FISH

FISHERIES RESEARCH & DEVELOPMENT CORPORATION **NEWS**

VOLUME 28
NUMBER 3

DECEMBER 2020

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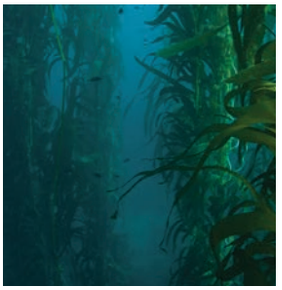

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REGULAR

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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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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.

Light on the horizon

In a year of chaos and tragedy there have also been moments of gratitude and a vision of the path forward

By **Peter Horvat**

2020 is a year that will be remembered for diverse reasons: fires we haven't seen the like of for decades; an unprecedented global pandemic; trade tensions between major nations; and a US election, albeit on the other side of the planet, that will have ramifications for Australia.

The repercussions will change how we work and relate to each other for a long time to come. It is hard to look back over the year and see more than the stress, the challenges and, for many, the loss.

Hardest of all to comprehend and deal with is the apparent randomness of it all, the vagaries of the impacts. Why did the fires and the coronavirus affect some people, houses, businesses and communities, but missed others right beside them?

Nonetheless, the community spirit remains strong and resilient. Many gave time, money and products to those in need.

We found ourselves reaching out to friends, family and stakeholders. Instead of just 'business as usual', this contact took a deeper meaning and broke the dimension of isolation that many people were feeling – especially for those doing a 14-day quarantine.

As some normalcy returns to life in Australia and the year comes to an end, the FRDC looks back at what has been achieved, starting with the centre four pages of this magazine, which is a summary of the Annual Report for 2019-20.

A big part of 2020 was the focus on communications and engagement. Despite not being able to travel due to COVID-19 restrictions, our staff spent a lot of time reaching out to researchers, industry members and managers across the spectrum of fishing and aquaculture to touch base and see how they were coping. Even as I write this for the last issue of *FISH* magazine for the year, we have the 2020 stakeholder survey out for comment and feedback. From this survey and some specific research, the FRDC is developing a COVID-19 report to capture the impacts of this incredible year.

This year, we delivered a bumper value pack for *FISH* magazine, producing five editions – including two COVID-19 issues – as well as starting the Message in a Bottle newsletter. If you haven't seen it, sign up at https://www.frdc.com.au/subscribe. A special thank you to the team at Coretext and, in particular, Catherine Norwood, who assisted with *FISH* magazine this year.

The FRDC Research and Development Plan 2020-2025 was finalised and approved by the Minister for Agriculture. This starts a new five-year R&D investment cycle at the FRDC that will bring with it some changes. The first was to open up the planning process and offer anyone who was interested the opportunity to participate – for more details visit https://www.frdc.com.au/frdc-stakeholders/meetings.

Photo: Britt Gaiser

This approach has come as a result of feedback that meetings were closed and for a limited few. The developments in online meeting platforms will help make future meetings more open and allow for greater input from stakeholders who want to be part of the process.

Speaking of technological change, if COVID-19 has done anything, it has spurred major changes in technology and its use. Zoom, Microsoft Teams and Facetime are now an everyday part of our lives. It has replaced many of the traditional meetings we would participate in and helped keep us connected. While these meetings serve a purpose and are useful, they don't fully replace the experience of face-to-face gatherings with people on farms or boats.

Another major achievement this year has been the formation of Agricultural Innovation Australia, a partnership between the rural R&D corporations to drive investment and innovation on the big, hairy, cross-cutting issues that all sectors face – see the story on page 12.

As Christmas approaches, the FRDC would like to wish all our stakeholders a safe, seafood-filled holiday season. F

This year, we can be thankful for:

- the many health workers and emergency services personnel who work across Australia and the world. This year has been tough for them and we give our thanks;
- our own physical and mental health. We think of those who have dealt with disease and loss through the year;
- the seafood producers, and other primary producers, who supplied our glorious food. For many, the year has been tough but they have perservered, and for that we give thanks;
- our wonderful weather. Last year, we were in the midst of savage drought and facing fire storms. This year, we think of all the wondrous rain and revel in the life it has brought across Australia;
- the new technology that connects us each and every day with our customers, stakeholders and friends. We can be grateful that this year we swapped ready-to-go overnight travel bags for Zoom, Teams, and Facetime meetings, but that the end is now in sight and we can get back to seeing each other face-to-face;
- the freedoms we cherish so much in Australia, and the fact that our communities are resilient enough to endure temporary restrictions to save and protect those who are most at risk;
- our families and friends, and even acquaintances who we recognise in passing with a smile and a nod. While we may not know each other that well, we give thanks knowing that if we were in real trouble all would lend a hand; and lastly,
- looking to the future and what it will bring: a vaccine, travel and plenty of seafood.

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FRDC RESEARCH CODE: 2018-181

Lake tales

An exhibition celebrating the contribution to community and industry of Gippsland Lakes fishers is set to open in the new year

Words **Melissa Marino** Photos **Leigh Henningham**

It was the end of a long era when the Gippsland Lakes commercial fishers pulled up their nets for the last time on 31 March 2020.

"It was a beautiful day, blue as far as you could see," recalls Lynda Mitchelson-Twigg, whose husband and father held licences in the inlet fishery that dates back some 150 years.

"We took our children out and shot lots of video, including our daughter accidentally dropping her fish over the side of the boat instead of in the fish bin."

The small-scale commercial fishery, which long ago formed the basis of today's bustling Lakes Entrance fishing community, was closed by the Victorian State Government as part of its Target One Million plan to grow recreational fishing. But thanks to a team of fishers, historians, photographers, anthropologists and curators, the fishers' stories and knowledge will not be forgotten.

'End of an Era: the Last Gippsland Lakes Fishermen' is an interactive exhibition presenting the social and cultural story of the fishery through the images and words of the last 10 Gippsland Lakes fishing families.

Through large-scale photographs and audio, it tells of their connection to the land and sea, and their contribution to fishing communities and the Australian fishing industry as a whole.

"It is about giving them a voice," says Lynda Mitchelson-Twigg, who led the exhibition project. Her personal connection to the fishery runs deep – right back to the 1880s when her great-great-grandfather began fishing the lakes.

Her husband, Andrew Twigg, and her father, Harry Mitchelson – two of the last 10 licence holders – are featured in the exhibition along with the "soft, croaky and lovely" voice of her great uncle, Frank Mitchelson, who at 94 was the lakes' oldest fisher, before he passed away in 2020. "This project gives people an opportunity to hear the stories and see a different side to how they might perceive fishers to be," she says.

One fisher who broke the mould is her late grandmother, Mary Mitchelson, a female commercial fisher on the Gippsland Lakes, who is featured in the exhibition "in her gumboots and beanie" – and who was the catalyst for the project.

Historian Nikki Henningham, who specialises in Australian women's history, had interviewed Mary in 2017 for the Invisible Farmer project – the largest ever study of Australian women on the land. So, when she heard about the closure of the fishery, she felt compelled to document the stories of the families who worked there. →

Pictured right
Andrew Twigg

ACKNOWLEDGEMENT OF COUNTRY
The Lakes Entrance region is recognised as part of Gunaikurnai country, known today as Gippsland.

Left Gary Leonard

Above Mary Mitchelson was a pioneering female fisher of the Gippsland Lakes. She is pictured here in the 1960s with her husband Kevin and teenaged son Harry (with the nets).

Left James Casement

"These people have knowledge that goes back through generations to the start of the commercial fishery, and recording their stories will continue to provide a window into an industry that was so strong and the foundation for many small communities," she says. "It's about our environmental history, and our socio-cultural history. The death of their industry should not go unnoted."

What began as an oral history project for the National Library of Australia archives quickly evolved into a public exhibition with support from the FRDC, Deakin University and the University of Melbourne, where Nikki Henningham is based.

In a truly collaborative effort, the project is "a really good example of how academic social science can engage with community to create knowledge", she says. "And Lynda is the driving force."

Telling local stories is important, not just for the benefit of the immediate community, but because they add rich texture to our national story and identity, Nikki Henningham says.

"Today, when there are so many global impacts upon us, the stories we can tell about ourselves are crucial to our self-esteem," she says. "That sense of history and how we belong and how we do things is absolutely vital."

In the Gippsland Lakes, those stories are of the nooks and crannies of the inlets that provide shelter no matter the wind direction; of the enormous twilight sky full of colour; of catching a morning bus home from Melbourne to step onto a fishing boat in the afternoon; of cold and wet dawns; and of quiet, traditional fishing methods, holding nets by hand.

"It's an opportunity to share with people who may not have ever known we existed," Lynda Mitchelson-Twigg says of the exhibition. "It's also important that people know where their food comes from, and I think as multigenerational operators we have a significant history."

Recording this history also means lessons of the past will not be lost for the future, says Nikki Henningham. "The stories of people who work the land or the waters are as old as this continent. And we've got a lot to learn about water management and fisheries management by listening to the people who have worked in those environments, sustainably, for generations."

As part of the project, Nikki Henningham is also developing a template so other communities can run their own oral history projects to record their experiences, curate material and present it online so their stories remain available for themselves and broader society.

"Those stories of ordinary life remind us of how everyone's lives are valuable, including your nana who cleaned the fish before they threw it onto the cart, or the old guy who brought the ice in before there was a fridge," she says.

"It's about reminding us that ordinary people actually live extraordinary lives, and you might value the lives of everyone in your community a bit more if you talk to them and ask them, 'what was your town like when you were growing up?'"

The exhibition, originally scheduled for May 2020 to coincide with the fishery's closure, was postponed due to COVID-19 restrictions until January 2021. After its premiere at the Slipway Lakes Entrance, it will move to the Library at The Dock Gallery at the Docklands in Melbourne and then Deakin University's Geelong Waterfront Campus.

Lynda Mitchelson-Twigg says while the loss of their industry has taken a heavy toll, she hopes the exhibition will honour and celebrate the men and women of the Gippsland Lakes fishery and provide an insight into their world. Since the closure some have continued to fish in other fisheries while others have found work in different industries. "It's a nice legacy for them to have," she says of the exhibition. "I am hoping it will do them proud and it will be something all the fishers will appreciate." **F**

Right Ballina's commercial fishers with water quality monitoring equipment they have donated to OzFish to support habitat initiatives. Photo: Karen Ward

FUNDING HABITAT RESTORATION

The Australian Government will invest $8 million over four years on projects to help restore the health and functionality of coastal and estuarine fisheries habitats.

Minister for Agriculture, Drought and Emergency Management David Littleproud has announced 28 projects across the country that will receive funding through the Fisheries Habitat Restoration Program.

Projects are spread across New South Wales, Queensland, Victoria, South Australia, Western Australian and Tasmania, with a particular focus on recreational fisheries.

This funding will see Regional Land Partnership providers, which include Oceanwatch, join with recreational fishing groups as partners in efforts to directly improve fish habitats.

Together, they will work on projects that include oyster reef restoration, riverbank stabilisation, fish passages, fish-friendly boat moorings, seagrass and saltmash restoration and other riparian vegetation initiatives to restore biodiversity in marine and estuarine areas. **F**

Fishers help track habitat water quality

Monitoring and responding to changes in water quality is the focus of a new fisheries habitat initiative supported by commercial and recreational fishers in the New South Wales Richmond River region.

Each year, commercial fishers from Ballina donate the proceeds from the annual 'mullet run' – when fish migrate from the Richmond estuary to breed at sea – to a local charity.

With funds from the sale of this catch, they have donated a state-of-the-art water quality monitoring device to the local chapter of Australia's fishing conservation charity, OzFish Unlimited.

The water quality meter provides real-time feedback on dissolved oxygen, temperature, salinity, pH and a number of other statistics related to water health and their respective changes over time.

It will ensure any changes in water and environment will be quickly identified, helping OzFish to better understand and manage these changing conditions as part of its fish habitat restoration projects within the Richmond River.

The aim is to improve the overall health and long-term productivity of the river and its fisheries. **F**

Research call

The FRDC has opened a competitive call for research projects to address several of the priorities identified in its Research and Development Plan 2020–2025.

Expressions of interest included four fast-track projects, with a deadline for applications of 6 December 2020 and a research delivery date of June 2021. There are also five longer-term projects, with applications closing on 20 January 2020 and no set deadline for project completion.

Projects – deadline 6 December 2020:

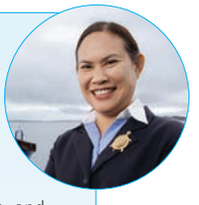
- Quantifying the inter-sectoral values within and among Indigenous, commercial and recreation sectors;
- The circular economy in fishing and aquaculture;
- An audit of plastic use in the fishing and aquaculture sectors; and
- Energy use and carbon audit in fishing and aquaculture.

Projects – deadline 20 January 2021:

- Fisheries abundance estimation toolbox;
- Resolving uncertainty on abundance for Mangrove Jack, Silver Trevally, Giant Spider Crab, Ocean Jacket and Giant Crab stocks;
- Mitigating interactions between longline tuna fishers and protected species;
- Investigating the reopening of closed, shared-access fisheries; and
- Evaluation of fisheries enhancement initiatives.

Full details of the research wanted, as well as the application process, are available at **https://www.frdc.com.au/en/research/call-for-applications/november-2020-call-for-applications**.

The FRDC is changing the way it calls for and commissions research. To stay in the loop, subscribe to the FRDC's updates at **https://www.frdc.com.au/subscribe**. **F**



REGIONAL APPROACH FOR LEADERSHIP PROGRAM

The FRDC has sponsored two participants in the Australian Rural Leadership Program (ARLP), now underway. Lukina Lukin (right) of Dinko Tuna in Port Lincoln, South Australia, and Hayley Abbott (below) of Narooma Seafood Direct in Narooma, New South Wales, are members of the 27th ARLP course, which began in November 2020.

Responding to COVID-19 restrictions and concerns, the ARLP has this year dispersed its face-to-face sessions across the country, using regional rather than national gatherings and engaging with local alumni.

The ARLP is a 15-month dynamic experiential learning program focused on the development of leadership for individuals and collectives who are contributing to the future prosperity of rural and regional Australia. Applications for the 28th ARLP program have closed. Applications for the 29th program will open in July 2021. **F**

Left Hayley Abbott Photo: Carl Davies

Top Lukina Lukin Photo: Robert Lang

DATA SCIENCE

Labour violations and illegal fishing dominate crimes involving fishing vessels. Photo: AFMA

UNTANGLING ILLEGAL FISHING FROM OTHER CRIMES

Violations of workers' rights, forced labour or modern slavery are the predominant crimes associated with illegal fishing in the Asia-Pacific region, CSIRO research reveals.

This is contrary to a common narrative connecting illegal fishing to organised crimes such as drug, human or arms trafficking.

Study leader Mary Mackay from CSIRO's Oceans and Atmosphere says the findings supported efforts to protect those vulnerable to fisheries exploitation; these efforts will enhance livelihoods, social wellbeing and the sustainability of global fisheries.

"By disentangling illegal fishing from other crimes, we can better focus on solutions to tackle it," she says. "This will help to ensure sustainable fisheries management and global access to seafood to meet growing protein demand."

Annual economic losses from illegal fishing are estimated between $35 billion and $68 billion.

Chris Wilcox, research scientist from CSIRO's Oceans and Atmosphere marine data analytics team, says illegal behaviour in fisheries is often driven by a need to reduce costs and increase revenues. "Our research [a systematic literature review] shows that fishers don't smuggle on a major scale. Instead, violations relate to the underpay of workers, fishing in prohibited areas and other activities that are closely related to the core business of fishing." F

NUTRITION

Refined finish for fish oil

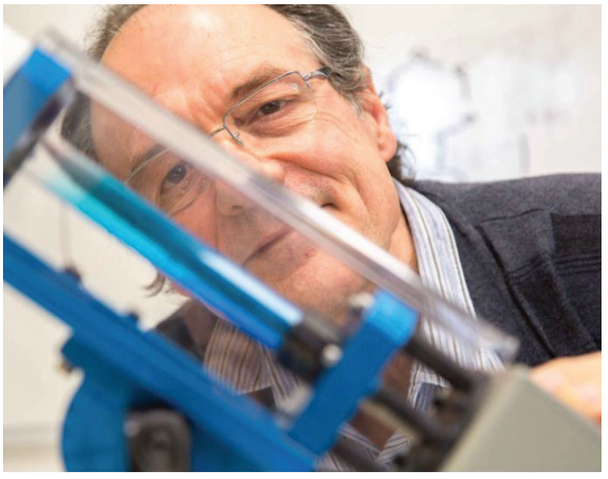
A new way of sustainably processing fish oil can create better dietary omega-3 health and dietary supplements with superior quality, taste and odour.

The vortex fluidic device, developed at Flinders University, South Australia, allows for high-speed processing that lifts the quality of active ingredients of the polyunsaturated fatty acids (PUFAs) in fish oil.

The process was used to enrich the omega-3 fatty acid content of apple juice, remarkably without changing its sensory values, which is important for the consumer, says co-lead author, University of Cincinnati's Harshita Kumari.

The device raised PUFA levels and purity by lowering oxidation and dramatically improving shelf life compared to fish oil produced by regular industrial homogenisation. Natural bioactive molecules were used in processing, showing that the fish oil medium can take up flavonoids and other health supplements.

Published in partnership with Guangzhou, Cincinnati and Flinders universities, and with the Australian Nuclear Science and Technology Organisation (ANSTO), the research is further proof of the value of rapid vortex fluidic green chemistry processing. F



Flinders University Professor of Clean Technology Colin Raston says the vortex fluidic device can scientifically measure and control the requirements for better outcomes in food processing. Photo: Flinders University

WORD-WISE

Aquaculture is the cultivation of aquatic animals and plants.
Mariculture is aquaculture that occurs at sea and on coasts, including in coastal ponds and lagoons.
Integrated multi-trophic aquaculture (IMTA) is the cultivation of aquatic species from different trophic levels – or levels in the food chain – in a system that allows waste from one species to be used as inputs for another. F

ECOLOGY

BLENNY CLUES TO EVOLUTION

Blennies are a remarkable fish family. Not only have some made a dramatic transition from water to land, they are also providing scientists with a unique insight into evolution.

"Some species of blennies never emerge from water and others stay on land full-time as adults – so they present an opportunity to study fish evolution in action and explore the transition from water to the land in a living animal," says University of New South Wales (UNSW) evolutionary ecologist and study lead Terry Ord.

The UNSW and University of Minnesota collaboration analysing big datasets found flexible behaviour; for example, a diverse diet and leaving the water for very brief periods of time, has likely allowed blennies to make a successful leap onto land. This insight can be extended to any species making a move between habitats and might have other implications. "The flipside of our study suggests that some species already uniquely specialised to their existing environment are probably less able to make further transitions in habitat, or might not cope well if abrupt changes occur to their environment, for example, as a consequence of the current climate crisis," Terry Ord says.

While the blenny had a diverse diet in the water, it faced restrictions on land. "These restrictions have triggered major evolutionary changes in their morphology, specifically dramatic changes in their teeth, as they have been forced to become specialist 'scrapers' of the rocks to forage on algae and detritus," he says. F

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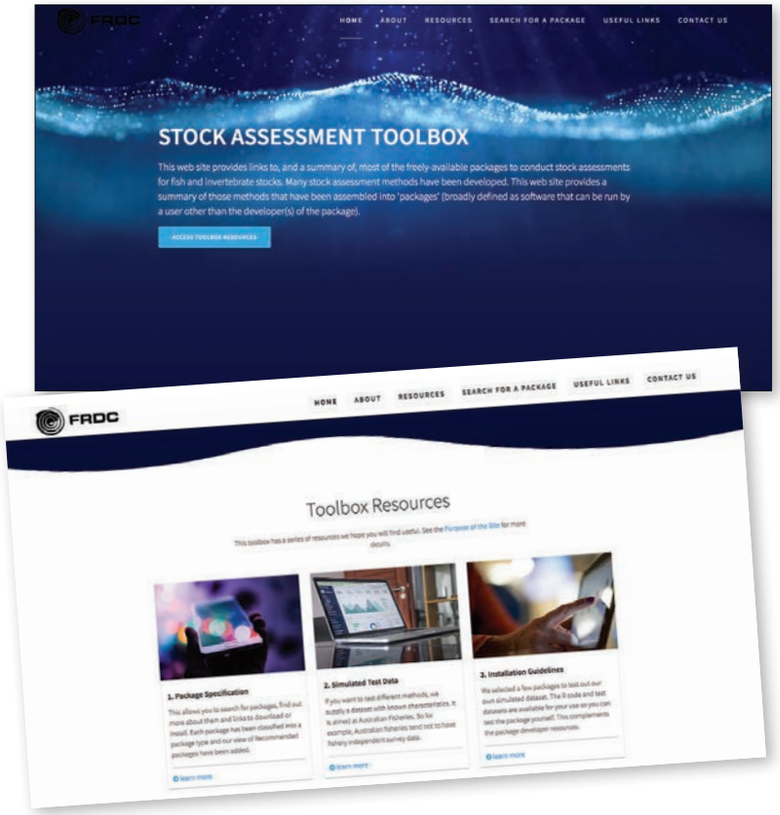
The Stock Assessment Toolbox, http://toolbox.frdc.com.au
FRDC RESEARCH CODES: 2014-039, 2018-148

Below Stock Assessment Toolbox website.



A strategic approach to stock assessment software

By **Gio Braidotti**

One website has brought together and reviewed the world's best, free, off-the-shelf stock assessment packages, helping fisheries researchers get more done with less

Stock assessments are the cornerstone of sustainable fisheries. However, these involve computationally intense methods to model fish population numbers, accounting for available fishery and biological information such as natural mortality, the age structure of the stock, age at spawning, fecundity and the ratio of males to females.

Over the years, a plethora of computer programs have been written to perform single-species stock assessments, but increasingly, off-the-shelf (OTS) software packages have become freely available worldwide.

Cathy Dichmont, an internationally recognised expert in stock assessment and natural resource management, says OTS packages offer considerable efficiencies, but there is a problem: "A review I undertook for the FRDC in 2016 found uptake of OTS software packages was low in Australia, particularly in comparison to other countries, such as the USA. For example, the review found that of the 76 data-rich assessment tools developed in Australia, about 52 of these could have been undertaken using OTS packages."

The key barrier preventing uptake was a lack of knowledge about existing OTS packages, along with difficulty understanding where these packages are located within the World Wide Web.

"We provide information that can help decide if these packages are useful, we rate them in each model category defined on the website, and also point to key resources for each package."

Cathy Dichmont

Those challenges have now been addressed with the 2020 launch of a website hosted by the FRDC called the Stock Assessment Toolbox (http://toolbox.frdc.com.au). The site not only lists all available OTS packages within one website, but also reviews their functionality and curates their ongoing evolution.

It is the only site of its kind in the world that focuses on globally available packages for data-limited to data-rich stock assessment methods.

The development work was funded by the FRDC, CSIRO and Cathy Dichmont Consulting. It was undertaken by Cathy Dichmont and three CSIRO researchers:

- André Punt (Washington, USA), who is a professor at the University of Washington, where he develops new stock assessment methods;
- Natalie Dowling (Tasmania), who develops harvest strategies in data-limited contexts; and
- Roy Deng (Queensland), who specialises in fishery model programming, spatial analysis and fishery data management.

The project team conducted an in-depth search of freely available packages. More than 130 packages were initially identified. However, over 60 were removed from the list because they were no longer supported, had been replaced by a more modern package, or were still under development and not available for general use.

On the positive side, the team observed that packages are increasingly being tailored for use in data-limited and data-moderate fisheries, creating more resources for these kinds of fisheries. This is a development that Cathy Dichmont strongly welcomes.

Prior to the launch, the site underwent independent testing by researchers in the fisheries sector.

At launch, the site contained about 70 packages and three main resources:

- a package list and search function to help find an appropriate package for a fishery;
- simulated test data that can be used to test packages, given that the stock status of the simulated dataset is known; and
- installation and use guidelines for a set of key data-limited and data-moderate packages using the simulated test data.

"The Stock Assessment Toolbox provides detailed descriptions of what the listed packages do and what they are for," Cathy Dichmont says. "We provide information that can help decide if these packages are useful, we rate them in each model category defined on the website, and also point to key resources for each package." F

Whole-of-agriculture research company to drive innovation

Creating a vehicle to coordinate investment will help agriculture, fisheries and forestry move from the financial shadows to centre stage for economic development

By **Brad Collis**

The future of Australia's fishing and aquaculture sector, right along the seafood supply chain, has been firmly embedded and linked to the future prosperity of Australia's whole primary production sector through the formation of a major new research collaboration and investment vehicle – Agricultural Innovation Australia (AIA).

The FRDC has been a key partner in the establishment of AIA, which is supported by the Australian Government and the 15 rural research and development corporations (RDCs).

A central objective is to leverage the combined research intelligence and needs of all RDCs to drive the R&D necessary to make agriculture and fisheries a $100 billion sector by 2030. This is the goal set by the National Farmers' Federation and the Australian Government.

AIA has been set up to drive cross-industry research and to attract private sector investment to target 'transformational' innovation in Australia's primary sector.

FRDC managing director Patrick Hone has been championing the company's creation and sees it as 'future-proofing' fishing and aquaculture's many value chains. Australian agriculture, including fisheries and forestry, needs an exponential lift in its innovation effort, and this means attracting more private sector investment, he says.

Photo: 123rf

> "AIA will capitalise on cross-industry opportunities to drive productivity, sustainability and profitability in agriculture by leveraging the power of collaboration. AIA will work with the private sector to attract investment, bringing new perspectives and players to agricultural innovation."
>
> David Littleproud, Minister for Agriculture

For example, at present agriculture attracts just 0.2 per cent of its investment from Australian superannuation funds.

Patrick Hone says the new company, AIA, will give the sector a much stronger investment profile.

Be prepared

"People ask why the FRDC is involved with a company called agriculture. It is because we need to be future-ready, and many of the major issues we face or will face are the same as those in other production sectors," he says. "Likewise, the technology we will require and will use. Twenty years ago, the iPhone didn't exist. Now look at the innovations and industries that have developed around it.

"So, if you project 10 or 20 years ahead, many of our clients don't exist today. There will be new companies, new innovations, new ways of fishing, new opportunities for Indigenous fisheries, and more. So, AIA is about looking to, and shaping, the future."

The FRDC, like other RDCs, is committed to the $100 billion national production target, but Patrick Hone points out that reaching this target cannot be achieved via 'business as usual'. It will require more industry partnering, as well as the foresight and decision-making agility that a commercially focused innovation company can bring to investment opportunities.

He says the FRDC joined the initiative because of five particular principles that have been established:

- the ability to operate across or even outside our current industry focus – it will expand our horizons;
- the RDCs are supporting AIA's startup by funding its administration for three years, but for its R&D dollars it has to go out to the market (the Australian Government is injecting $1.3 million to kickstart research investments);
- the company has to demonstrate its value to investors and attract non-traditional investors to the sector;
- it has been given the authority to be agile and adaptable without having to go back to all the RDCs to make decisions; and
- it will be enduring because of its ability to take a long-term approach to strategy.

Patrick Hone says the bottom line is that if agriculture, including fisheries, does not embrace change and try different things, they are in trouble.

"Our industries will not be able to compete. They will senesce," he says.

Collective power

"Alternatively, look at the potential to be unlocked by a structure such as AIA with all 15 RDCs behind it. This creates an $800 million to $900 million engine room working collectively for the benefit of Australia."

The formation of AIA, along with the government's recent announcement on the development of regional Adoption and Innovation Hubs, is also a chance to upskill regional communities and remove their reliance on capital cities.

"We have to build satellite cities in regional areas that have depth of character – science, innovation, engineering and other elements that build critical mass," Patrick Hone says.

In unveiling the creation of AIA in early October, the Minister for Agriculture David Littleproud described the initiative as "a game changer" in driving collaboration and coordination of investment in agricultural innovation.

"AIA will capitalise on cross-industry opportunities to drive productivity, sustainability and profitability in agriculture by leveraging the power of collaboration," he said.

"AIA will work with the private sector to attract investment, bringing new perspectives and players to agricultural innovation."

Minister David Littleproud said AIA was a key element of the government's National Agricultural Innovation Agenda to modernise Australia's agricultural innovation system.

He cited climate resilience, natural resource management and supply chain traceability as the type of big, national challenges needing advanced research-driven responses.

"Now more than ever we need to demonstrate the greatest returns from our investments, improve transparency of outcomes and drive efficiencies and greater uptake of our R&D efforts," he said.

Chair of the Council of RDCs and the Grains Research and Development Corporation, John Woods, said AIA represented an exciting new era for Australia's primary industries.

"AIA will transform investment in Australian agriculture. Having a single entity to lead cross-industry strategies will make it easier for investors from around the world to navigate and partner with our agricultural system.

"Activities undertaken by AIA will focus on areas with greatest impact across multiple agricultural industries. To avoid duplication of effort, when prioritising opportunities for investment, consideration will be given to existing RDC and industry strategies."

An interim board has been appointed to recruit a CEO and directors for a permanent board by the end of 2020. F

FAST FACTS

Agricultural Innovation Australia Ltd will be managed by an independent, skills-based board, and invest in strategies that address shared challenges and opportunities to deliver transformative outcomes for the agriculture sector.

RDCs are responsible for investing more than $800 million each year in agricultural innovation. Almost $300 million of this is Australian Government funding from taxpayers, and around $500 million comes from industry levies.

The Australian Government has committed $1.3 million to support the development of AIA.

Fifteen rural research and development corporations are supporting the development of AIA.

MORE INFORMATION
Alison King, alison.king@cdu.edu.au;
David Crook, david.crook@cdu.edu.au
FRDC RESEARCH CODE: 2015-012, 2009-094

Below Project team members David Crook (left) and Brendan Adair (right) with a saltwater Barramundi from the Roper River.
Photo: Chris Errity

Monsoons and river flow bring more Barramundi

By **Catherine Norwood**

New modelling identifies crucial links between the wet season and Barramundi populations, providing vital information for the Northern Territory's resource managers

The year 2010 was a good one for the recruitment of Barramundi *(Lates calcarifer)* in the Northern Territory. It was also a year when the Bureau of Meteorology's Australian Monsoon Index peaked in response to a big wet season.

The relationship between a good wet season and strong Barramundi recruitment has long been recognised by fishers and researchers, for example, in the FRDC project 'Tactical Research Fund: topping up the "Crystal Bowl" for Barramundi'. However, new modelling has quantified the correlation, allowing researchers to predict the impacts of future increases in water extraction for mining and agriculture on Barramundi fisheries in northern Australia.

This iconic species is highly significant to the region's recreational and Indigenous fisheries and supports an important commercial fishery.

Researchers Alison King and David Crook from Charles Darwin University have led the FRDC-funded project to learn more about what drives Barramundi productivity and the potential impacts of increased water extractions in the region. The University of Melbourne's John Morrongiello was also a crucial member of the research team, helping to develop sophisticated biochronological modelling that incorporates fish age and growth data with different climate and water management scenarios.

They began by determining the age, specifically the birth year, of more than 3000 Barramundi, whose otoliths (ear stones) are held in the Northern Territory's fisheries collection. The otoliths have been sourced from commercial and recreational catches in the Daly, Mary, McArthur and Roper rivers since the early 1990s.

Otoliths from the collection were put under the microscope and photographed, allowing the research team to count the rings that represent a year of growth. Given the age of some fish at the time they were caught, this has provided information about fish recruitment dating back to 1985.

Identifying the year of birth allows the researchers to match highly productive 'year classes' with recorded environmental conditions. They evaluated a range of datasets against the recruitment patterns, including large-scale climatic factors and local river flows. The strongest correlation came from a simple measure of wet season intensity used by the Bureau of Meteorology – the Australian Monsoon Index. River flow also strongly correlated with year class strength, although flow–recruitment relationships were quite complex and variable among rivers. These correlations were independent of the available spawning stock for the species – the stock–recruitment relationship – which often forms the basis of recruitment assessment in fisheries models.

Alison King says the results indicate that strong wet season rains associated with monsoonal weather patterns support the replenishment of water sources across the landscape, creating environmental conditions that sustain Barramundi recruitment.

She highlights this as an important finding, in the light of increased demands for freshwater to support economic development of the north. She says there is a common perception that fresh water that flows into estuaries is "wasted to the sea" if it is not harnessed for consumptive uses. However, this research demonstrates that freshwater outflows are fundamental to maintaining fishery productivity, and depend on the strength of the wet season and the resulting river flows.

With more data available from the Daly and Roper rivers, the modelling showed that scenarios of increased water harvesting from these catchments during both the wet and dry seasons strongly affects Barramundi recruitment. The modelling predicted a negative impact in both wet and dry seasons, with recruitment more than halved in some scenarios. For example, extraction of 40 per cent of annual river flow was predicted to result in a 40 to 50 per cent decline in Barramundi recruitment in the Daly River.

Management approach

Principal fisheries research scientist with the Northern Territory Department of Industry, Tourism and Trade Thor Saunders, also a collaborator in the project, says the findings provide valuable additional knowledge for fisheries and water managers.

Identifying the relationship between Barramundi recruitment and the monsoon index and river flow provides a valuable reference for fisheries productivity. Other proxies used in the past include river heights that represent a known level of floodplain inundation and satellite images of catchments.

"Inundation of appropriate habitat for juvenile fish allows a whole lot of fish species to reproduce and become productive, which makes the whole ecosystem more productive," he says.

"You could have really good rainfall in the catchment, but that might not mean more productivity because the bulk of the river remains relatively unaffected. It's important to get the metrics right, and this project has helped to do that."

Thor Saunders says the department is reviewing the management of the Barramundi fishery. The new modelling will provide the potential to flag changes in the fishery up to three years in advance; three years is the average time between recruitment and fish reaching legal catch size.

"You could have really good rainfall in the catchment, but that might not mean more productivity because the bulk of the river remains relatively unaffected. It's important to get the metrics right, and this project has helped to do that."

Thor Saunders

Complex migration patterns

Researcher David Crook says, as part of the project, the team also examined the influence of monsoons and river flows on the growth rates of Barramundi. The results showed some interesting patterns and suggest that flexibility in the life cycle of individual fish has a strong effect on growth rates.

It has long been known that Barramundi spawn in marine waters and grow to maturity in fresh water before returning to the ocean to breed. However, more recent studies have found some fish spend all their life in the ocean while others spend most of their life in fresh water, returning to the ocean to breed only after a decade or more in fresh water. Others travel from salt to fresh water and back again at a much younger age.

Related research by Charles Darwin University PhD student Brien Roberts showed Barramundi grow faster when they are living in fresh water than when they are in the estuary or sea. "Given that fish with different migration histories grow at different rates, there's a lot of complexity in the dataset that we weren't able to address comprehensively in this study," David Crook says.

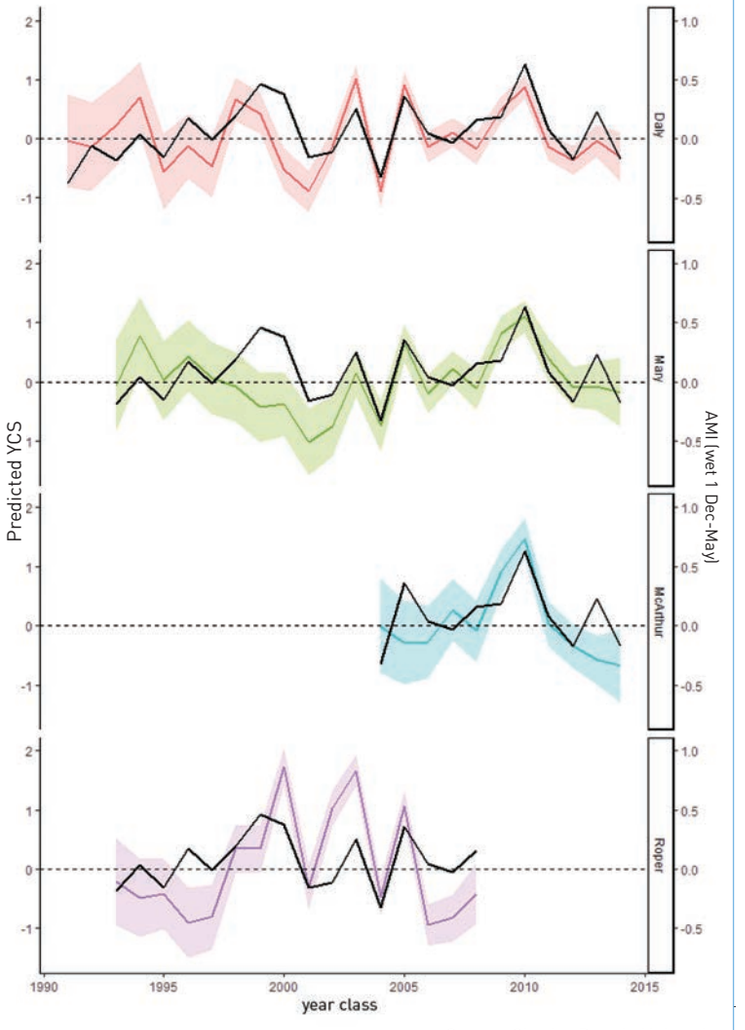
While it leaves room for further research, this project has highlighted the value of otolith collections held in the Northern Territory and other jurisdictions. The photographed collection of Northern Territory Barramundi is now available digitally, which will make it more widely accessible to other researchers with relevant projects.

Other species

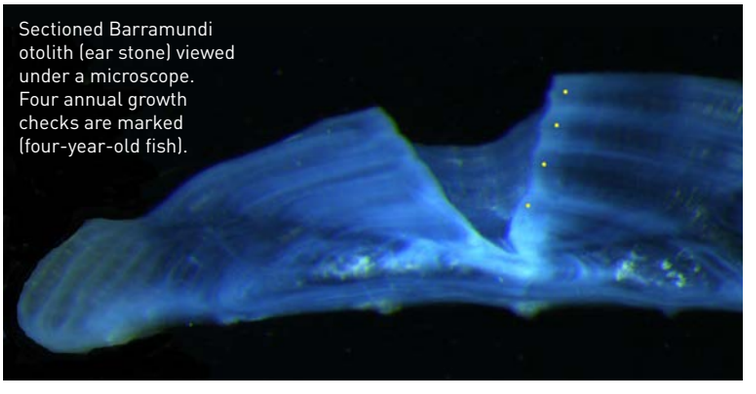
In parallel with the Barramundi modelling, the researchers had also planned biochronological analysis for another high-profile coastal fishery species in the region, Giant Mud Crab (*Scylla serrata*). The gastric ossicles – calcified mouthparts – have been previously used to age the animals. However, David Crook says this study found no evidence that annual growth rings are retained in the ossicles. Rather, the results suggest the species moults its ossicles with the rest of its shell as it grows. Ultimately, they concluded they could not confidently use the rings on the gastric ossicles to age Giant Mud Crab, and suggested caution is also needed when applying such techniques for ageing other crustaceans.

The researchers say the biochronological modelling techniques developed as part of this project have the potential to be applied across a wide range of other fisheries as well, to identify patterns in recruitment and growth and to help understand the effects of environmental drivers on fishery productivity. F

Figure 1. Predicted Barramundi year class strength (+/- 95% confidence intervals) for Daly, Mary, McArthur and Roper rivers versus wet season Australian Monsoon Index (black line).



Source: Charles Darwin University



Sectioned Barramundi otolith (ear stone) viewed under a microscope. Four annual growth checks are marked (four-year-old fish).

Recognising Indigenous relationships

A new Statement of Intent formalises the FRDC's aspirations to advance reconciliation and the role of Indigenous Australians within the sphere of Australian fishing and aquaculture

Words **Annabel Boyer** Illustration **Beau Pennefather Motlop**

Indigenous Australians have conducted fishing and aquaculture across this land for tens of thousands of years, maintaining and managing the natural resources for sustenance, and in balance with the broader ecosystem. The evidence is plentiful, displayed around the coasts as middens, in the remnants of fish traps, across many rock murals, and in aquaculture networks such as those at Budj Bim in Victoria and Brewarrina in NSW. It is an embedded cultural practice shared between generations.

The FRDC has developed an Indigenous Statement of Intent in recognition of the continued tenure over and connection with their traditional lands and waters that Aboriginal and Torres Strait Islander peoples have had for tens of thousands of years. This document also recognises that the past two centuries have led to the dispossession and alienation of Australia's Indigenous peoples, who continue to face both social and economic disadvantage, requiring intent and action to remediate.

The journey

The Statement is the latest step on a journey the FRDC has been taking for some time. At 2017's Seafood Directions conference, FRDC managing director Patrick Hone identified a number of goals for the Australian seafood industry. These included recognising that Indigenous culture, in which fishing has been a way of life for thousands of years, is the shared culture of all Australians and improving the participation of young people and Indigenous people in the sector.

The Statement has recently been endorsed by the FRDC's board; it formalises the organisation's aspirations and outlines a range of activities to realise those aspirations.

A decade ago the FRDC set up its Indigenous Reference Group (IRG) to help guide the FRDC in its investments in relation to Indigenous fishing and aquaculture. While the IRG will continue its advisory role, the Statement of Intent embeds these aspirations within both the internal culture of the FRDC and the research and development activities it funds across its entire portfolio.

As well as directly funding research activities, the FRDC will seek to act as a conduit in the space for Indigenous fishing. This includes linking with organisations seeking to do similar work, such as the Indigenous Land and Sea Corporation, CSIRO, the Department of Agriculture, Water and the Environment, and various state governments. Broadly, the FRDC commits to:

- acknowledge the special relationship Aboriginal and Torres Strait Islander peoples have with their traditional lands and waters, and the plants

INDIGENOUS HERITAGE

Illustrator Beau Pennefather Motlop has links to Djirrabal Tribe (Aboriginal) and Wagedoegam Tribe (Torres Strait Islander) through his mother's family and Ngapuhi (New Zealand Maori) on father's side.

and animals that exist in those lands and waters;

- value the experiences, knowledge, perspectives and cultures of Aboriginal and Torres Strait Islander peoples and seek their input; and
- seek prior informed consent from Aboriginal and Torres Strait Islander peoples in any projects in which they are involved that utilise their knowledge or have benefits or outputs relevant to them.

The Statement's adoption will have flow-on effects for a myriad of FRDC activities. As an example *FISH* magazine will make a point of acknowledging the sea or land country where our stories take place, where possible. For example, an article about research taking place in Narooma, on the south coast of New South Wales, will acknowledge that this is Yuin country.

A broader movement

With its adoption of the Indigenous Statement of Intent, the FRDC joins a movement that stretches across Australian society and involves a great diversity of individuals and organisations working towards a common goal. The FRDC adopts the vision expressed by Reconciliation Australia: "A united Australia which respects this land of ours, values the Aboriginal and Torres Strait Island heritage and provides justice and equity for all."

It also acknowledges that to achieve reconciliation and beneficial outcomes for Indigenous Australians we must embed and involve Indigenous peoples and culture in all relevant research activities and structures.

While the FRDC had the opportunity to adopt a Reconciliation Action Plan, which is the more common pathway forward, the FRDC chose to start by adopting the Statement of Intent. This course of action acknowledges that we are at the beginning of a journey.

We can take action within the internal operations of the organisation and externally, in how we fund research, development and extension.

In reviewing progress each year we will continue to learn where the FRDC can have the most relevant impact to help Indigenous Australians maintain and build their cultural connection to Australia's natural resources. F

More information: www.frdc.gov.au
The full Statement of Intent will be posted on the FRDC's website, www.frdc.com.au/about/corporate-documents

VISUALISING INTENTION

The FRDC has commissioned this illustration from Indigenous artist Beau Pennefather Motlop to reflect its Statement of Intent.

The fish, animals and circular elements with ochre and orange represent the special relationship Aboriginal and Torres Strait Island peoples have with their lands and waters, plants and animals.

The woven textures in the background represent the sharing of knowledge, ideas and perspectives of Aboriginal and Torres Strait Islander peoples integrated into decision-making and management.

The symbols within the snake-like lines depict meetings between people, sharing knowledge then going away to find information; lines connecting people show a gathering and sharing of knowledge.

The running water hole – three circles and connecting streams – depicts aquaculture.

Seafood Sundown Series shares marketing expertise

A new series of industry webinars offers seafood businesses practical guidance in the world of online marketing and branding

By **Barbara Adam**

Like tens of thousands of other conferences around the world, the Queensland Seafood Marketers Association's (QSMA) Sea Beyond 2020, scheduled for July 2020, was cancelled because of the global COVID-19 pandemic. But the organisers were not prepared to simply reschedule. Instead, they chose to 'pivot', as many others have done, to deliver the equivalent to a conference, but in a new way. The result is the Sundown Series of webinars which promise to 'zoom in' on seafood marketing secrets (pun intended).

The webinars are streamed on the Zoom platform, which allows the hosts to give a real-time video presentation that can include PowerPoint slide shows, graphics and prerecorded clips. For the Sundown Series, audience members can ask questions using the chat function, usually towards the end of the presentation.

Originally planned as a series of eight webinars, organisers of the Sundown Series are now contemplating extending the concept to help the seafood industry navigate its way through the global pandemic.

Event organiser James Fogarty said the reaction to the first webinar on social media, hosted by Ben Hale from the 'Love Australian Prawns' campaign, was very positive. A schedule of upcoming webinars and recordings of previous webinars are available on the QSMA's website, www.queenslandseafoodmarketers.com.au.

The FRDC has helped to fund the events, and the library of recorded webinars will have ongoing value to the seafood industry, says Peter Horvat, FRDC communications, trade and marketing general manager, who had a hand in developing the concept.

"What started out as everything going to be cancelled has actually turned out to be quite a nice little project," he says. "We are building a great resource for the future. We have been through a similar process to how we developed the previous two marketing conferences, looking at the key issues that we wanted to raise and discuss, and working out who would be best to present on these issues.

"We need something that is relevant to the current environment, and one of the things we've seen is a move to online and branded products. That's why our first two webinars focused on these topics."

Ben Hale, who presented the first session, agrees. "It was a real thrill to 'show' rather than 'tell'. Walking people through setting up their own online store and publishing products in a live session really helped break down the barriers.

"Too often retailers and producers are just too busy in their own business and think it's all too 'techy', but when you see it done in front of you, it makes it much more accessible."

Future webinar topics under consideration include a look at seafood packaging ideas and trends, an overview of the status of Australian fish stocks and a guide to using social media to sell products.

There is even scope to bring in international experts to discuss overseas trends and share their insights and knowledge.

Feedback from attendees has been positive with comments that the webinars have some valuable advice, particularly for small to medium-sized businesses. Insights into social media, in particular, offered some avenues for marketing that can be done with relatively small budgets.

Peter Horvat says the great part of a 'live' conference program is being able to change presenters and add new ones as needed. A great example of this is asking Veronica Papacosta, CEO of Seafood Industry Australia, to speak on the new 'Eat Seafood, Australia!' campaign.

"When we started the development of the Sundown Series, funding for this promotional initiative had not even been announced. We're pleased to be able to add this presentation to the mix," Peter Horvat says.

Response to the sessions from participants suggests this new format of presenting information in such a deregulated, open way, via online presentations, will have a place in the future, post-COVID-19. The FRDC is already looking at how to extend the information offered to include a broader range of topics.

View the recorded webinars at www.queenslandseafoodmarketers.com.au. F

Left Marketing materials used to support seafood brands were showcased during the second of the Sundown Series webinars.

WEBINARS

Webinar 1: Selling Seafood Through Social
Streamed Monday
14 September 2020
Hosted by Ben Hale from 'Love Australian Prawns', this webinar gives a step-by-step guide to setting up an online store. Ben Hale also explains how to use Facebook advertising to drive sales to your online shop, and how to cost an online marketing campaign.

Webinar 2: Branding Bold and Beautiful
Streamed Monday
28 September 2020
Seafood marketing specialist John Susman, principal of Fishtales, draws on more than 30 years of experience to give an overview of how to create a seafood brand. The webinar looks at some successful Australian seafood branding stories that illustrate how much a well-thought-out campaign can increase sales.

Webinar 3: Fishing for Insights and Opportunities in COVID Infested Waters
Streamed Monday
19 October 2020
Hosted by Melanie Norris and Neil Moody from data analytics firm Nielsen, this webinar looks at the latest trends in the Australian market, including a deep dive into latest retail seafood sales trends revealed by Nielsen's Homescan panel.

Webinar 4: Seafood Supply Chain Resilience – leveraging digital and data for industry growth
Streamed Monday 26 October 2020
Agrifood experts Ben van Delden and Dan Ginger from KPMG host the fourth webinar in the Sundown Series, outlining the findings in the recent *Mission Food for Life: AgriFood Supply Chain Resilience* report. The webinar looks at the key challenges facing the agrifood sector today, offering comparisons between the seafood and other agricultural sectors.

Webinar 5: Eat Seafood, Australia! promotional campaign
Streamed Monday
9 November 2020
Assistant Minister for Forestry and Fisheries Jonathon Duniam and Seafood Industry Australia CEO Veronica Papacosta peek under the hood of Australia's first national seafood marketing campaign and the launch of the national seafood brand, 'Great Australian Seafood'.

MORE INFORMATION
www.queenslandseafoodmarketers.com.au

How the seas can help meet global food needs

By **Catherine Norwood**

New research into the production capabilities of the oceans highlights their potential to provide global food security

The sustainable production of meat proteins from the world's oceans could almost double by 2050, according to a recently released international blue paper, *The Future of Food from the Sea*.

The report has identified that capture fisheries could increase yields by 20 per cent, and mariculture – or ocean aquaculture – has the potential to increase 600 per cent over the next 30 years.

With this, the oceans would be capable of sustainably providing up to two thirds of the estimated 470 million tonnes of animal protein that the anticipated global population of 9.1 billion would require.

The Future of Food from the Sea is one of 16 blue papers commissioned by the High Level Panel for a Sustainable Ocean Economy, and has a focus on how the oceans can address the United Nations (UN) Sustainable Development Goal 2: Zero hunger.

The High Level Panel is an initiative of 14 heads of government, including the Australian Prime Minister, committed to catalysing bold, pragmatic solutions for ocean health and wealth that support the Sustainable Development Goals.

The modelling used to provide production estimates and 'sustainable supply curves' account for ecological, economic, regulatory and technological constraints. These are overlaid with demand scenarios to estimate future seafood production.

The Future of Food from the Sea lead authors Christopher Costello, Ling Cao and Stefan Gelcich report current production from capture fisheries at 80 million tonnes, with 29 million tonnes from mariculture. Combined, these produce 58 million tonnes of edible meat foods. In the most optimistic scenario modelled, the authors suggest this could be increased to 364 million tonnes of food a year.

They highlight fisheries management as the key factor to limit growth of capture fisheries, while reliance on capture fisheries for critical feed ingredients is the major constraint for mariculture.

Competitive advantages

Food from the sea provides about 17 per cent of the current production of edible meat worldwide; however, demand for food is increasing. The paper highlights five areas where the oceans outshine their terrestrial counterparts when it comes to food production.

Climate change: Food from the ocean does not contribute to land use changes, such as forest clearing, that drive climate change. The harvest of wild fish and farming of marine animals also have lower greenhouse gas emissions per portion of protein than the farming of terrestrial animals.

Feed efficiency: Ocean animals are particularly efficient at converting feed into food for humans. Some mariculture species do not need feed inputs, and fed mariculture systems are more efficient than terrestrial systems.

Production potential: Unlike land-based food production, the suitable area for cultivating food from the sea is not limited by scarce land and water resources, although there are limited appropriate locations for mariculture.

Accessibility: Seafood is readily available to coastal communities and well situated for trading.

Nutrition: In addition to protein, seafood provides essential vitamins, minerals, long-chain omega-3 fatty acids and other nutrients not found in plant-sourced foods or other animal proteins.

The report considers a combination of improved harvests from capture fisheries along with mariculture. It identifies that the largest potential gains come from mariculture, which it breaks into two categories: unfed and fed.

Unfed mariculture includes species that can be farmed without the need for feed inputs, which are supplied by the oceans themselves, such as seaweeds and bivalves. While recognising the significant potential to increase the production of seaweeds as a food product, the report has not included them in its calculations.

Fed mariculture includes species for which feed must be provided, such as crustaceans and finfish. And while this sector represents the area of greatest gain, the report suggests its growth will be constrained by the continuing need for fish meal and fish oil in the diets of mariculture species.

Capture fisheries

The world's capture fisheries extract about 80 million tonnes of fish from the sea each year, based on 2016 figures from the UN's Food and Agriculture Organization (FAO). However, this is expected to decline to 67 million tonnes under a 'business as usual' scenario. Some fish stocks would decline as a result of overfishing; other stocks will remain underfished.

Yet with improved management to reduce overfishing and to increase the efficient harvesting of other stocks, including better use of underfished resources, the report estimates wild fisheries could increase production to 98 million tonnes a year, fishing to maximum sustainable yield. This is an increase of 20 per cent on current yields and 40 per cent on the potential decline under a continuation of current practices. However, the authors estimate 96 million tonnes as the economically viable sustainable yield, taking into account management costs and market prices for fish.

The report considers a combination of improved harvests from capture fisheries along with mariculture. It identifies that the largest potential gains come from mariculture, which it breaks into two categories: unfed and fed.

Recent research funded by the FRDC indicated Australia has significant underfished wild stocks, with the potential to more than double its harvest based on the 2016-17 catch if stocks were fished to their maximum sustainable yield. However, the total potential yield of 371,500 kilograms, as reported in *FISH* December 2019 'Doubling up on wild fisheries', also shows the tiny contribution Australian wild fisheries make to the annual global total harvest – less than 0.4 tonnes of the 80 million tonnes produced each year.

The report indicates improved management is needed globally to address overfishing; illegal, unregulated and unreported fishing; and fishing subsidies, which encourage fishing that would otherwise be uneconomical.

Other issues that could also affect future harvests from wild fisheries include climate change, habitat degradation and pollution, and interaction with fed aquaculture as a feed source and as a competitor for coastal ocean resources.

Mariculture

Mariculture represented 36 per cent of total global marine animal production in 2016, or 29 million tonnes. Production of both unfed and fed species has increased in the past 20 years; however, demand has driven a significantly greater increase in the fed species, such as salmon, of 600 per cent, according to FAO figures for 2018.

Over half of mariculture production of marine animals is shelled molluscs, while finfish and crustaceans represented 23 per cent and 17 per cent, respectively, the report says. When these volumes are converted to edible food equivalents, finfish mariculture provides more food by volume than shelled molluscs and offers the potential for the greatest gains in food production.

Unfed mariculture

The report estimates bivalve production, as a form of unfed mariculture, could be increased from current levels of 15.3 million tonnes to 768 million tonnes, with about 60 per cent of this being profitable based on a market price for Blue Mussels of US$17,000 per tonne.

Production estimates are based on suitable marine habitat of 1.5 million square kilometres spanning temperate and tropical regions. The authors suggest prohibitive regulatory barriers, which may be driven by food safety concerns, as a major contributor to the gap between actual and potential production.

While seaweed mariculture provides 1.4 million metric tonnes (dry weight) of food a year, it has not been included in the report's supply chain curve calculations. The report does recognise there is significant potential to expand production of a range of uses including food, and as a mariculture feed ingredient, reducing reliance on capture fisheries.

The expansion of unfed mariculture will be constrained by the limitations of the ecological carrying capacity of local environments, particularly under climate change.

Fed mariculture

If fed mariculture could be freed from the constraints of capture fisheries as a source of critical feed ingredients, the paper calculates the potential of finfish mariculture at 15 billion tonnes – more than 100 times the yield from capture fisheries.

But under current feeding regimes and requirements for fishmeal and fish oil ingredients, bivalves rather than finfish offer the greatest potential for increased production for mariculture as a whole.

A modelled scenario where fishmeal and fish oil demand are reduced by 75 per cent could double potential finfish production. But it increases sixfold when fish oil and fishmeal demand are reduced by 95 per cent, resulting in an estimated 180 million tonnes of edible meat protein. Economically viable production is based on a price of $US5000 per tonne; the global price for salmon is in the order of $US7000 per tonne, the report says.

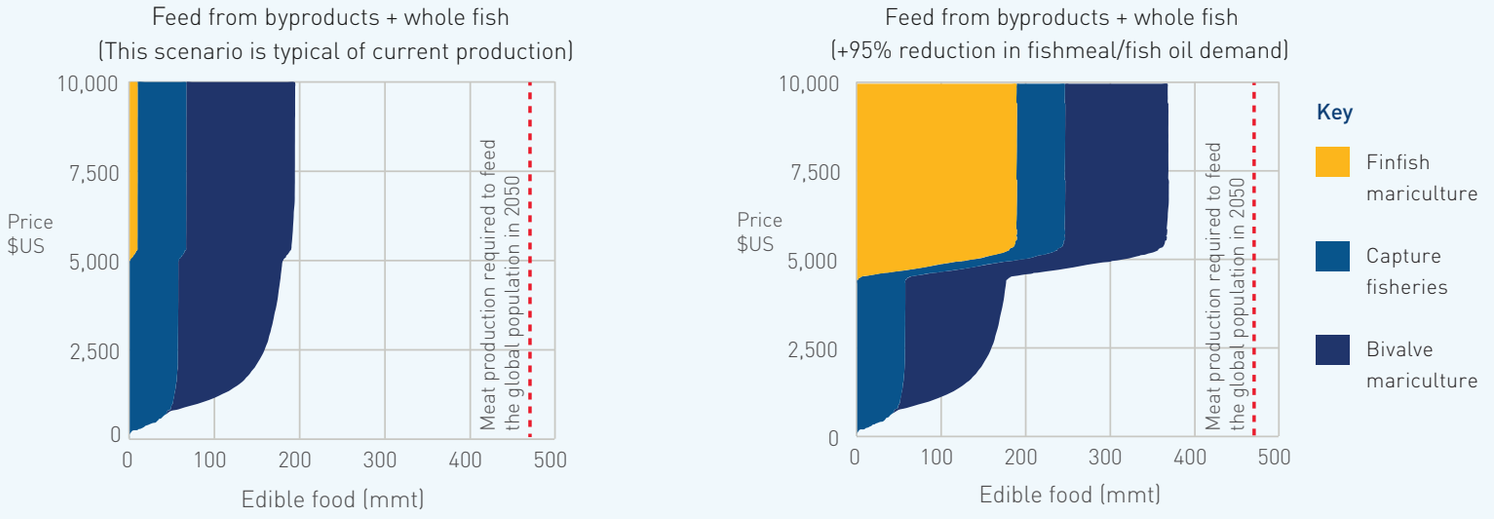
Existing production systems rely on an estimated 18 per cent of the harvest from capture fisheries being used to produce fish meal and fish oil. The authors recognise trade-offs will be needed in sourcing alternative feed ingredients to support increased mariculture.

Advances in regulatory policies and ocean property rights, along with mariculture technologies, farming systems and genetic improvements in species farmed are also identified as important to grow the sector.

Mariculture production has the potential for negative environmental impact, such as disease and parasite outbreaks, chemical and nutrient pollution, and habitat loss.

Some can be addressed through technological advances, and at a cost that might make profitable operations unprofitable. Establishing and enforcing standards, pricing environmental externalities into production and financial incentives for research and development should all be considered. →

Figure 1. Two modelled scenarios of combined supply curves for capture fisheries and mariculture.



Consumer trends

While the supply of food from the sea can expand significantly, demand for these products will depend on prices, consumer preferences, income and national and local capacities to implement novel management approaches.

Seafood consumption per capita has doubled since 1961 and is projected to continue rising, along with increases in population and affluence. International research indicates consumers do not see fish as an immediate substitute for terrestrial meats, and trends towards health-conscious diets have been shown to increase seafood consumption.

The quantity of a particular fish purchased in markets depends on income, prices and preferences, and the blue paper notes that forecasting preferences can be challenging, as once-rejected species find themselves in demand. Bluefin Tuna was once regularly discarded, halibut was thought to be unpalatable and jellyfish had a market limited to Asia.

Rebranding can also play a role. Slimeheads, as they are historically known in the US, were in high demand as Orange Roughy, and Patagonian Toothfish is marketed more successfully in some countries as Chilean Seabass. Likewise, Atlantic Salmon forged its way into traditional Japanese sushi markets, rebranding itself as a key ingredient even though it is not a traditional sushi species.

The blue paper highlights that significant expansion of food production from the ocean is costly.

Mariculture has much greater production potential than capture fisheries, but generating this production is expensive. Scaling up and intensifying mariculture, as terrestrial food production systems have been, will help reduce costs. However, there will be important environmental consequences.

The blue paper says policymakers will need to weigh the benefits and costs associated with making mariculture production financially feasible. No production system can have zero environmental impact, and it is important to assess the relative costs and benefits associated with food production options (including the decision of inaction). F

SUSTAINABLE OCEAN ECONOMY BLUE PAPERS

Australia is a member of the High Level Panel for a Sustainable Ocean Economy, established in 2018. The new ocean action agenda is launching this December. Blue Papers prepared for the panel have been published at www.oceanpanel.org

- The Future of Food from the Sea
- The Expected Impacts of Climate Change on the Ocean Economy
- Technology, Data and New Models for Sustainably Managing Ocean Resources
- Illegal, Unreported and Unregulated Fishing and Associated Drivers
- Towards Ocean Equity
- The Ocean Genome: Conservation and the Fair, Equitable and Sustainable Use of Marine Genetic Resources
- Critical Habitats and Biodiversity: Inventory, Thresholds and Governance
- Integrated Ocean Management
- Leveraging Multi-Target Strategies to Address Plastic Pollution in the Context of an Already Stressed Ocean
- The Ocean Transition: What to Learn form System Transitions
- What Role for Ocean-Based Renewable Energy and Deep-Seabed Minerals in a Sustainable Future?
- National Accounting for the Ocean and Ocean Economy
- Organised Crime in the Fisheries Sector
- The Human Relationship with Our Ocean Planet
- Ocean Finance: Financing the Transition to a Sustainable Ocean Economy
- Coastal Development: Resilience, Restoration and Infrastructure Requirements

Photo: SIA

Great Australian Seafood is 'easy as'

A new whole-of-industry approach will encourage people to eat more Australian seafood as the industry recovers from the impacts of COVID-19

Simplicity is at the heart of a new seafood marketing campaign, aiming to harness public support for local produce in the wake of the COVID-19 pandemic.

In November, Seafood Industry Australia (SIA) launched the national flagship brand, Great Australian Seafood, and its first marketing campaign, 'Easy As'. Combined, these mark the start of an initiative designed to help the seafood industry build a long-term relationship with domestic consumers. It aims to inspire a generational shift in attitude towards seafood consumption and the industry, and to encourage people to eat more Australian seafood. It does this by showcasing how simple it is to cook seafood and incorporate it regularly into our diets.

Great Australian Seafood is the sector's first whole-of-industry brand, following in the footsteps of Australian Pork Limited's Australian Pork, and Meat & Livestock Australia's Lamb 100% Australian and Australian Beef.

SIA media and communications manager Jessica McInerney says there has never been a more timely opportunity to launch a consumer brand campaign, as the sector recovers from the economic impact of COVID-19.

"Consumer support for domestic produce is high in the wake of coronavirus, and behaviour is shifting to prioritise locally grown and made products," she says. "We are excited to have the opportunity to join consumers as they re-evaluate their purchasing routines and where Australian seafood is positioned in their minds."

SIA CEO Veronica Papacosta says the Australian seafood industry, as a supplier to export markets and the food service sector, was particularly affected by COVID-19. "This campaign is led by industry, for industry, to drive a much-needed boost in domestic sales," she says.

The Australian Government has provided a $4 million marketing grant as part of its $1 billion COVID-19 Relief and Recovery Fund. Veronica Papacosta says this is a direct response to the pandemic and the need to deliver a boost to seafood industry.

Industry ownership

Great Australian Seafood has been developed as an industry-owned brand through SIA's marketing committee, which includes members representing businesses across the entire seafood supply chain. This embeds industry expertise and insights into the fabric of the brand to effectively target consumers and add value for businesses.

The 12-month 'Easy As' campaign will engage consumers a number of times over its life. Activities include consumer-facing advertising across all regional and metro TV and streaming platforms, and out-of-home advertising including shopping centres, street furniture and roadside signage. There are also digital partnerships with BuzzFeed, Taste and NewsCorp, social media and search engine marketing.

Jessica McInerney says the industry is realistic about what it wants to achieve, and the timescales required to achieve it. "We know we won't change national attitudes overnight ... we want to continue to tell the story of our incredible industry well into the future," she says.

Veronica Papacosta and Senator Jonathon Duniam, Assistant Minister for Forestry and Fisheries, launched the Great Australian Seafood brand and 'Easy As' campaign on Monday 9 November, as part of the Sundown webinar series organised by the FRDC and the Queensland Seafood Marketers Association (QSMA).

View their presentation at the QSMA website: www.queenslandseafoodmarketers.com.au. F

MORE INFORMATION
Neil Moody, neil.moody@nielsen.com;
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Queensland Seafood Marketing Association, www.queenslandseafoodmarketers.com.au

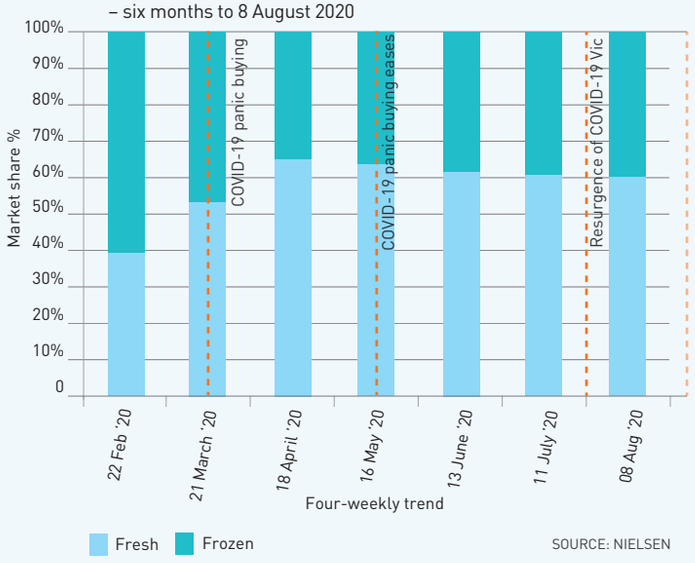
Double-digit growth continues for retail seafood sales

Market data from Nielsen shows seafood, across most categories, continues to rise in value and volume

By **Barbara Adam**


Photo: Shutterstock

Figure 1. Market share of fresh versus frozen seafood retail sales by volume – six months to 8 August 2020



KEY POINTS

Retail seafood sales were dominated by the major supermarket chains, with an 83.4 per cent share.

Victoria (while in lockdown) recorded the biggest leap in retail fish and seafood sales in the four weeks from 11 July to 8 August, with an increase of 34.2 per cent compared to the same time last year.

Sales of fresh fish and seafood accounted for 70.4 per cent of the overall sales, while frozen represented 29.6 per cent by value compared to same period last year.

In the past year, prawns were a key driver of growth, with a 14 per cent increase, with a combination of 'other species' recording a 25 per cent increase in the value of sales.

Retail sales of fresh and frozen seafood experienced double-digit growth over the past year, driven by the COVID-19-related consumer trend of households swapping restaurant meals for home cooking.

The latest FRDC Seafood Industry Trends Report, prepared by data analytics company Nielsen, shows total retail sales of fresh and frozen seafood was up 12.7 per cent in the year to 8 August, compared to the same time a year ago.

Breaking down the results, retail sales of fresh seafood were up 11.8 per cent compared to a year ago, and frozen up by 14.7 per cent over the same period.

The report is based on data from the Nielsen Homescan Australia panel that looks at in-home consumption of products bought in the Australian retail market. It focuses on sales from the start of the year to 8 August, compared to the same period a year earlier.

Nielsen's associate director of retail client services, Neil Moody, says the report showed strong retail sales of seafood were going some way to making up for the downturn in the sector's wholesale and export sales.

"Some seafood producers have pivoted. Some have moved to making sure they have an online presence," Neil Moody says. "The pandemic has really pushed online and direct-to-home sales, with products such as meal kits seeing very strong growth in the market at present.

"Online is not necessarily a natural fit for food buying, but it is picking up strongly in recent times as shoppers look for convenience and value."

Overall, the report's findings suggest Australian households were buying and consuming more seafood at home over time. Neil Moody says the report also showed households were buying a broader range of seafood species, possibly as they experimented at home and expanded their culinary repertoire. "I think that's a really positive sign for the industry."

The challenge will be to maintain retail sales as food service and exports return to more 'normal' levels, post COVID-19. With research suggesting it takes 66 days to form a new habit, increased consumption of seafood at home may well be a lasting trend.

According to the report, the value of prawns sold rose 14 per cent this year, white fish by 12.2 per cent, Barramundi by 11.3 per cent and other species by 25 per cent (see Figure 3).

In the four weeks to 8 August 2020, as COVID-19-related restrictions were reintroduced in New South Wales and Victoria, the total market share of retail frozen seafood sales increased to 39.9 per cent, continuing a trend seen over a four-month period (see Figure 1).

Retail seafood sales were dominated by the major supermarket chains, which had an 83.4 per cent share by value of sales in the four weeks to 8 August, compared to a 16.6 per cent share held by non-supermarket outlets (see Figure 2. The value of sales within the supermarket channel increased by 20 per cent in the same period, while the non-supermarket channel posted 21.1 per cent growth.

"This shows there are some benefits being experienced by seafood suppliers who are not supplying supermarkets; however, these may not fully make up lost volumes through food service channels," Neil Moody says.

Apart from the Northern Territory and South Australia, all states posted strong growth in supermarket sales of seafood in the four weeks to 8 August. Victoria, which remained in a stage four lockdown during the period, recorded the strongest growth, with a 38.8 per cent increase in the value of sales in the period, ahead of NSW with a 21 per cent increase and Western Australia with a 10 per cent rise. Across Australia, there was a 20 per cent increase in the value of supermarket seafood sales during this time. Neil Moody says it is encouraging to see an increase in supermarket seafood sales in states that had not experienced a second wave of COVID-19 infections, and where cafes and restaurants had remained open. "We've seen a healthy double-digit growth in supermarket seafood sales across Australia, suggesting the behaviour of increased in-home consumption is becoming ingrained. It's a very healthy story in this regard."

Neil Moody and Melanie Norris from Nielsen presented the findings of the market research in 'Fishing for Insights & Opportunities in COVID Infested Waters', part of the Sundown Series webinars (see story page 18), which can be viewed at the Queensland Seafood Marketers Association website https://queenslandseafoodmarketers.com.au. The FRDC Seafood Industry Trends Report is part of a larger program of activity to map and quantify the impacts of COVID-19 on the fishing and aquaculture industry. A full report on this will be covered in the March edition of *FISH*. F

Figure 2. Fish and seafood market share | Four weeks to 8 August 2020

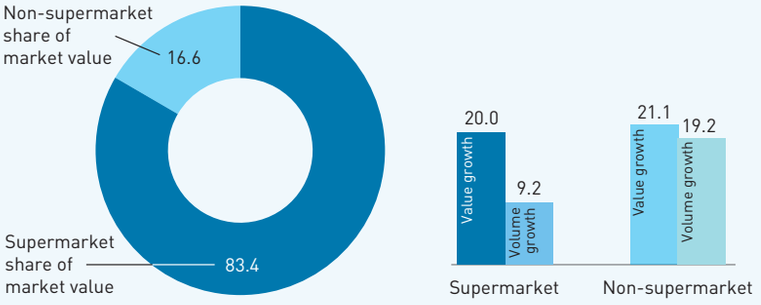


Figure 3. Fish and seafood by species | Value & volume growth %

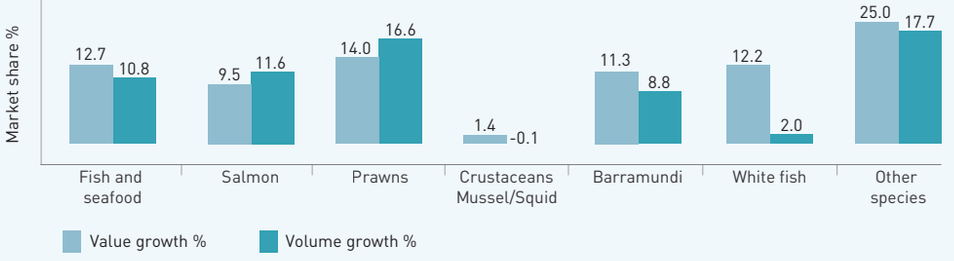
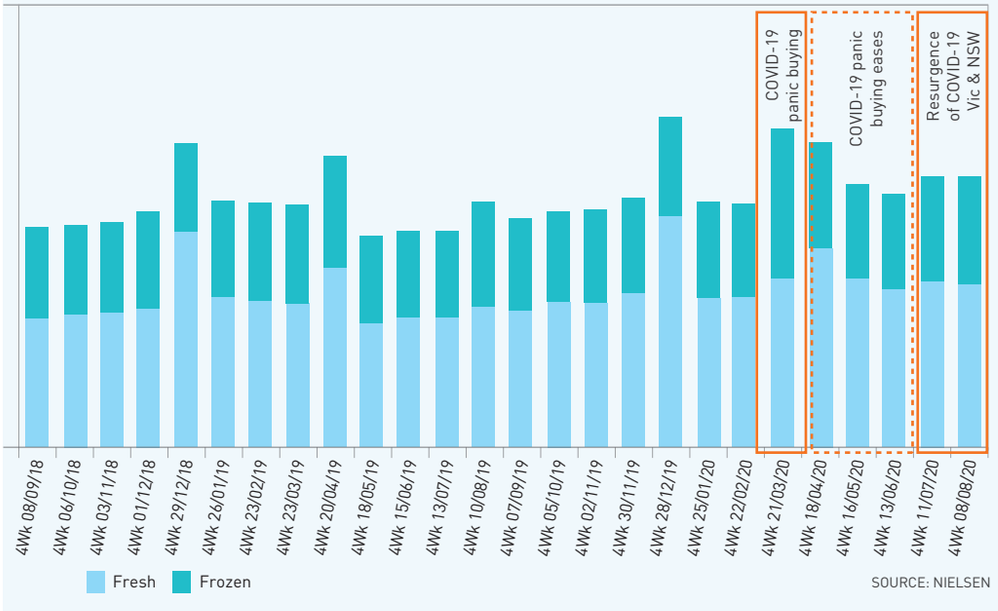


Figure 4. Australia | Volume sales ('000) | T. Fish & Seafood by Subcategory | Four-weekly trend for the two years ending 8 August 2020



Roadmap to a collaborative fishing future

Working together is the key to achieving a future for the fisheries sector that rises from being an 'acceptable' part of society to a 'celebrated' one

By **Catherine Norwood**

The FRDC will begin 2021 with a new roadmap outlining the steps needed to bring to life a new sector-wide vision for Australia's fishing and aquaculture. Technically, there are five roadmaps, each identifying the steps needed to deliver on the five outcomes in the FRDC's Research and Development Plan 2020-25. But they all point to a larger goal – a sector-wide vision:

Fish Forever 2030: Collaborative, vibrant fishing and aquaculture, creating diverse benefits from aquatic resources, and celebrated by the community.

The actions identified in the roadmaps will require participation from stakeholders across the four sectors: wild-catch, aquaculture, Indigenous fishers and recreational fishers, as well their various suppliers and participants in the seafood supply chain. The FRDC is just one player needed to address the complex challenges facing the sector.

The larger vision was developed to focus the development of the FRDC's R&D Plan 2020-25 on working together and striving to create value and achieve more than the acceptable minimum standards.

As the project leader for the R&D Plan, Matt Barwick has also led the development of more detailed roadmaps for the 2030 vision.

He says the long-term target, beyond the life of the current R&D Plan, has allowed those working on the roadmaps to think more broadly about what can be achieved and how to achieve it. It also recognises that time will be needed to address some of the difficult challenges that lie ahead.

The FRDC experimented with an open-to-all engagement process with a series of five online workshops to canvass input into the roadmaps. Smaller, expert committees have further refined the often wide-ranging ideas raised during the workshops. Ongoing consultation with the FRDC's stakeholder groups, its Research Advisory Committees and those organisations involved in Industry Partnership Agreements and Subprograms will follow.

New process

Matt Barwick says the online roadmapping workshops are the first time the FRDC has undertaken such a planning process, relying on virtual rather than in-person events. While this has been mandated by differing COVID-19-related travel restrictions across the country, it has also allowed diverse participation in the discussion, including people and organisations which had not previously taken part in similar events.

More than 100 participants joined the workshop process, with most attending sessions of specific interest and a few attending all five events.

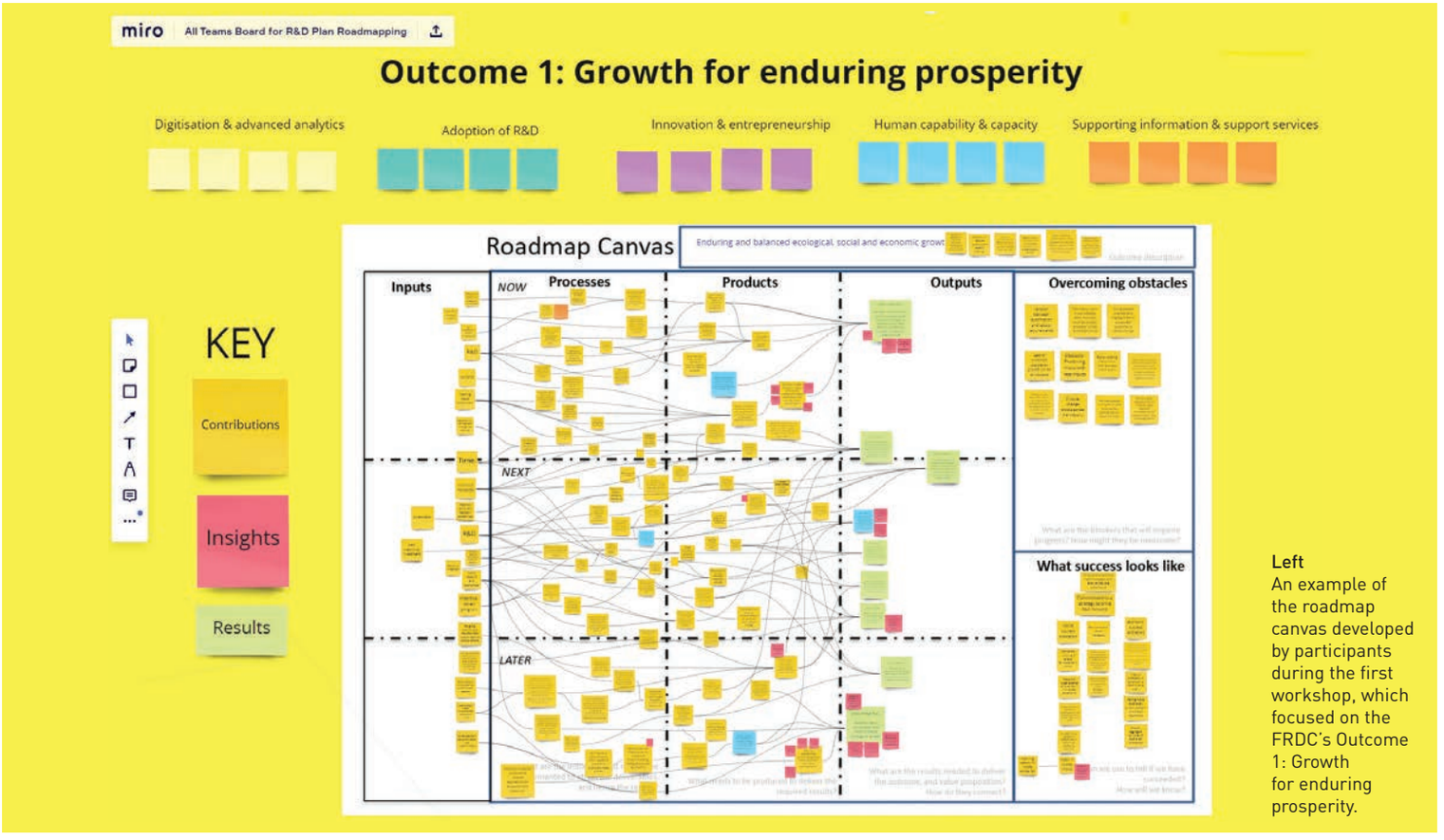
"One of the things we're learning from the COVID-19 world is online technologies allow people who have children, or otherwise complex and busy lives, to engage in things they just couldn't before, because they can do it from their home or wherever they are," says Matt Barwick. "We're also refining how we go about providing these kinds of sessions as we go, including addressing some of the technological challenges."

Each workshop focused on one outcome from the current R&D Plan to develop a roadmap forward. These outcomes are:

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; and
5. Community trust, respect and value.

The roadmapping challenge used a reverse-engineering approach, working backwards from the desired outcome.

For each specific R&D Plan outcome, participants considered what results are needed to deliver success, what 'deliverables' or products might be needed to achieve those results, and what activities or initiatives are needed to produce those deliverables. Finally, discussion identified the critical inputs required to allow activities to be undertaken. "What are the critical things that need to be done to enable growth for fishing and aquaculture in social, economic and ecological



Left
An example of the roadmap canvas developed by participants during the first workshop, which focused on the FRDC's Outcome 1: Growth for enduring prosperity.

terms – that's what we're trying to identify in the first roadmapping process, focusing on R&D Plan Outcome 1," says Matt Barwick.

"Then we can explore which of those things the FRDC is well placed to help deliver. But starting with a broad focus and then narrowing it down enables a more detailed and complete conversation about what is needed, and what each player can contribute to the shared challenge."

Discussion during the workshop highlighted the ongoing impacts of 'old wounds' and conflicts within sectors, between sectors, with resources managers and with vested political and commercial interests committed to protecting the status quo.

Across all of the five workshops, participants identified it would be crucial to address these issues if a vision based on collaboration, forward thinking, inclusiveness and trust is to be achieved.

"Ultimately, if the shared vision is something that people from all sectors can unify behind, the roadmaps help to identify how people can work together to achieve that vision, enabling the FRDC to understand how we can use R&D to assist – that's our aim. It's about getting a broader cross-section of the Australian community together to build consensus, awareness and push in the same direction," Matt Barwick says.

Roadmaps for each of the five outcomes are expected to be launched in January 2021 and will help inform investment under the R&D Plan. However, Matt Barwick points out that roadmaps are 'living' documents that can evolve along with further discussion and debate across the sector as a whole, and as progress is made and more is learned.

The new process being undertaken by the FRDC is also a great example of collaboration across the agribusiness systems. Insights collected through the roadmapping process will feed into an initiative by Food Innovation Australia Ltd (FIAL), which aims to help increase the value of Australia's food and agribusiness sectors to more than $200 billion by 2030.

The roadmaps will also help to inform the development of a National Fisheries Plan, https://www.agriculture.gov.au/fisheries/domestic/developing-a-national-fisheries-plan. F

View the FRDC Research & Development Plan 2020-2025 online on the FRDC's website www.frdc.com.au.

THE ROADMAPPING PROCCESS – AN EXAMPLE

Desired outcome: a sustainable, productive food and agribusiness industry.

Result needed to achieve this, or 'what success looks like': the prolific use of big data and precision agriculture.

Deliverables on which the result can be achieved: adoption of technologies that support profitable businesses; trusted processes for data sharing.

Activities required to generate these deliverables: creation of incubator programs to accelerate R&D and scale technologies; processes to identify and incorporate the evolving and real-time needs of producers into new products and services.

Initial essential inputs needed to undertake required activities: a workforce with the necessary skills; data standards for the collection, storage and sharing.

MORE INFORMATION
Jo Kelly, Australian Seaweed Institute, jo.kelly@australianseaweedinstitute.com.au,
Australian Seaweed Industry Blueprint
www.agrifutures.com.au/product/australian-seaweed-industry-blueprint-a-blueprint-for-growth/

Below Giant Kelp (*Macrocystis pyrifera*) is a potential aquaculture species. Photo: Shutterstock

Blueprint for $1.5 billion Australian seaweed industry

By **Catherine Norwood**

A new report identifies the issues that need addressing if seaweed is to become a serious part of Australia's marine production

The Australian seaweed sector could grow to be worth $1.5 billion by 2040, employing 9000 people and helping to reduce Australia's greenhouse gas emissions by 10 per cent, according to the recently released *Australian Seaweed Industry Blueprint*.

The blueprint, released by AgriFutures Australia in September 2020, identifies research and regulatory priorities that need to be addressed if the industry is to reach its production potential. AgriFutures Australia and the FRDC have invested in seaweed-related research and development for more than a decade.

Lead author Jo Kelly, CEO of the Australian Seaweed Institute, says there have been no commercial-scale seaweed ocean farms established in Australia to date, and there is no industry development plan. However, rapid change is on the horizon.

One opportunity highlighted in the blueprint is the potential to farm *Asparagopsis*, a native seaweed found off the Australian coast. Meat & Livestock Australia funded recent research by James Cook University and CSIRO which shows that adding a small amount of this seaweed to cattle feed can reduce the cattle's methane emissions to almost zero. This is significant, given around 10 per cent of greenhouse gas emissions in Australia come from the digestion process of cattle, and seaweed could potentially eliminate this.

Recent media coverage has revealed major investors such as Andrew Forrest, Woolworths and GrainCorp have invested in FutureFeed, a company established by CSIRO to commercialise *Asparagopsis* as a feed additive.

"This single use for seaweed is incredibly exciting but it is just the tip of the iceberg," says Jo Kelly.

"Research into bioproducts from native Australian seaweed species has potential to contribute to global health and nutrition while adding significant value to the Australian economy. Seaweed offers a huge opportunity for Australia's blue economy development."

Industry consultation suggests the potential value of commercial production from seaweed projects being developed could grow to $100 million by 2025, with 1200 jobs and a reduction in domestic greenhouse gas emissions of three per cent using an *Asparagopsis* feed supplement to reduce methane emissions from cattle.

The blueprint suggests growth of the industry will rely on significant expansion into ocean cultivation of seaweed and development of high-value functional food and bioproducts for people, animals and plants.

It also highlights the importance of state government aquaculture policy and processes, and R&D funding, as critical to support early stage industry development. In particular, regulatory changes may be required to allow for the large ocean leases that will be needed to establish commercial-scale seaweed aquaculture.

Other barriers identified include that seaweed is not seen as a serious aquaculture industry in Australia, although the global market for products is valued at $A16.8 billion. Australian production is estimated at $1.5 million, almost entirely for non-food products, while we import $40 million of seaweed products, 85 per cent of which are for human consumption. Markets for Australian products are also not yet proven, although there is a long history of Indigenous use of seaweeds.

The *Australian Seaweed Industry Blueprint* recommends investment of $8.1 million over two years to fund the following activities as crucial to the future of the sector:

- establish an industry leadership group to drive implementation of the *Australian Seaweed Industry Blueprint* and work with government, research and supply chain collaborators to achieve industry potential;
- prioritise accelerating *Asparagopsis* cultivation and developing products and markets immediately;
- develop a national hatchery network that can provide seedstock to rapidly scale cultivation efforts, starting with *Asparagopsis* and kelps, and expanding to other species over time;
- develop cluster plans for key regions in South Australia and Tasmania, southern NSW and southern Western Australia to drive supply chain development in these areas; and
- support extension of kelp integrated multi-trophic aquaculture (IMTA) throughout temperate regions to follow on from the Seaweed Solutions Cooperative Research Centres Project (CRC-P) currently underway and due for completion in 2022. F

MORE INFORMATION
www.seaweedsolutions-crc.com; Craig Sanderson, craig.sanderson@tassal.com.au;
Wayne Hutchinson, wayne.hutchinson@frdc.com.au
FRDC RESEARCH CODES: 2017-177, 2017-212, 2019-032, 2019-144

ACKNOWLEDGEMENT OF COUNTRY
Research trials are being undertaken on land and sea country of the Neunonne and Paredarerme people in southern and south-eastern Tasmania.

Ocean-farmed seaweed harvests underway

By **Catherine Norwood**

FRDC-funded research has been critical in developing the propagation techniques that are helping Australia to establish ocean farming of seaweeds

This year marks Australia's first harvests of commercial-grade, farmed ocean seaweeds – the first in September, the second in November. Both harvests, in Tasmania, have occurred under the auspices of the Seaweed Solutions Cooperative Research Centres Project (CRC-P), funded through the Department of Industry, Science, Energy and Resources.

The Seaweed Solutions CRC-P officially kicked off in June 2019 and began work in earnest at the start of this year. Partners in the CRC-P include Tassal Group Ltd, the University of Tasmania's (UTAS) Institute for Marine and Antarctic Studies (IMAS), Deakin University and Spring Bay Seafoods.

Developing commercial production practices for native seaweeds is part of research that has been underway in Tasmania for four years, with the aim to develop an integrated multi-trophic aquaculture (IMTA) system. Aquaculture company Tassal Group has been the leading force behind this work, conducted in conjunction with its Atlantic Salmon farm operations in the state.

Tassal seaweed biologist Craig Sanderson says the trials now underway build on previous research the FRDC funded to develop culture methods for Tasmanian native seaweeds.

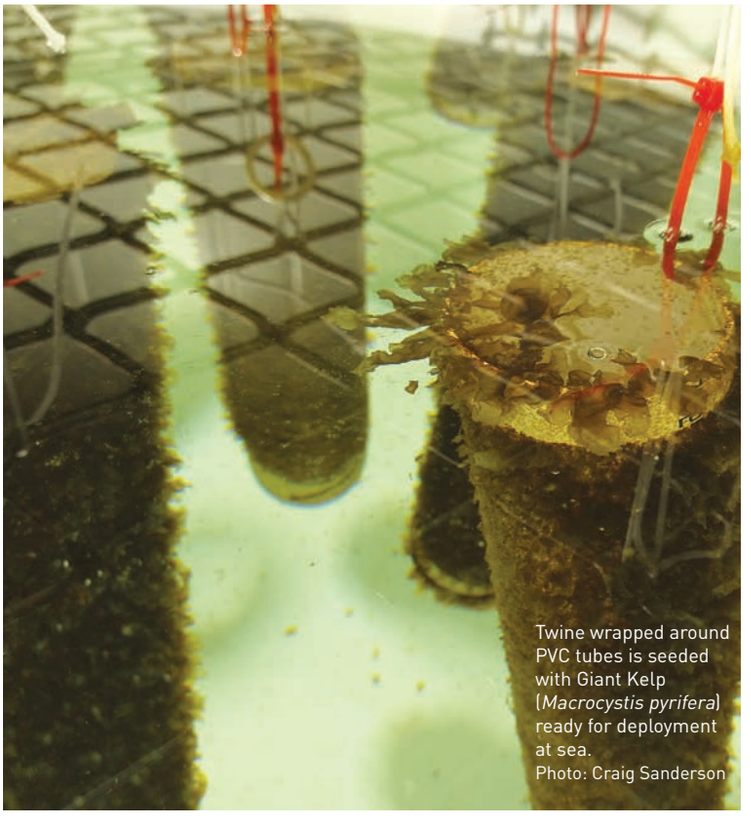
During that project, IMAS researchers led by Catriona Hurd have helped to establish gametophyte-seeding technology for Giant Kelp (*Macrocystis pyrifera*), a species listed as threatened under the national *Environment Protection and Biodiversity Conservation Act 1999*.

This technology is now also being applied to a locally endemic species of Southern Kombu (*Lessonia corrugata*) and the more widely found Golden Kelp (*Ecklonia radiata*). Giant Kelp, Southern Kombu and Golden Kelp are all brown seaweeds with existing markets.

The success of this work means a ready supply of seed gametophyte stock can be made available for commercial trials. The new propagation techniques may also allow producers to skip the hatchery phase and seed seaweeds directly onto lines to be deployed to sea.

Craig Sanderson says this offers a significant cost saving on the more labour-intensive practices used in many Asian countries where seaweed industries are well established. It will help to make Australian production more economically competitive.

Current Seaweed Solutions CRC-P trials are using gametophyte-seeded ropes at three different locations in south-eastern Tasmania. The primary site is at Okehampton Bay, on a Spring Bay Seafoods site adjacent to Tassal's fish farming operations. The second site is at Great Taylor Bay, on Bruny Island, on a Tassal aquaculture lease. IMAS holds the lease on another site at Tower Bay, near Dover. As in previous trials, Giant Kelp has remained the most easily established and fastest growing of the three species propagated.



Twine wrapped around PVC tubes is seeded with Giant Kelp (*Macrocystis pyrifera*) ready for deployment at sea.
Photo: Craig Sanderson

Head of the Ecolology and Biodiversity Centre within IMAS Catriona Macleod says while modest, the harvests are a significant achievement given the many challenges posed by the COVID-19 pandemic.

"We couldn't have done this without the industry–research collaboration, which is why CRCs are so important. Our next step is to get some product out to the markets and see what they think," she says.

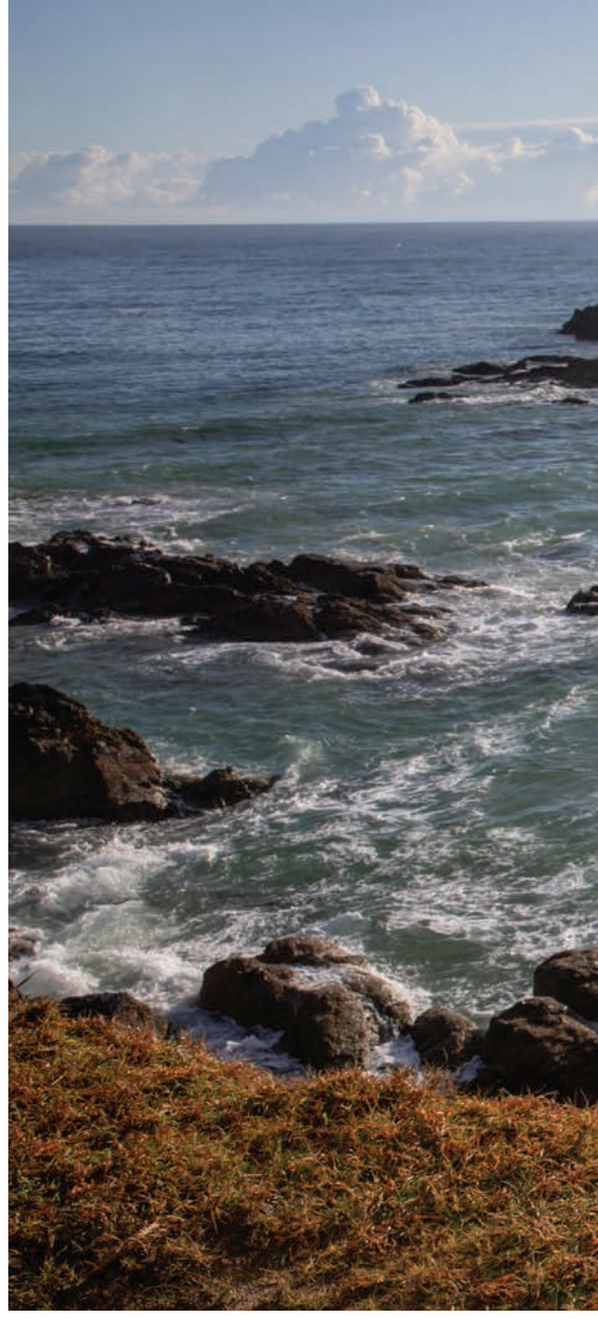
Deakin University's Alecia Bellgrove, a specialist in seaweed product quality, says the research team was keen to analyse the composition and quality of the three species harvested.

"We hope this can show us not only the potential of these seaweeds for food and agriproducts, but also how the Australian species grown in clean cool waters off Tasmania differ from those grown elsewhere," she says.

Other research

Other FRDC-funded seaweed-related projects include:

- the creation of an Australian Standard for aquatic plant names (2017-212), designed to provide a shared language and understanding about the plants and products available in Australia;
- cultivation trials of the red *Asparagopsis* species in South Australia (2019-144);
- also in South Australia, research into *Ulva* species as potential aquafeed ingredient for farmed Abalone (2019-156); and
- the use of local seaweed species to offset nutrient loads in Moreton Bay, Queensland (2019-032). F



Right Stephan Schnierer at one of his favourite fishing and surfing spots, Broken Head, south of Byron Bay, NSW.

Researcher refocuses from fish to fishing rights

From the marine biology and life sciences, Stephan Schnierer has expanded his field of view to raise the profile of traditional knowledge and Indigenous fishing rights

Words **Larissa Dubecki** Photo **Paul Harris**

For more than three decades Stephan Schnierer has been advocating for the rights of Indigenous people to access Australia's fisheries, in a role that has not always come easily for the fisheries scientist.

"I was a mad bass fisherman back in the '70s, so I combined that love with my research project on the biology of the Australian Bass. This basically involved getting in a canoe and fishing for bass from the Richmond River, as well as doing all the scientific stuff," he says of his postgraduate studies at the University of Queensland.

He developed and taught a course on fisheries biology at Southern Cross University (SCU) while studying for a PhD on freshwater fish community ecology. But fate intervened and it remained unfinished when the local Bundjalung Elders encouraged him to help them set up an Indigenous education program at SCU.

"At one point I was talking to Elders about traditional fishing knowledge. And they said, 'You're a smart fella. You know all the science. You should get out and help us to get our rights to catch fish'. So that planted a seed."

In the early 1990s Stephan Schnierer was an adviser to the Australian Government Coastal Zone Inquiry, which aimed to develop coordinated guidelines to protect the nation's coastline and coastal communities, addressing the potential impacts of climate change, in particular. Following the inquiry, he helped the New South Wales Department of Primary Industries to secure Commonwealth funds to develop an Aboriginal Fisheries Strategy, in which he also played an advisory role.

Initially a classic 'pure' scientist, he found himself refocusing his energies "on the much more human area" of Indigenous fisheries and the protection of Indigenous rights to biological resources, which ultimately led him to participate in various United Nations forums.

Then in the late 1990s and early 2000s, when marine parks were being established around Australia, Stephan Schnierer shifted his focus from the international policy arena to Australia and became immersed in the fight for Indigenous fishing rights, especially in NSW.

"I came back fired up to make sure someone was on the advisory committees set up to establish a representative system of marine protected areas. I was there to ensure Aboriginal people's fishing rights weren't going to be hindered in any way, because one of the first targets in marine protected areas is fishing and Indigenous people's rights at that time were being ignored."

A leader in closing the knowledge gap and codifying Indigenous fishing practices, Stephan Schnierer realised that decision-makers lacked any real knowledge or understanding of those practices. He set about encouraging funding bodies to support research into Indigenous fisheries.

"Sitting on various government advisory committees as a blackfella trying to say what we should be doing and hearing the policymakers and managers reply they didn't have the data to support my assertions was very, very hard to take," he says.

In working to address those data gaps, he has become a wearer of many hats. Stephan Schnierer is an adjunct associate professor at both SCU and the University of Canberra. He is a member of fisheries-related advisory committees that include the NSW Ministerial Fisheries Advisory Council, the NSW Aboriginal Fishing Advisory Council, the NSW Aboriginal Land Council Fishing Fund Advisory Committee, the Indigenous Reference Group to the FRDC and the Commonwealth Government's independent expert panel on the Great Barrier Reef Marine Park 2050 plan.

One of his first pieces of Indigenous fisheries research was conducted in 2009 with FRDC backing, focusing on the NSW Tweed area.

For this work he made sure the research involved a two-way exchange of knowledge with the local community to inform policy developments.

"It's important to build capacity in a community at the same time as you are seeking

information from them. The research I tried to promote was research where you engage with the community. They become partners in the study. The research is for them, to help them with information and knowledge about their own fishery, so they can negotiate with governments around how the fisheries might be managed."

Stephan Schnierer points to the NSW Pipi and Abalone harvest as an ongoing example of the understanding gap. Aboriginal people potentially face prosecution for ignoring recreational fishing quotas on their catch. But this ignores Aboriginal and Torres Strait Islander rights to fish on their own country and fails to acknowledge and protect the unique role that fishing plays in the daily life and culture of Indigenous communities, he says.

"The cultural fishing practices associated with the maintenance of traditional fishing knowledge systems must be protected, and the impacts of non-Indigenous fisheries identified and addressed," he says. "This is so that Indigenous fisheries are sustained along with the associated traditional fishing knowledge that people have in their aquatic biological resources."

In the research space, Stephan Schnierer believes there is some cause for optimism. The Indigenous Reference Group the FRDC established in 2012 to advise on research was an important step in enshrining Indigenous voices in the space – not tokenistically or on an ad hoc basis, but as a matter of course.

"It was a very positive and strong initiative by a Commonwealth Government agency, recognising the fact that Aboriginal and Torres Strait Islander fisheries were distinct from commercial and recreational, and recognising the importance of Indigenous fishing. It also sent a loud message to other agencies," he says.

He hopes one of the positive spin-offs to come from this will be more Indigenous researchers undertaking research with Indigenous communities. (While he has an Indigenous heritage, Stephan Schnierer does not represent any one particular Indigenous community; his mother is Australian and his father is Hungarian.)

The fateful switch from scientist to social scientist – a translator between communities and scientists, researchers and policymakers – has not always been easy for a man happiest fishing for bass. "But I made that shift not just because we needed to get some research into it started, but to show other researchers that this can be done and should be done," he says.

"Whenever there are potential Indigenous fishing rights in play, Indigenous opinions and voices should be consulted as a matter of course. Even one step before that. Researchers should think: 'Is there going to be an Indigenous element in my work and how might that impact on rights?'" F

MORE INFORMATION
https://www.piefa.edu.au/reports.html

Lesson for the future

Photo: 123rf

A study showing Australian school students lack basic understanding of food and fibre highlights the role education can play in encouraging interest in primary industries

By **Melissa Marino**

Australian school students still have a lot to learn about the production of food and fibre – including fisheries, aquaculture and seafood – a national study by the Primary Industries Education Foundation Australia (PIEFA) has found.

PIEFA CEO Luciano Mesiti says the foundation's latest findings are concerning, as many children and teenagers have little knowledge about Australian primary industries, or how important they are to their daily life.

The *Food, Fibre and Our Future 2020* report builds on baseline PIEFA research undertaken in 2011 to assess knowledge about Australian primary industries among students and teachers. The national survey of more than 1100 primary and secondary school students provides an in-depth insight into student understanding and sentiment towards primary industries.

It found that, while understanding of the egg, dairy, fruit and vegetable industries had improved, little was known about aquaculture or the rice, cotton, grain and oilseed industries.

While two thirds of students felt confident in their knowledge of fruit and vegetable growing and dairy farming, nearly half (49 per cent) knew little or nothing about fisheries and more than half (56 per cent) knew little or nothing about aquaculture.

There is also confusion over the origins of some seafood products. More than one in five respondents did not know Atlantic Salmon and oysters (21 per cent and 22 per cent, respectively) were animal products. More than half (55 per cent) did not know prawn crackers were animal-based.

The findings will be taken back to government and education departments to inform further changes to curriculums. With 59 per cent of respondents gleaning what they know about food and fibre from their teachers, the data highlights the importance of developing high-quality teaching resources. This includes farm visits and excursions (whether they are virtual or face to face), which have a powerful influence.

The report found it is essential to educate students about food and fibre industries, including wool and cotton production, and the role they play in driving Australia forward commercially, environmentally and socially. This will increase awareness and boost interest in careers in the sector.

While many students found agriculture interesting, the report found there was only limited follow-through. Some 60 per cent of students indicated an interest in knowing more about food and fibre careers, but these jobs were, generally, not highly regarded.

PIEFA CEO Luciano Mesiti says the foundation's latest findings are concerning, as many children and teenagers have little knowledge about Australian primary industries, or how important they are to their daily life.

When it came to careers, 22 per cent of students wanted to know more about aquaculture, and 24 per cent fruit and vegetables – the two industries of highest interest. But careers in fisheries industries, as well as wool growing and pig farming, were of least interest.

"There is an ongoing challenge to establish a compelling dialogue with students to reposition food and fibre industries in their hearts and minds," the report said. "Increased knowledge and positive messages will be key to debunking myths and disrupting the apathy that surrounds food and fibre careers."

Students overall indicated a very positive sentiment towards food and fibre industries and were concerned about key environmental issues. A significant number reported a positive or neutral sentiment towards fisheries (82 per cent) and aquaculture (85 per cent). Generally, industry perceptions fared better among males and those from regional areas.

Regarding environmental factors in fisheries and aquaculture, nearly three quarters of students knew there were laws to control the number of fish caught in Australia. However, about a quarter did not know whether most seafood was wild-caught. One in five believed most seafood was caught with lines or poles and 18 per cent believed there would always be plenty of seafood in the ocean. Overall, 73 per cent indicated there was 'plenty of science' in farming. F

Final reports

Low-cost management for small fisheries 2015-215

Low-cost, practical management regimes for small-scale, low-value fisheries are desperately needed to ensure long-term sustainability without the need for resource-hungry management frameworks.

This study provides comprehensive, process-based guidance to developing low-cost management regimes for these fisheries. The approach outlined is strongly 'bottom up' and it attempts to provide advice that is tailored to each fishery's unique circumstances. This includes incorporating and formalising, where appropriate, existing management arrangements into a harvest strategy, and recommending assessment approaches based only on available information.

The resulting guidelines provide an efficient, transparent, defensible and standardised process to identify management options that are best suited to the fishery's context. Such a process mitigates against decision paralysis and inefficiency in having to develop a harvest strategy, and against using the wrong assessment or inappropriate control rules or monitoring programs. The guidelines developed as part of this project are underpinned by a review of the literature, and an accompanying 'Low-cost Management Regime Guidelines' document.

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Easy-Open oyster automation 2015-238

The difficulty in shucking oysters experienced by many people limits the demand for oysters, and for this reason, most oysters are shucked by staff (employed by wholesalers) and sold in the half shell. All wholesalers report difficulty in maintaining shucking staff. Also, the eating experience of half-shell oysters is inferior to that of freshly shucked oysters.

This project attempted to overcome these barriers by developing the idea of an 'easy open' oyster; it was suggested by Robert Simmonds, owner of Oyster Bob Pty Ltd. This entailed making a slit in the edge of the oyster shell and resealing it with wax so the oyster remained alive but could be easily opened later by placing a knife through the slit and cutting the muscle that holds together the two shells of the oyster. To enable production of sufficient volumes of Easy-Open oysters, the process had to be automated. It then had to be evaluated under commercial conditions.

This project created a successful protype of the robotic technology, plus vision and sensing systems based on three-dimensional laser cameras to automate the Easy-Open process. The process of cutting and waxing oysters is now protected by an Australian innovation patent number, owned by the FRDC.

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Sea state analysis in the Great Australian Bight 2018-210

The Australian Southern Bluefin Tuna Industry Association (ASBTIA) operates in shelf and offshore waters of the Great Australian Bight (GAB). In recognition of the exposed nature of the offshore GAB environment, ASBTIA requested information to better understand the climatology of the physical meteorological and oceanographic conditions that contribute to the 'sea state' and ocean conditions at a deep-water petroleum permit location in the GAB.

This report provides a detailed characterisation, assessment and prediction of the meteorological and oceanographic conditions that will be encountered by, and have the potential to impact, future petroleum activities in the GAB.

In the absence of direct, long-term observations, the improved understanding of the offshore GAB environment generated by this study is critical to the assessment of the suitability of the GAB for hosting offshore petroleum industry and response planning necessary to mitigate any environmental impacts that may result from associated activities.

By providing comparisons to the environmental conditions experienced at several major international offshore petroleum locations, the information in this report provides the clarity and context needed by South Australian fishing and aquaculture sectors, and the broader community, to make informed decisions regarding meteorological and oceanographic interactions with petroleum activities in the GAB.

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Reducing whale entanglements 2014-004

This project provided a robust assessment that gear modifications introduced into the West Coast Rock Lobster Managed Fishery and octopus fisheries have reduced the number of reported whale entanglements. The management arrangements around the implementation of these modifications are appropriate in light of the new information on the migratory behaviours of humpback whales off the west Australian coast.

This study recommends that the current management arrangements in place to reduce whale entanglements remain. However, it should be noted that the number of entanglements may rise in the future as a result of continued increases in the whale population off the west Australian coast. Additional research may be required to assess possible additional gear modifications or management arrangements.

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Optimising WA scallops 2015-026

Ballot's Saucer Scallop (*Ylistrum balloti*) numbers have been variable across Western Australia in different years. This study examined possible contributing environmental factors affecting the population, to improve future management advice.

This project also set out to examine the feasibility of using assisted recovery through seeding of hatchery-produced juveniles, or translocation of mature breeding stock or immature scallops.

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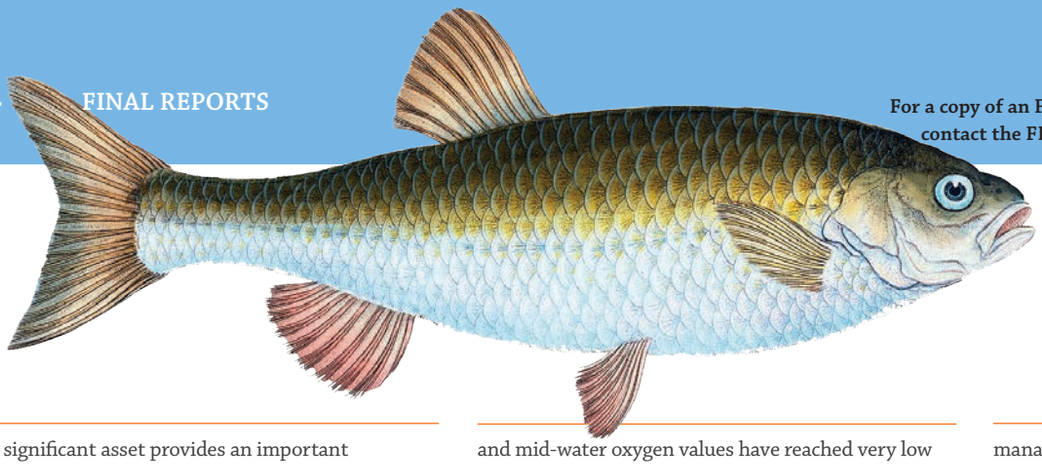
Aboriginal business development in supportive fishing industries 2016-201

Aboriginal communities have property rights for 85 per cent of the Northern Territory's coastline. →



This significant asset provides an important opportunity for communities to create niche markets and build their capacity around providing services to, and engaging directly in, the fishing and seafood sectors. However, these mostly remote Aboriginal communities have limited capacity to access the services and expertise needed to assist them in their planning and development of commercial interests.

This report presents the outcomes of the Participatory Action Research (PAR) that was implemented with the Wurrahiliba Management Committee. The project enabled the community of co-researchers based in Darwin, Katherine and Borroloola to come together in Borroloola.

Primarily, this project found that the Northern Territory Fisheries (NTF) and some Yanyuwa individuals are aligned in seeking to develop local fishing sector economies through Aboriginal Coastal Licences. Yanyuwa have identified that a Yanyuwa fishing enterprise is the appropriate vehicle to support Yanyuwa individuals to engage in relevant NTF programs.

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Managing King George Whiting in SA 2016-003

This study investigated the spawning dynamics of King George Whiting (*Sillaginodes punctatus*) in South Australia's southern gulfs and Investigator Strait. King George Whiting is one of the most valuable and iconic coastal finfish species of southern Australia.

This study developed a fishery-independent method to estimate King George Whiting biomass to supplement and underpin the future fishery-dependent estimates of stock. The work has been synthesised to inform future management decisions, including the evaluation of spatial closures to protect future spawning stocks. Therefore, key results of this study have been integrated with the ongoing assessment and management of the resource.

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Oxygen levels in Macquarie Harbour 2016-067

Sustainable finfish aquaculture is dependent on the seafloor environment being able to process farm waste. In Macquarie Harbour, Tasmania, bottom and mid-water oxygen values have reached very low levels, and this has caused an increase in the presence of bacterial mats and a significant decline in the abundance and diversity of benthic (seafloor) fauna.

This project integrates multiple lines of evidence to characterise the water quality and oxygen dynamics of Macquarie Harbour. Using modelling, researchers now understand that river flows control the flushing time and influx of marine water and, together with human activities, this ultimately defines the low-oxygen condition of the harbour. The findings documented in this report are available to inform ongoing sustainable management of the harbour to minimise the deleterious impacts of human activities on water quality and local environmental values.

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Maugean Skate in a declining environment 2016-068

The Maugean Skate (*Zearaja maugeana*), known only from two isolated estuarine systems located on the west coast of Tasmania, represents one of most restricted distributions of any elasmobranch. The species is listed as endangered and, apart from protected status, is without a recovery plan or management strategy. The present study shows there is an intricate link between movement of the Maugean Skate and environmental conditions in Macquarie Harbour, Tasmania.

This study provides a greater understanding of the ecology and life history of the Maugean Skate and describes for the first time some of the behavioural and physiological adaptations that have enabled the species to survive in such a unique and challenging environment as Macquarie Harbour. Results suggest the species can survive some environmental variability by a combination of behavioural (movement) responses and physiological adaptations. However, the vulnerability of early life stages to the changing environmental conditions, long-term changes in the size structure of the population, and the mortality of some tagged individuals following significant environmental events, collectively highlight the vulnerability of the Maugean Skate in Macquarie Harbour and the need to consider further conservation action to support the persistence of this unique micro-endemic skate.

There is a need for further research to better understand this species, but more importantly, managing the known impacts of human activities on its environment will ultimately prove crucial to the success of any conservation strategy. A multi-stakeholder and holistic environmental management approach for Macquarie Harbour should be considered as part of this strategy.

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Carp control in the Murray–Darling Basin 2016-132

This project investigated the current and future impact costs of European Carp (*Cyprinus carpio*) in Australian waterways, particularly the Murray–Darling Basin, and the costs and benefits of carp biocontrol through the proposed release of cyprinid herpesvirus 3 (CyHV-3). The project provided critical information on the potential costs and benefits associated with carp and carp biocontrol for decision-makers assessing the proposed control of carp in Australia through the National Carp Control Plan.

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Traceability systems for wild-caught lobster 2016-177

This project has raised awareness of the importance of traceability within and along the Southern Rock Lobster (*Jasus edwardsii*) supply chain. The research team has engaged with the industry on current practices, and identified and demonstrated, through trial and evaluation, a range of mechanisms, tools and techniques to enhance Southern Rock Lobster (SRL) traceability systems.

The production of a 'traceability implementation' guide provides the SRL industry with a genuine opportunity to take a step forward to 'better traceability practices', and it opens up the possibility for the industry to consider the development of a traceability platform for coordination and integration of an industry-wide traceability system.

Based on the results and outputs from this project, it is evident there are still several challenges to the implementation of standard industry-wide traceability practices. However, this project has demonstrated a way forward, as well as making recommendations that would help in achieving this goal.

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Annual fish biology annual conferences 2016-404

In the face of mounting pressure on Australia's marine and freshwater ecosystems, there is a need for robust scientific information to support the sustainable development and management of our aquatic resources. The Australian Society for Fish Biology (ASFB) is Australasia's premier professional association for fish and fisheries researchers. From 2016 to 2019, the society's annual science conferences and associated workshops have made an important and tangible contribution to skill development of people involved in fish and fisheries research and management. In particular, they have offered students and early career researchers opportunities to present their work, interact with peers and develop collaborative links.

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Risks for SA's under-utilised species 2017-023

South Australia's Marine Scalefish Fishery (MSF) is facing a number of complex issues that are affecting business profitability and stock sustainability. One particular issue relates to the long-term reliance of the fishery on the three primary finfish species King George Whiting, Snapper and Southern Garfish, which has compromised the status of a number of their stocks. This project undertook to identify marine scalefish taxa (species or groups of species) that could sustainably support higher levels of commercial production. A risk assessment workshop concluded any increase in fishery catch constituted too great a risk to population sustainability for 13 taxa. However, 13 other taxa were considered capable of sustaining higher catches. These involved nine taxa of finfish, two species of sharks, as well as the *Octopus spp* and Sand Crabs. Achieving increases in catches would involve some challenges for fishery management and the commercial fishing sector. These pertain to easing fishing restrictions on some species without doing the same for fully exploited taxa. Furthermore, for most taxa, any increase in catch would need to be shared with the recreational sector. Also, for Ocean Jackets and Blue Mackerel, the bulk of the biomass is located in offshore waters outside the gulfs, which would make it challenging to gear up for appropriate fishing operations.

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Seafood industry's 'Our Pledge' 2017-242

The Australian seafood industry has clearly identified social licence and community perceptions as critical issues for its ongoing viability and prosperity.

To help improve the industry's social licence, this project aimed to develop a clearer understanding of community and industry values and underpinning behaviours to identify threats to social licence and behaviours community would like to see reinforced by industry.

This project collated and evaluated community values and expectations regarding the Australian seafood industry with the shared values and practices of the seafood industry itself, in order to develop a commitment from industry to the Australian public regarding its intent to serve the common good and to improve its social licence to operate. Comparison of community values and expectations of the seafood industry with the actual values and practices of the seafood industry indicated good alignment between the two. The core values and practices identified as mutually important became the basis for the formation of the elements of the 'Our Pledge' statement, which was finalised using an extensive internal industry and external community survey-based review process.

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Southern Rock Lobster cold chain 2018-176

Southern Rock Lobsters (SRLs) are a premium, high-value product, where the end-product quality is a key indication of the performance of the export supply chain. Catch quality by fishers and subsequent handling must be effectively managed throughout the supply chain as the product is highly sensitive to poor handling and temperature variation during transit.

The key findings of this project include the identification of key issues faced in the live export supply chain for SRLs, proposed solutions to address them, and implementation work packages to assist the industry with actioning these solutions.

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Movers and ...

Aaron Irving has resigned as executive officer of the Pearl Producers Association and will return to New Zealand with his family.

Darryl Hockey has been appointed as the new CEO at the Western Australian Fishing Industry Council.

The Abalone Industry Association of South Australia (AIASA) Incorporated has elected **Thomas McNab** as AIASA president. He takes over the role from **Jonas Woolford**, who has served as president for 11 years and who will continue as a representative on seafood industry boards.

Lisa Croft has been appointed as CEO of the Australian Pesticides and Veterinary Medicines Authority (APVMA). She has been deputy CEO since February 2018.

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From January 2021 Marine Safety Inspectors will be out checking.

Float-free EPIRBs are water-activated distress beacons fitted in a float-free bracket. They activate automatically when a vessel capsizes to a depth of 1–4 metres and float to the surface of the water where they then transmit a distress signal.

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