic resources
5 Community trust, respect and value

Final reports

No ghosts in the NSW Rock Lobster Fishery

2007-038

This project addressed the issue of ghost gear in the NSW Rock Lobster Fishery by investigating two possible solutions. The first approach studied the addition of sacrificial panels to the trap. These would corrode faster than the rest of the trap, allowing caught lobsters to escape sooner. While this solution did release lobsters earlier, the substantial variation between locations in the speed of corrosion and consequent breakdown time of sacrificial panels severely limits the potential for implementing a standard design of sacrificial panel across the fishery. Researchers also investigated the use of the ARC-1XD acoustic release system from Desert Star Systems (USA) to minimise the loss of traps in the first place, thereby minimising ghost fishing. Testing of this technology over six months in commercial fishing settings resulted in no loss of traps. The businesses that assisted with the trials immediately purchased the technology and further FRDC-funded work has begun to facilitate industry uptake. The acoustic release system has since been successfully adopted by several fishing businesses operating in the NSW lobster fishery.

More information: **Geoff Liggins, geoff.liggins@dpi.nsw.gov.au**

Managing whaler sharks in NSW

2010-062

Identification of shark species has historically been problematic with many species lumped into similar groups in historical catch logbooks, making management decisions difficult. A combination of novel genetic techniques, extensive field work and numerical modelling was undertaken during this FRDC Shark Futures project. This allowed the development of an innovative way of bringing together genetic and demographic data for estimating population size and modelling sustainable catch levels. The project indicates that a large shark fishery, particularly for sandbar sharks, is feasible. The approaches employed allowed the compilation of a diverse and unique set of data that will provide fisheries managers with options on how to maintain a sustainable large shark fishery with reduced impact on non-target species, including threatened, endangered and protected species.

More information: **Vic Peddemors, vic.peddemors@dpi.nsw.gov.au**

Baselines for northern coral biomass

2014-029

Australia's aquarium fisheries are high value (>$20 million), small-scale fisheries that are critically reliant on continued exports of corals listed in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES). However, widespread and accelerating degradation of coral reef ecosystems is leading to considerable public and political scrutiny about the sustainability of ongoing coral harvesting. This project shows there is substantial standing biomass of select coral species in areas with highly concentrated and sustained harvesting pressure, especially compared to the current harvest limits and reported levels of harvesting. Simply comparing the total biomass of harvested species versus standing biomass in major fishing areas does not, however, accurately represent potential fisheries impacts, as corals are harvested selectively for colour, shape and other desirable characteristics, and the consequences of selective targeting on the population structure is unknown. This study of Australian coral fisheries has provided new data on the distribution, abundance, biology and vulnerability of major target species. It greatly increases confidence in assessing the risk posed by commercial harvesting of corals, contributing to long-term sustainability and viability of these important, intensive and highly selective fisheries.

More information: **Morgan Pratchett, morgan.pratchett@jcu.edu.au**

Harvest strategies for multi-sector fisheries

2015-013

This project focused primarily on developing a method for incorporating 'triple bottom line' (TBL) objectives into harvest strategies for multi-sector fisheries. TBL incorporates a range of environmental, economic and social objectives, as well as a fourth pillar relating to institutional objectives. Multi-sector fisheries include the commercial, Indigenous and recreational sectors. Using the Coral Reef Fin Fish Fishery (CRFFF) as a case study, two approaches were tested to operationalise TBL harvest strategies. The project worked with the CRFFF Working Group and fishery stakeholders to elicit and weight TBL objectives and develop harvest strategy options, including environmental aspects affecting the fishery, such as cyclones and the chronic effects of climate change. The first approach was a semi-quantitative expert judgement process that applied multi-criteria decision analysis. The second was a data-hungry, novel simulation approach that optimised a total allowable catch across the suite of TBL objectives, as well as over the range of stakeholder group preferences (weightings). Both approaches were able to operationalise TBL harvest strategies, although the former is not defensible quantitatively, and the latter makes many assumptions and is not ready for implementation. The project developed a general method summarising key learnings in a practical stepwise process to assist managers with future approaches to TBL harvest strategy development.

More information: **Natalie Dowling, natalie.dowling@csiro.au**

Managing seals in the Coorong fishery

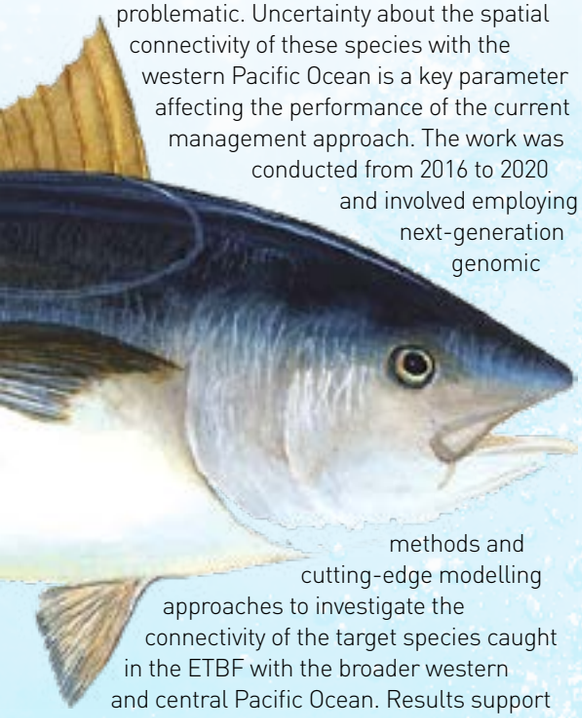
2016-001

This project trialled a range of strategies to mitigate the effects of catch depredation and gear damage caused by Long-Nosed Fur Seals (*Arctocephalus forsteri*) in the South Australian Lakes and Coorong Fishery. These included using crackers to deter seals from approaching gill nets and using fyke nets and mechanical or manual-hauling nets as alternatives to the gill nets currently used. Crackers proved effective approximately 85 per cent of the time, and fishery management changes have been made to allow their use. Fyke nets proved relatively easy to use but failed to land any significant catch. The hauling nets were made ineffective by the local fishing conditions, including snags and turbid water that limited the ability to locate target species when deploying the nets.

More information: **Jason Earl, jason.earl@sa.gov.au**

Spatial dynamics of tuna and billfish
2016-018

This project informs the management of fish stocks at the national level for Albacore (*Thunnus alalunga*), Bigeye (*T. obesus*) and Yellowfin (*T. albacares*) tunas, Swordfish (*Xiphias gladius*) and Striped Marlin (*Kajikia audax*), which are part of a wider population shared by many fisheries that is managed by an international fisheries management organisation. Application of harvest strategies, required under Australia's Commonwealth Fisheries Harvest Strategy Policy, to the tuna and billfish species caught in the Eastern Tuna and Billfish Fishery (ETBF) has been problematic. Uncertainty about the spatial connectivity of these species with the western Pacific Ocean is a key parameter affecting the performance of the current management approach. The work was conducted from 2016 to 2020 and involved employing next-generation genomic methods and cutting-edge modelling approaches to investigate the connectivity of the target species caught in the ETBF with the broader western and central Pacific Ocean. Results support current assessment structures in the Western and Central Pacific Fisheries Commission area and provide confidence that Australian management is aligned with regional management measures. The project also identifies what is needed to further reduce uncertainties in population structure relevant to harvest strategies and management frameworks for the ETBF.



More information: **Karen Evans, enquiries@csiro.au**

Guide to climate adaptations
2016-059

The project team made up of CSIRO scientists, university researchers and fisheries managers assessed climate-associated risk to the ecological resources of Australia's Commonwealth fisheries and the capacity of the Australian Fisheries Management Authority (AFMA) to meet its policy and legislative objectives. The project team then worked with industry and other stakeholder groups to develop and trial a risk assessment-based way of identifying potential adaptation strategies for Australian Commonwealth fisheries. A handbook (and associated assessment tool) acts as a guide for future evaluations, stepping interested stakeholders, industry members and managers through a structured process to rate risks and identify adaptation options, relating to both fishery operations and management actions. This project found the existing Commonwealth fisheries management framework has many vulnerabilities with respect to climate impacts and has many potential points of failure with respect to pursuing policy and legislated objectives and international obligations. Adaptive responses will be required to cope with the multifaceted impacts climate change is having and is anticipated to have on Australian marine ecosystems. The outcomes of this project can support AFMA's (and industry's) short to medium-term adaptation responses (out to 2025–30).

More information: **Ryan Murphy, ryan.murphy@afma.gov.au**

Oxygen dynamics in Macquarie Harbour
2016-067

This report provides an update on the status of dissolved oxygen (DO) and benthic conditions in Macquarie Harbour. It follows on from the results reported in the Institute for Marine and Antarctic Studies (IMAS) reports released in January, May and September 2017, which described a deterioration of benthic and water column conditions in Macquarie Harbour in spring 2016 and some early signs of faunal recovery observed in May 2017. This report presents the results and preliminary interpretation of DO monitoring data up until the beginning of January 2018 and a repeat survey of benthic communities in October 2017.

More information: **Jeff Ross, jeff.ross@utas.edu.au**

Saucer scallop mortality in Queensland
2017-048

This research was undertaken on the Ballot's Saucer Scallop (*Ylistrum balloti*) fishery in south-east Queensland, which is an important component of the Queensland East Coast Otter Trawl Fishery (QECOTF). It was a collaboration between the Queensland Department of Agriculture and Fisheries, James Cook University (JCU) and the Centre for Applications in Natural Resource Mathematics (CARM), University of Queensland. Research focused on an annual fishery-independent trawl survey of scallop abundance, relationships between scallop abundance and physical properties of the seafloor, and deriving an updated estimate of the scallop's natural mortality rate. The scallop fishery was once one of the state's most valued, estimated to be worth $30 million in 1992. Stock has declined in recent years and the fishery is currently considered to be overfished. Results from the project combined with long-term commercial catch and effort logbook data show a significant decline in the scallop population throughout the main area in which it is fished, and an increase in the most southern extent of the fishery. The towed-camera pilot study results indicate scallop density and total abundance estimates could be improved by incorporating a towed-camera system in the survey, as the imagery detects more scallops than are detected by trawls, and therefore provides more accurate abundance estimates. Results from the study are being used to improve monitoring, stock assessment and management advice for the fishery.

More information: **Tony Courtney, tony.courtney@daf.qld.gov.au**

Marine microplastics in Australian seafood
2017-199

A team of researchers led by the University of Adelaide investigated microplastics in Australian fish and invertebrates collected from seafood processors in capital cities of all coastal states and territories. They found about 44 per cent of the approximately 1800 fish and invertebrates examined contained microplastics. The average number of microplastics per organism was low at around one piece. This study represents

the first Australia-wide assessment of microplastics across a broad range of species. Microplastic loads in Australian finfish and invertebrates were low in comparison to many international studies.
More information: **Bronwyn Gillanders, bronwyn.gillanders@adelaide.edu.au**

Maintaining the Fish Names Standard 2018-006

This project focused on the ongoing development and maintenance of the Australian Fish Names Standard (AS 5300-2019), which was initiated by Seafood Services Australia in 1999, and continued with funding support from the FRDC in 2013. The operating procedures of the Fish Names Committee have continued to improve, and proposed amendments have been rigorously evaluated. The list of approved names in the Australian Fish Names Standard has continued to expand to meet stakeholder needs through harmonising with the Status of Australian Fish Stocks (SAFS) Reports and adding commercially important invertebrate species. An extension to the project was approved for the period from 1 October 2020 to 30 June 2021. This extension included a six-month period to develop the Australian Standard for Aquatic Plant Names (AS 5301-2020).
More information: **Meaghan Dodd, FNC@frdc.com.au**

Data on Indigenous use of marine resources 2018-016

Through two national workshops, Indigenous community and agency representatives and researchers discussed issues around collection, sharing and ownership of Indigenous fishing data. Challenges and opportunities were shared from all perspectives. Expertise, knowledge and information came together to enable the development of a framework for improved data on Aboriginal and Torres Strait Islander fisheries resource use. Sharing these data, which incorporate catch-related information and Indigenous knowledge, should improve understanding of the needs (cultural, social and economic) of Indigenous communities and resource managers. This framework and the ongoing development of data collection methods aim to facilitate the sharing of Indigenous fishing data and ensure a more holistic and collaborative approach to fisheries resource management.
More information: **Rural Solutions SA, pirsa.ruralsolutions@sa.gov.au**

Non-market values audit in fisheries and aquaculture 2018-068

Effective management of marine resources requires the inclusion of both negative and positive impacts of fishing and aquaculture on the wider ecosystem and community. Not all these costs or benefits have an explicit market value, so non-market valuation is required to derive an appropriate equivalent monetary value. This project examined the issues around non-market values requirements and identified potential sources of robust and defensible estimates of key values. The project identified 13 types of non-market values that fisheries and aquaculture managers considered potentially important in their decision-making. These include fisher satisfaction; values to Indigenous Australian fishers; the value of fish and experience to recreational fishers; and the impact on habitats, species and local communities. The project identified a need for increased education about the types and uses of economics data for fisheries and aquaculture managers. In particular, it recommends examining how existing and future recreational fishing data can be adapted to provide estimates of value, and how values can be derived for high-prority impacts including bycatch and habitat damage.
More information: **Louisa Coglan, l.coglan@qut.edu.au**

Fisheries stock assessment toolbox 2018-148

Stock assessment scientists from CSIRO and Cathy Dichmont Consulting designed a web-based tool that collated freely available stock assessment packages. The final product is a website (toolbox.frdc.com.au) that collates available stock assessment packages to give assessment analysts a single platform that summarises the features of currently available packages in a consistent manner. Also highlighted are current state-of-the-art packages and those that are no longer supported or have been superseded. In addition, the website helps users of packages to give feedback to developers about which features of other packages could be included in future versions. This will support the design of the next-generation stock assessment packages.
More information: **Cathy Dichmont, cathydichmont@gmail.com**

Seafood demand and price analysis 2018-017

This project is a collaboration involving economists from CSIRO, Central Queensland University and the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). It is the first detailed analysis of the interrelationship of fish prices in the Sydney and Melbourne fish markets. The study established that the Sydney and Melbourne markets are highly integrated, with prices of individual species moving together. Demand modelling results indicate prices of individual key fish species are sensitive to changes in the quantities landed, but less sensitive to changes in the quantities supplied of other fish species. It also found the increased production of farmed salmon in Australia has had a substantial negative impact on the prices received for salmon in the Sydney Fish Market, more so than the impact of imports. The results demonstrate the importance of considering price–quantity interactions in a total allowable catch (TAC) setting. Managers and industry may wish to consider greater use of bioeconomic models to support TAC setting. In the absence of a bioeconomic modelling framework, price impacts could be taken into account when considering changing target catch levels. Long-term decisions for the fisheries could also explicitly consider the future price environment given likely changes in imports and domestic salmon production. Consideration could also be given to increased research into assessing price flexibilities in fisheries not previously assessed.
More information: **Sean Pascoe, sean.pascoe@csiro.au**

Southern Bluefin Tuna forecasts
2018-194

This project was a collaboration between CSIRO, the Australian Southern Bluefin Tuna Industry Association (ASBTIA) and the Australian Bureau of Meteorology. Building on FRDC project 2012-239, its key goal was to provide industry with habitat preference forecasts for Southern Bluefin Tuna (*Thunnus maccoyii*) in the Great Australian Bight, based on the new seasonal climate forecasting model and updated preference models. With a greater-than-expected volume of data available from new archival tags, researchers developed age-specific models with age classes of three to four years of particular interest to industry for its farming operations. The website that was developed as part of the original project to help industry members plan their operations was revised significantly to deliver the new age-specific habitat forecasts, as well as to accommodate requests for additional material. The revised website is being used in the 2020–21 fishing season and has been well received.

More information: **J. Paige Eveson, paige.eveson@csiro.au**

Seismic survey impacts on Southern Rock Lobster larvae
2019-051

This project was undertaken by the University of Tasmania's Institute for Marine and Antarctic Studies and Curtin University's Centre for Marine Science and Technology. It characterises the impacts of seismic surveys on puerulus and juvenile Southern Rock Lobster (SRL, *Jasus edwardsii*). Researchers assessed mortality rates, impairment of the righting reflex and development through the moult cycle following exposure. Key findings and implications include that exposure did not result in any elevated mortality for puerulus or juveniles, but it impaired righting at a distance of at least 500 metres (the study's maximum range) in SRL sampled immediately following exposure. Impairment resulting from close-range exposure appeared persistent, whereas lobsters exposed at a more distant range showed recovery. This indicates a range of 500 metres may not cause lasting impairment to righting. Intermoult duration was significantly increased in juveniles closer to the exposure site (E0) and appeared to be increased in E0 puerulus, indicating the potential for slowed development and growth, and physiological stress.

More information: **Jayson Semmens, jayson.semmens@utas.edu.au** **(see story page 30)**

Support for owner-operated fishing businesses
2018-205

Southern Rock Lobster (*Jasus edwardsii*) fishers have expressed concerns about trends in ownership of the fishery, including issues such as the concentration of ownership, foreign ownership and loss of regional economic benefits. A workshop hosted by Southern Rocklobster Limited was held in Melbourne in October 2019 to give industry stakeholders, managers and investors the opportunity to discuss the current industry structure and determine any paths of action. The workshop reviewed options to deliver objectives and fishery community goals. These options ranged from legislative and regulatory instruments to voluntary local agreements. Assessment of these goals could constitute further work in this area.

More information: **Thomas Cosentino, tom@margoconsulting.com.au**

Movers and ...

MOVERS WE'VE MISSED?
PLEASE SEND INFO TO: Ilaria Catizone
02 6122 2128 ilaria.catizone@frdc.com.au

Clamms Seafood CEO **Stephanie Kaparos** and Food South Australia CEO **Catherine Sayer** are new members of the Seafood Industry Australia board.

Julie Willis has joined Seafood Industry Australia as trade export manager.

Roberta Muir has left the Sydney Seafood School.

Jen Fry has left the Tasmanian Salmonid Growers Association.

Justin Coombs has been appointed CEO of the Marine Bioproducts Cooperative Research Centre.

Belinda McGrath-Steer has left Primary Industries and Regions South Australia fisheries to become assistant director, Water Division, in the Commonwealth Department of Agriculture, Water and the Environment.

Tim Ward has moved from South Australian Research and Development Institute to the Institute for Marine and Antarctic Studies in Tasmania.

Lukina Lukin has been appointed to the board of the Spencer Gulf & West Coast Prawn Fishermen's Association (SGWCPFA) and **Kelly Pyke-Tape** is the organisation's new executive officer.

Rachel Przeslawski is the new Research Leader for Marine Ecosystems with the Department of Primary Industries NSW.

Dallas D'Silva has left the Victorian Fisheries Authority to become the new executive director, Fisheries Queensland, for the Queensland Department of Agriculture and Fisheries.

FRDC MOVERS

Annabel Boyer left the FRDC in September after five years with the communications team.

Kate Harvey is the new general manager stakeholder engagement.

Louise Mickan is the new part-time human resource manager for the FRDC, based in the Adelaide office.

Adrianne Laird has taken the position of research portfolio manager, based in Port Stephens.

Toby Piddocke has also been appointed as a research portfolio manager.

Sally Roberts is the FRDC's new capacity capability and culture change manager, based in Melbourne.

Joshua Fielding has returned to his role as senior portfolio manager after a secondment to the Australian Fisheries Management Authority.

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AVAILABLE NATIONWIDE THROUGH STAY AFLOAT!

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Seafood Industry Mental Health & Wellbeing

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Who can attend?
Any employee or business owner in the commercial seafood sector (including aquaculture), their family or friends over 18 years.

What's the cost?
There is no cost for our industry. The course is funded by the Federal Government Department of Health, Mental Health program through a grant provided to Seafood Industry Australia and Women in Seafood Australasia.

What's involved?
Once you register by clicking the link below that suits your timing, we'll send you all of the information regarding next steps and we'll guide you through the simple process of getting your e-learning started.

The e-learning component is self-paced and takes 5-7 hours. The online component comprises of 2 x 2.5 hour interactive workshops over Zoom.

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