FISH

FISHERIES RESEARCH & DEVELOPMENT CORPORATION **NEWS**

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Lessons in resilience

HABITAT VALUES RE-EVALUATED

ROCK OYSTER BREEDING ADVANCES

MARKETING INITIATIVES

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REGULAR

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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.

What we value

The COVID-19 crisis has given many Australians a new-found appreciation for the simple things in life. For many there is also a welcome and new sense of confidence in the processes and people who provide us with our food, including fishers and farmers.

A large part of the FRDC's business over the past few months has been to understand what is happening around the country. As the COVID-19 crisis deepened, we examined the purpose of *FISH* magazine, did an about-turn, and dedicated two editions to recording the impacts of the COVID-19 crisis on the sector around the country, speaking to retailers, fishers, researchers and others in the process.

While this edition continues to reflect the unavoidable circumstances affecting different parts of the country, and fishing and aquaculture along with it, we have returned to our more usual coverage exploring some of the research funded by the FRDC.

The core business of the FRDC continues and, for many of us, there has been a return to more normal circumstances.

The rolling impacts of COVID-19 have transfixed Australia and the world for the past six months, and it is a relief to return to a semblance of normality, providing an insight into research underway in this edition of *FISH*.

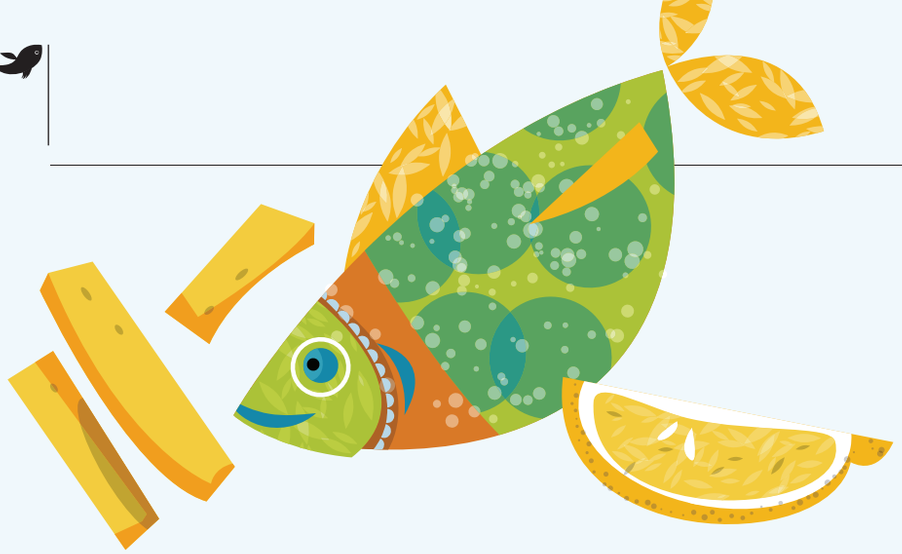
But neither have we returned to where we began at the start of the year. As we found with our two COVID-19 editions of the magazine, it's a tough ask to get an accurate picture of what is going on around the country, especially with the diversity of players within Australian fishing and aquaculture.

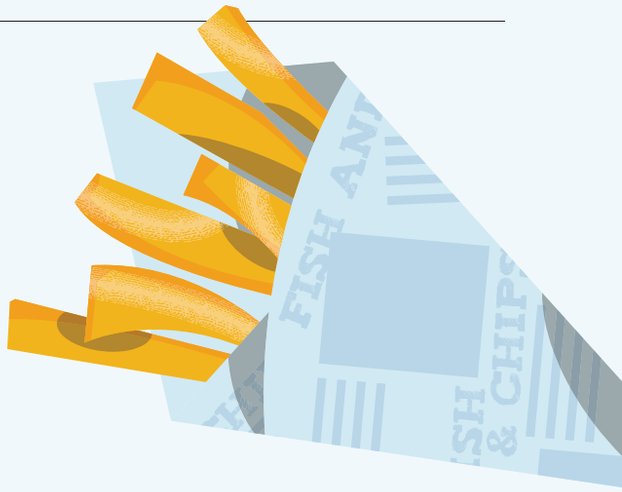
This time we have opted for a simple snapshot in time, speaking to the owners of fish and chips shops around the country as a kind of litmus test of how things are going in each state and territory, bar the ACT. Their stories add to the tapestry we are weaving to better understand how to deal with crises such as COVID-19 in the future.

While Victoria is starting to come out of its deep freeze, border closures and restricted travel make the country seem more fragmented than before.

But wherever they live, people are still eating fish and chips and the people who make that possible continue to work hard, often in trying circumstances.

A serve of grilled or fried fish and chips enjoyed by the waterside was an unremarkable outing just six months ago. Now it is a simple pleasure to be grateful for.





Around the country in fish and chips shops

Albany, Western Australia
Ocean and Paddock, Trenton Brennan

"Sales are up by half on July last year, although there was a significant financial loss from shutting the business for six weeks earlier in the year.

"We are also actively looking to recruit staff in preparation for summer and increased numbers of tourists. But if we had to close again, we would be broke. I love our business, our family, our location. This all keeps me going.

"We are fortunate that we are in the country in Albany, and people are already mindful about supporting local suppliers. COVID has generally created a sharper focus on where our food is coming from, where everything is coming from, and there is a growing anti-import sentiment."

Darwin, Northern Territory
Frying Nemo, Eddie Willoughby-Smith

"About half our business during the dry season, from May to September, is from tourists (and 40 per cent come from Melbourne). So our trade is down compared to last year, although it's not down a lot. We have a strong local following, including takeaway, which has really helped.

"We have had no supply issues. Because other hospitality businesses have closed, there is plenty of local seafood at the moment."

Henley Beach, South Australia
The Stunned Mullet, Amanda Papadopoulos

"Once restrictions in South Australia lifted, business pretty much returned to normal. I hear that many takeaway businesses are actually doing really well.

"Our customers are really appreciative of the fact that we are still open and operating, as a lot of other businesses decided to close. It's actually a real privilege that we can continue to provide a service to our customers and most people are so thankful."

South Coast, NSW
Pelican Rocks Seafood Restaurant and Café, Sam Cardow

"It's been a rough year. First the bushfires, and then we've had two floods since Christmas-time, and then COVID hit.

"We had eight really goods weeks, where, with everyone not allowed overseas and some amazing weather here, lots of Sydney people came down the coast for day trips. Now it's slowing down a little bit.

"We've had to employ someone to be a safety marshal, we had to reduce our seating from 130 to 70 people because we've got to keep a distance. The challenges are sticking with the guidelines and keeping everybody happy at the same time.

"As long as we don't go into another lockdown, I think we'll be OK. Or if a meteor hits or aliens invade."

Capalaba, Queensland
Costa's Seafood, Jason Tapinos

"It's been a bit strange. I can never pick whether it's going to be busy or quiet, day to day.

"We did see a decline in sales at the start. But once we adapted to online ordering, home delivery and contactless delivery, we found the demand was there. We just had to work out how to meet it."

Launceston, Tasmania
Fraggles Fish and Chips, Chris Fragoulis

"Business is good. In Tasmania we're lucky. We got off fairly lightly.

"Obviously, there's no tourism, so that has slowed things down a little bit. But we're pretty much back to how it was before.

"We shut for five or six weeks. We just thought, 'we're going to do the right thing for everyone'. We started up about three months ago with modified hours, and built up from there. When we reopened, we noticed that people had changed their habits a bit, were more aware of distancing. The community had changed the way they went about their everyday life.

"We were doing online orders and deliveries before. We noticed that side of things picked up, probably doubled. It's stayed higher too, because I think people have changed their habits. Especially in winter, they think getting a delivery is a good idea."

Queenscliff, Victoria
Trident Fish Bar, Fonda Tzaninis

"We're struggling. We rely on tourism, on people staying in the caravan parks and taking the ferry to Sorrento. Queenscliff is tiny, only 1200 people. We rely a lot on people from Melbourne and surrounding suburbs and they're all stuck at home [under stage 4 lockdown].

"We can't survive on only feeding the locals. They're doing their bit but there's just not enough of them. Queenscliff is so small, and there are three fish and chip shops here.

"The prices are going through the roof and I've had to pass that on; customers aren't happy.

"These are challenging times. We can't do much when our hands are tied. Even if we have got the best view in Queenscliff." F


Veronica Papacosta

SIA APPOINTS NEW CEO

Seafood Industry Australia (SIA) has appointed Veronica Papacosta as its new CEO, taking over the role from Jane Lovell who resigned in April 2020.

Veronica Papacosta has been acting in this role since early April. She was formally appointed as the new CEO in August following an extensive, independent recruitment process.

Acting chair of SIA, Chauncey Hammond, says the board of directors looks forward to seeing her expertise take SIA to a new level over the next few years.

As chair of SIA and then as interim CEO, Veronica Papacosta has already led important initiatives for the industry, such as the $4 million federal grant for the Eat Seafood, Australia! marketing campaign and the national mental health pilot program. She has also coordinated a state peak body roundtable, increased membership and strategic partnerships, and conducted extensive government engagement.

As a third-generation seafood retailer, Veronica Papacosta is a longstanding participant in the Australian seafood industry.

"I will continue SIA's good work to promote, protect and develop the interests of the Australian seafood industry. I will continue to improve communications and collaborations within the industry, and also with governments and regulators, along with other sectors and industries. The long-term sustainability and success of SIA and SIA members is my primary goal." F

Historic new company to drive RDC collaboration

The FRDC will join with all 15 other Rural Research and Development Corporations (RDCs) to establish a new company, Agricultural Innovation Australia Limited. Its establishment follows a number of government-commissioned reviews that have highlighted barriers to innovation within primary industries, particularly in relation to cross-sectoral issues and opportunities.

The company will promote research into and development of Australia's national agricultural resources. It will increase the productivity, profitability and sustainability of the agricultural value chain, including fisheries and forestry, by:

- identifying nationally significant cross-sectoral opportunities;
- developing strategies that facilitate a collaborative approach to investing in research and development, and the adoption of new knowledge and innovation required to realise those opportunities; and
- raising and acquiring funding and resources from its RDC members, government and third parties, and managing that funding and those resources to implement company strategies.

Establishing this company furthers the goal of the primary industries sector to make Australia number one globally for innovation in rural agriculture, fisheries and forestry and achieving the National Farmers' Federation's target of $100 billion of annual production by 2030.

More information: Patrick Hone, patrick.hone@frdc.com.au F

Shared objectives with First Peoples

Building on the work of its Indigenous Reference Group, the FRDC has signed a memorandum of understanding with the Indigenous Land and Sea Corporation (ILSC).

This will allow the two organisations to further their relationship and allows for the sharing of information and regular consultation on relevant projects. It is expected to help prevent duplication of projects and to enhance opportunities for the two organisations to work together to support opportunities in fishing and aquaculture for Australia's First Peoples.

The aim of the ILSC is to assist Indigenous Australians to acquire and manage country to achieve economic, environmental, social and cultural benefits. F

Tuna fishery MSC certified

The Eastern Tuna and Billfish Fishery (ETBF) has achieved Marine Stewardship Council (MSC) sustainability certification.

The ETBF extends from Cape York to the waters around Tasmania. This area includes several national marine parks, such as Lord Howe Marine Park and the one million square kilometre Coral Sea Marine Park.

"The certification recognises fishing in marine parks can be done sustainably while enabling Tuna Australia members to access new markets and premium prices. Consumers can be assured the fish they're eating is from a sustainable source," says David Ellis, CEO of Tuna Australia.

Minister for the Environment Sussan Ley says certification highlights the interdependence of Australia's world-class fisheries management and healthy and resilient marine ecosystems.

Assistant Minister for Forestry and Fisheries Jonathon Duniam congratulated Tuna Australia, saying the achievement reinforces Australia's reputation for producing safe, high-quality and environmentally sustainable seafood.

Anne Gabriel, MSC program director for Oceania and Singapore, says the independent assessment process demonstrated that the ETBF is meeting world's best practice for sustainable fishing. She says 46 per cent of Australia's marine wild catch by volume is now certified to the MSC's Fisheries Standard, reflecting strong leadership by Australian fisheries in reducing impacts on the environment.

Tuna Australia received a $506,000 grant from the Australian Government's Our Marine Parks Grants program to fund the independent assessment of the fishery for certification. F

ARCHAEOLOGY

Mussel shells collected from along the River Murray in SA's Riverland. Photo: Flinders University

MUSSELS RECORD ABORIGINAL HISTORY ON THE RIVER MURRAY

Radiocarbon dating of river mussel shells from a midden site in South Australia has dated Aboriginal occupation of the area to about 29,000 years ago. The results extend the known Aboriginal occupation of the Riverland by approximately 22,000 years. The site overlooks the Pike River flood plain downstream of Renmark in SA.

The period dated by the radiocarbon is part of the Last Glacial Maximum (commonly known as the last Ice Age), which occurred from 115,000 to 11,700 years ago. During this time, climatic conditions were colder and drier, and the arid zone extended over much of the Murray–Darling Basin.

More than 30 additional radiocarbon dates were collected in the region, spanning the period from 15,000 years ago to the recent present. Flinders University has led the archaeological research in collaboration with the River Murray and Mallee Aboriginal Corporation (RMMAC). The research has been published in *Australian Archaeology* and forms part of ongoing research into past and contemporary Aboriginal connections to the Riverland region.

Funding has been provided by the SA Murray–Darling Basin Natural Resource Management Board (now the Murraylands and Riverland Landscape Board) through the Australian Government and the Natural Resources Management levies, and Australian Research Council Linkage Project (LP170100479). F

NUTRITION

Omega-3s from ocean microbes

CSIRO will use new technology to produce omega-3 oils from ocean microbes, offering an alternative to sourcing from wild fish and creating new economic opportunities from the ocean.

The technology cultures and extracts omega-3 from specific strains of unique and endemic Thraustochytrids, a marine microorganism. CSIRO research scientist Kim Lee Chang says it builds on CSIRO's expertise in identifying and developing new sources for omega-3 oils, such as engineered canola.

CSIRO has signed an 18-month partnership agreement with Brisbane-based company Pharmamark Innovation to develop omega-3 oils, proteins and other extracts from marine microorganisms.

The partnership aims to unlock significant economic potential from a novel source of protein and omega-3 oils and will contribute to Australia's growing 'blue economy' target of $100 billion annual revenue by 2025.

Products aim to boost the nutritional value of a range of food and beverages, beginning with the $89 billion global baby milk formula market.

Omega-3 fatty acids are important for good health, assisting with brain and eye development and cognition, particularly in early childhood, and may help to decrease the risk of cardiovascular diseases, neural disorders, arthritis, asthma and skin diseases in humans.

Omega-3 oils are traditionally sourced from wild fish stocks and ocean krill. Minor sources are nuts and seeds, and oils from flaxseed, soybean and canola. F

Omega-3 oils are being derived from Thraustochytrids, a marine microorganism. Image: CSIRO/Dion Frampton

WORD-WISE

VIRAL INSIGHTS

A **mutation** in viruses is a 'mistake' that occurs when a virus replicates; the virus reproduces by using a host cell to copy its own DNA or RNA. All viruses mutate, though the rates at which mutations occur vary greatly among different viruses. A mutation does not automatically enable a virus to infect a new host species – most mutations result in virus particles that are functionally useless and simply die.

Virus **latency** is the state where an infection is present in a host, but is dormant.

Recrudescence refers to the recurrence of viral activity (usually with the reoccurrence of associated symptoms) following a period of latency. F

IN PRINT

COMMUNICATING SCIENCE

Australian case studies form part of a new book launched in September, *Communicating Science: A Global Perspective*. The book provides the first detailed documentation of this international field of work, with 108 contributing authors.

It includes 38 national accounts that describe how modern science communication emerged in different countries around the world.

As chief editor and co-author of the chapter on Australia, Toss Gascoigne featured as one of five authors speaking at the official launch of the book, via Zoom, on 15 September 2020.

He is a visiting fellow at the Centre for the Public Awareness of Science at the Australian National University and was the inaugural president of the Public Communication of Science and Technology Network, expanding its sphere of influence internationally. F

MORE INFORMATION
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FRDC RESEARCH CODE: 2013-026, 2017-049

Below Tasmanian scientist John Keane measures sea urchins as part of research into control measures for this invasive species.
Photo: University of Tasmania

Multi-pronged strategy targets invasive urchins

By **Larissa Dubecki**

A coalition of research, government and industry partners is working to bring invasive sea urchins under control in Tasmania, with a mix of biological and market solutions

John Keane
Research fellow, Institute for Marine and Antarctic Studies
"It's about the light at the end of the tunnel."

It has been more than 40 years since the first Longspined Sea Urchin (*Centrostephanus rodgersii*) was positively identified in Tasmanian waters. In the following decades its numbers have exploded to an estimated 20 million animals along the island state's eastern coast, progressively destroying large areas of shallow reef habitat.

The Shortspined Sea Urchin (*Heliocidaris erythrogramma*) occurs naturally in Tasmanian waters and exists in harmony with the local ecosystem. However, the Longspined Sea Urchin is an unwelcome visitor, and a badly behaved one at that.

It is also a native species but has reached pest proportions in Tasmanian waters after migrating south from its New South Wales coastal homelands. Thanks to global warming, which has strengthened the southward movement of the East Australian Current, the Longspined Sea Urchin can now be found all the way to Tasmania's southern-most tip.

A program of research over the past 15 years, including work funded by the FRDC, has sought to quantify and understand the problem posed by the creature more colloquially known as 'Centro'.

Centro are voracious eaters of kelp and other marine plants. In large numbers, they can completely strip underwater reefs of vegetation, at first creating bare patches known as incipient barrens. If left unchecked, the urchins go on to create vast underwater deserts of bare rock, denuded of all plant life. These established barrens have a devastating effect on local marine life.

"I view *Centrostephanus* as a range-extended pest species," says Ian Dutton, director of marine resources at Tasmania's Department of Primary Industries, Parks, Water and Environment (DPIPWE). "They're not just a Tasmanian problem; they've eaten their way through eastern Victoria's marine systems as well. In Tasmania they pose a significant threat to our east coast habitats, fisheries and marine tourism industries."

The first extensive FRDC-funded assessment of the Longspined Sea Urchin's impact on Tasmanian waters was released in 2005. It warned that, in parts of southern NSW, urchins had removed entire kelp beds and created extensive barrens on about 50 per cent of the state's shallow rocky reef habitat. It concluded that Abalone and rock lobster production would be lost from those patches of reef converted to barrens.

Subsequent studies have shown that in Centro's Tasmanian epicentres, particularly around St Helens, barrens have grown alarmingly over a relatively short period of time. An FRDC coastline survey in 2001 found urchin barrens accounted for about three per cent of the state's eastern reefs; 15 years later that figure had grown to 15 per cent. On a particularly badly affected part of the coast around St Helens, 37 per cent of the reef habitat had been overtaken by urchin barrens.

"The best way to describe it is a moonscape," says John Keane from the Institute for Marine and Antarctic Studies (IMAS) at the University of Tasmania. "In one-kilometre stretches near St Helens there's just nothing to see except bare rock and the black dots of urchins."

Control options

The larger members of Tasmania's Southern Rock Lobster population represent one of Centro's few predators. As it stands, however, Tasmania's east coast lacks the biomass of rock lobster required to represent a viable biological control method.

"The rate of climate change on the east coast is benefiting urchins while disempowering predators like rock lobsters," says Ian Dutton.

Above Known as uni, sea urchin roe is a delicacy in Japan.
Photo: PauaCo

Working together, the Tasmanian Government and industry partners began a 10-year rock lobster stock rebuilding strategy after populations reached historically low levels. Launched in 2013, the program involved creating a separate management zone for the east coast, tracking catch within this zone, and capping the combined catch of both the recreational and commercial sectors to well below average historical levels. Since 2015, about 30,000 rock lobsters have been relocated from Tasmania's south-west to incipient barren areas further north along the east coast. The strategy is on track to rebuild rock lobster stocks to greater than 20 per cent of the unfished stock by 2023.

However, even if the program proves a success, scientific consensus holds that in the short term, predators such as large lobsters are unlikely to be able reduce urchin numbers on extensive barrens to the point where seaweed can re-establish. Researchers have therefore turned their sights to other potential control methods.

Laboratory trials are beginning this year to test the feasibility of a technique known as 'liming' – piping calcium oxide (quicklime) to barrens. In Norway, where urchin and urchin barrens have been an issue for decades, this has proven extremely effective in killing the animals and aiding reef restoration.

The automated culling of urchins using robotic technology is another field of inquiry at the research and development stage, currently stymied by the considerable expense.

The most direct and comprehensive methods of control currently employed involve direct removal or culling by commercial divers. Divers have culled Longspined Sea Urchins as part of research projects over the past 10 years, which has proven an effective approach to helping prevent specific patches of reef from turning into lifeless barrens.

SEA URCHIN STEPS AHEAD

The invasion of the Longspined Sea Urchin (*Centrostephanus rodgersii*) into Tasmanian waters has galvanised a coalition of government, researchers and private enterprise into an emergency action.

The success of this campaign to date will be followed by public awareness activities, highlighting the sea urchin problem and current progress.

Temporarily put on hold by COVID-19, an exhibition at IMAS's headquarters on Hobart's Salamanca Wharf will explore the journey of the Longspined Sea Urchin and the past 15 years' worth of research. It will showcase what has become a positive environmental and industry story.

"It's about the light at the end of the tunnel," says John Keane. "It's unlikely we will ever eradicate it, but increasingly we have confidence we can keep it under control with minimal impact on other species, while gaining a healthy, profitable industry. It's the culmination of 15 years' worth of FRDC and IMAS projects, coming together into a story with solutions."

Another positive step in the Centro harvesting story is imminent, thanks to the financial aid of the Abalone Industry Reinvestment Fund. RTS PauaCo has procured a Chinese-made machine that converts the urchin waste into valuable byproducts. After being delayed due to coronavirus, the machine has now arrived and will soon begin operating.

The roe accounts for only eight to nine per cent of the animal and the rest has traditionally been thrown away. Waste disposal adds a significant cost to urchin processing. The new technology, however, will enable the extraction of the sea urchin's oil and the processing of the rest of the shell into products like organic fertiliser or fish and animal feed.

"It's a great story," says Beth Mathison. "You've got an invasive pest, you utilise all of the animal to establish an innovative and viable business and create jobs, you help restore the Abalone and crayfish habitat by harvesting the invasive pest species rather than wasting a resource. It's such a fantastic win-win for the industry and for Tasmania." F

In addition to roe, sea urchin byproducts will soon include oil and ingredients for fertliser and animal feeds. Photo: PauaCo

An edible solution

In more accessible areas with higher catch rates, commercial harvesting has proven to be the most effective control option.

While many Australians are unfamiliar with the taste and culinary uses of sea urchin roe, it is in demand in Asian markets – particularly Japan, where it is known as uni and commands a premium price.

The roe of the Shortspined Sea Urchin has traditionally been more prized for its sweeter flavour, but its inconsistent colour is a market drawback. The Longspined roe, while offering a stronger flavour, has been buoyed by its reliable golden colour, and it comes into season when the Shortspined Urchin is spawning and unsuitable for harvest.

The past few years have seen efforts to develop a quality product paying dividends both economically and environmentally. At the forefront of these efforts is RTS PauaCo, a stalwart of Tasmania's Abalone industry on the south-east coast, which first ventured into urchin territory three years ago as an experimental response to a reduced Abalone quota.

"Without removing the urchins, the Abalone quota will continue to decrease," says RTS PauaCo Group chief executive and managing director Beth Mathison. "We've spent several million dollars over the past three years refining the processes and reaching a point where urchin processing has become a viable part of the business."

The latest FRDC report on the Centro problem, co-authored by John Keane and released last year, found the commercial harvest of Longspined Sea Urchins reduces Centro's impact on Abalone and rock lobster fisheries, even with low levels of harvesting.

Centro catches over the past three years have seen more than 1000 tonnes taken from east coast waters. It has definitely had a positive impact, says John Keane; to what extent will be known later this year when another project re-surveys a previous habitat study done between 2014 and 2016.

"The removal is relative to recruitment," he says. "Visually, it appears the divers are winning the war in some areas, and we want to quantify that. When you're diving you can see areas where the kelp is coming back – all these lovely, juvenile kelp where once there were just urchins."

Below A diver swims over an urchin barren, Tasmania.
Photo: University of Tasmania

Above In Tasmania, invasive Longspined Sea Urchin is being harvested for its roe.
Photo: PauaCo

A helping hand

The adoption of a subsidy for urchin divers has been crucial to the crusade against Centro – and to the investment and growth of RTS PauaCo and a small number of competing businesses.

The subsidy was initiated in 2018, with $5.1 million available over five years to support and increase the sustainability and productivity of the $90 million Tasmanian Abalone industry. It is administered by the Abalone Industry Reinvestment Fund, a joint initiative between DPIPWE and the Tasmanian Abalone Council.

"There has been a broad acceptance over the past decade that eradication is not possible and that we need to focus on mitigation," says Dean Lisson, chief executive of the Tasmanian Abalone Council. "The best approach from a sustainability perspective was to try and create a lasting industry based on the harvest of Centro, and to that end the creation of the subsidy has been the single most important thing to happen in this area."

The subsidy to urchin divers has altered slightly as the program evolved. Initially, a single rate was provided along the east coast. However, now the rate increases for urchin harvesting towards the south of the state.

Most of the active urchin divers also hold Abalone diving licences. With recent quota reductions in the Abalone sector, the dual-licence divers have welcomed the additional demand for Centro by processors, which is underpinned in part by the urchin subsidy.

It offers both a crucial financial lifeline to divers and acts as startup funding, enticing fish processors into harvesting the urchins for their roe.

"It's effectively removed over two million urchins," says Dean Lisson. "In the absence of a subsidy it would be a small fraction of that. The divers are looking at the ocean floor from the perspective of both species and they're reporting a diminishing urchin population and an increase in seaweed, with the Abalone coming back." F

MORE INFORMATION
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FRDC RESEARCH CODE: 2016-400

Australian seafood industry launches mental health pilot program

A new initiative provides support from within local fishing communities to help fishers manage the psychological impacts of industry challenges


Photo: Brad Collis

A new national mental health program has been launched, designed specifically for the commercial fishing sector, with three local communities chosen to host a pilot of the program.

It focuses on mental health early intervention, engagement and education for commercial fishers. Lakes Entrance (Victoria), Newcastle (New South Wales) and Darwin (Northern Territory) have been chosen for the pilot after consultation with fishing industry stakeholders.

The Australian Government is funding the new program, which is an initiative of Seafood Industry Australia (SIA), supported by Women in Seafood Australasia (WISA).

Research undertaken as part of an FRDC project completed in 2019 showed Australia's commercial fishers experience twice the rate of psychological stress of any other sector. SIA CEO Veronica Papacosta says the program is a response to these concerning research findings.

"We understand the pressures our fishers face are unique to industry, and a third of fishers suffering psychological stress said they hadn't reached out for support because they didn't believe health professionals would understand the pressures of the fishing industry," she says.

"This program has been specially developed to help break the stigma associated with poor mental health within industry, to develop a network of trusted advocates who fishers can contact to help them find support, and to educate primary healthcare networks about industry pressures."

> "We are all faced with adversity, but the last few years have been especially tough for the Lakes Entrance fishing community and I am glad this program has arrived." Simon Boag

To manage the two-year program, SIA has appointed psychologist Jo Marshall, who brings extensive experience in mental health engagement and education to the role. She is supported by a steering committee that includes Allison Kennedy from Deakin University's National Centre for Farmer Health; Kirsten Abernethy, director of Sea Change Consulting; and Barbara Konstas, Victorian director of WISA

Jo Marshall says trusted advocates will be identified in each community to provide industry with information and referrals to local services, and coordinate activities to build awareness and reduce the stigma of mental illness.

"We will equally be working towards providing people with a better understanding of prevention and wellness activities. Just like our physical health and wellbeing, our mental health can be cared for in an effort to prevent illness."

The program has been welcomed by industry leaders in the target communities, including executive officer of the South East Trawl Fishing Industry Association Simon Boag, who is based at Lakes Entrance. He says recent challenges for local fishers have included the loss of commercial fishing to other interests such as recreational fishing and gas and oil exploration.

"We are all faced with adversity, but the last few years have been especially tough for the Lakes Entrance fishing community and I am glad this program has arrived."

CEO of the NSW Professional Fisher's Association Tricia Beatty says the NSW commercial sector has also been through a recent large-scale restructure that caused great anxiety. "This has been coupled by other major issues such as COVID-19, bushfires, floods, seismic surveys and dropped shipping containers causing significant safety issues," she says.

The pilot program will help to inform ongoing national industry-specific mental health and wellbeing programs, projects and outreach activities.

SIA will also provide mental health first aid training for national industry leaders, and it can also provide Community Resilience Grants to help fund industry events where mental health information is available or where a speaker talks about their lived experience.

If you or someone you know needs help, contact a crisis helpline:

- Lifeline – 13 11 14
- Beyond Blue – 1300 224 636
- MensLine – 1300 789 978

If there is immediate danger, please call 000 or visit your nearest hospital emergency department. F

Abalone case study in aquaculture resilience

Lessons in biosecurity and diversification have paid off for a leading Australian Abalone producer, providing valuable business resilience in the face of market disruptions

By **Brad Collis**

Australia's largest Abalone producer and processor, Yumbah Aquaculture, has become an instructive case study for the expanding aquaculture sector's use of technology and investment to build operational scale and sustainability.

In the two decades since its startup at Narrawong, near Portland in Victoria, it has grown by developing farms at Port Lincoln and Kangaroo Island in South Australia and Bicheno in Tasmania.

Much of this expansion has been driven by critical lessons in biosecurity, risk management, product development and marketing, and has been backed by long-term investor commitment.

It is also a powerful illustration of the value of industry-building science. Yumbah's early development was able to make use of extensive FRDC-supported research into breeding technologies for farmed Abalone. This scientific rigour gave early investors the confidence to back the development of new processes to support nurseries, grow-out stages, and new processing technologies for canned and frozen product.

The diversity of Yumbah's operations, product offerings and markets has provided further value this year, helping maintain operations in the midst of the COVID-19 upheavals.

Success shaped by calamity

The Yumbah story began in 1999 and, in many ways, owes its success to a disaster. The business had boomed from the start, as had similar ventures in southern and western Australia, powered by investors from a wide mix of backgrounds including grains, livestock, information technology and Abalone diving. There was no shortage of entrepreneurial drive, but there was a shortage of biosecurity knowledge.

Yumbah founding director Anthony Hall says when the company was hit by Abalone Viral Ganglioneuritis (AVG) in 2006, it was devastating. "It caused a lot of pain for the whole Abalone industry at the time, but we were made better for the experience."

The Victorian operation was forced to destock and Anthony Hall says it showed clearly the risks of having all their eggs in one basket.

"We needed to diversify geographically and

Left Aerial photo of the Narrawong facility in Victoria.
Photo: Yumbah Aquaculture

Above Anthony Hall at the Yumbah facility on Kangaroo Island. Photo: Yumbah Aquaculture

Above Yumbah Greenlip Abalone.
Photo: Yumbah Aquaculture

that led to a merger with a group of investors who owned assets in South Australia. This created quite a large aquaculture enterprise, but which still operated as separate farms, all with different names and brands."

More farms were purchased in Kangaroo Island, SA, and Tasmania, and finally, after an 18-month search, a new name emerged to embrace all of the operations and to facilitate a common brand strategy. "Basic marketing, but very important," Anthony Hall notes.

New identity

In researching possible names, Anthony Hall came across records from the 1830s that included an Aboriginal name, Yumbah, describing a "rough, edible shellfish the size of a man's hand that clings to rocks and is similar to an oyster": Abalone.

It took several more months to locate the traditional custodians for the extinct language, the Yaegl Local Aboriginal Land Council on the New South Wales north coast, who granted permission for Yumbah to be the Abalone company's new name.

"We love the name … makes you smile when you say it," says Anthony Hall. But more importantly, the single name binding all of the operations also created a sense of belonging across the merged group. "Every achievement started being able to be shared by everyone, and we now had a single brand to market and be proud of."

The company grows two Abalone species, Greenlip and Tiger. Greenlip Abalone (*Haliotis laevigata*) is farmed in South Australia and Victoria. The hybrid Tiger Abalone (*Haliotis laevigata x Haliotis rubra*) is farmed in Victoria and Tasmania from crossbred spat the company produces itself.

The company grows two Abalone species, Greenlip and Tiger. Greenlip Abalone (*Haliotis laevigata*) is farmed in South Australia and Victoria. The hybrid Tiger Abalone (*Haliotis laevigata x Haliotis rubra*) is farmed in Victoria and Tasmania from crossbred spat the company produces itself.

Its products include canned, frozen, live and partially cooked Abalone, with a focus on retail. It has markets in Japan, Singapore, Hong Kong, China, the US, Canada, the EU and Australia.

The company's achievements as an industry pioneer have been recognised with the 2017 national Agribusiness Exporter of the Year Award from Austrade and the Australian Chamber of Commerce and Industry. In 2019 it was named Primary Producer of the Year at the National Seafood Industry Awards.

COVID-19 impacts

While viruses care nothing for accolades or awards, many of the factors recognised by those awards have allowed the company to maintain sales momentum through the COVID-19 pandemic. Product and market diversity have "absolutely" helped, says Anthony Hall.

"Yumbah's farms and its central processing facility (in the former Aqa Oysters processing factory in Adelaide) work pretty much to a 'just in time' principle – so Abalone destined for sales in one market or country can quickly be diverted to another customer if the first market closes on you.

"Likewise, if demand shrinks for one product format, we can switch resources to another format, such as frozen or canned," he says.

Operationally, the company's already rigorous biosecurity measures were stepped up at its facilities, with extra cleaning, staff distancing and team segregation in response to COVID-19 safety requirements.

Staff at the Adelaide processing facility were split into two shifts, with additional time taken for extra cleaning between shifts.

Throughout the pandemic, the company has continued to export, but freight has been a significant challenge. Yumbah uses ocean freight as often as possible and is not heavily reliant on daily airfreight to reach its markets.

However, it has made use of the Australian Government's International Freight Assistance

Above Inside the facility at Yumbah Narrawong near Portand, Victoria. Photo: Yumbah Aquaculture

Mechanism (IFAM) to access available flights.

"All freight rates have increased well above pre-COVID levels, but the IFAM has significantly helped us to minimise our freight costs during the pandemic," says Anthony Hall.

Technology and innovation

The Adelaide processing facility uses state-of-the-art sorting and packaging technology that automatically selects from the different-sized Abalone to accurately reach the required weight.

"This has increased cost-efficiencies considerably," says Anthony Hall. "Previously, when putting together orders manually, you would always be adding extra as a safeguard against being underweight.

"Now we can accurately match the weight of meat to the order. For example, the machine will pick out exactly the Abalone it needs for, say, a one kilogram order with no or minimal surplus."

Production technologies are also poised for a major update, with plans for a $60 to $70 million expansion at Portland in Victoria being finalised.

Anthony Hall says because aquaculture is so capital-intensive, technology developments tend to wait for new farms to integrate advances, which will happen with the new Portland Abalone nursery and grow-out facility.

It will have a 1000-tonne production capacity based on new technologies that have patents pending. To put this into perspective, this is roughly the same size as the largest wild-catch fishery off Tasmania.

It will add to the existing output from Yumbah farms in South Australia and Victoria, which totals 600 to 700 tonnes. Anthony Hall says that once fully operational, the new Victorian farm will employ more than 100 people.

The increased production capacity is to meet growing demand for frozen and canned products from both national and international markets.

The Portland facility will comprise four 250-tonne modules and it will introduce a whole new approach to Abalone aquaculture, the details of which are commercial in confidence.

Broadly speaking, though, Anthony Hall says that one of the key focuses of Abalone aquaculture development is simulating, as realistically as possible, sea conditions on land.

"What we are doing, basically, is bringing the sea onto land and endeavouring to maintain its condition … clean, plenty of oxygen, cool, free-flowing. It needs to mimic the sea: a mix of crashing, rushing and slow-flowing water movement.

"Because Abalone are marine snails and vegetarian, we also have to have a plant-based protein feed that convinces them they are eating seaweed. The trick is to keep the sea water natural and for the Abalone to enjoy eating the feed we also produce."

This element has been achieved through another R&D investment underpinning a vertically integrated business, Yumbah Aquafeed. A pasta-like feed gives the company full control over nutrition and provenance so it can guarantee the process is free of contaminants such as antibiotics, pesticides, artificial colouring or pigments and growth hormones.

Further diversification has also occurred in Port Lincoln, where Yumbah and Cameron of Tasmania have produced oyster spat for South Australian farmers hit hard after the Tasmania supply was quarantined to prevent the spread of Pacific Oyster Mortality Syndrome in 2016.

Industry outlook

Looking to the future of mollusc aquaculture, Anthony Hall sees a strong future for the sector and one that also works alongside the wild-catch fisheries. In fact, he believes the breeding capacity of aquaculture nurseries could be used to help wild fisheries whose stocks have been declining.

"A single Abalone can produce 10 million eggs. Only a tiny fraction survive in the wild but many more survive in a nursery, so the aquaculture sector has the ability to produce a large quantity of Abalone to put back into the wild. Of course, we first need to establish the science that supports this."

Anthony Hall says in the longer term, and in a post-COVID-19 world, the bigger challenge for the Australian Abalone industry as a whole will be protecting itself against the production capacity of Abalone farming in Asia, which he says is a hundred times greater.

"That means protecting our brands and our provenance against a more mass-produced, lower-cost product. So we have a challenge and an opportunity to promote the sustainability, cleanliness and ethics of our production to justify a premium price for a premium product."

Overlaying all of this is product quality. "Our quality standards were set by our customers, particularly our Japanese buyers who still visit twice a year to make sure we are adhering to their standards.

"The three main pillars of the business are product quality, risk management and, it has to be said, a great enthusiasm for the industry and for the coastal culture in which we live and work." F

MORE INFORMATION
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www.agriculture.gov.au/abares/conferences-events/scienceawards
FRDC RESEARCH CODE: 2008-339

Below From left, FRDC managing director Patrick Hone, Department of Agriculture, Water and Environment assistant secretary Gabrielle Vivian-Smith, award winner Phoebe Arbon, Minister for Agriculture, Drought and Emergency Management David Littleproud and FRDC program manager Carolyn Stewardson. Photo: Steve Keough Photography

Abalone AI in for the count

AI technology offers the potential to help producers improve animal welfare and analyse data for better decision-making

By **Catherine Norwood**

A project to develop a high-tech, 'hands-off' way to count and measure Abalone in aquaculture grow-out tanks won Queensland's Phoebe Arbon a $22,000 grant through the Science and Innovation Awards for Young People back in February 2020.

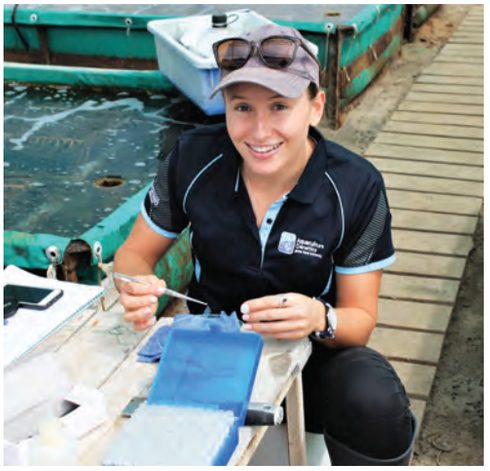
The national award, which is sponsored by the FRDC, was announced as one of 11 made to young people in agriculture, fisheries and forestry as part of the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) Outlook conference.

Phoebe Arbon will use artificial intelligence (AI) processes to undertake the Abalone assessment process – turning images of Abalone in grow-out slab tanks into useful information about the number, size, weight and growth rates of Abalone in production.

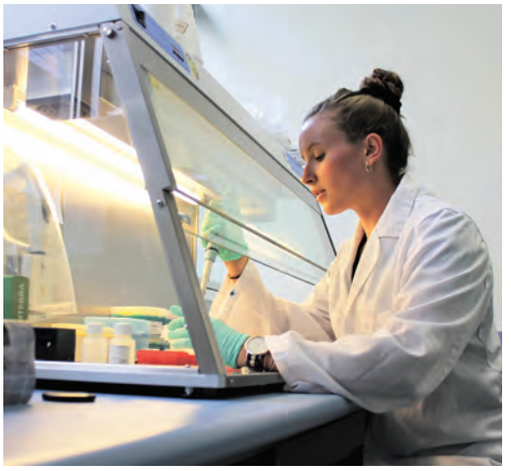
She developed the research proposal after listening to Abalone producers at an Australian Abalone Growers Association (AAGA) meeting in Tasmania last year. She attended the meeting as part of her honours research into Abalone genetics for her Bachelor of Science (Honours) in the aquaculture department at James Cook University (JCU).

After finishing her studies in 2019, she now works at JCU providing biosecurity testing for prawn producers, but is looking forward to beginning her own research project.

Phoebe Arbon says while biological studies in aquaculture were the focus of her science degree, she also took several maths units that will help with the skills needed to develop algorithms for the AI system.



Above Phoebe Arbon sampling Abalone post-larvae. Photo: Jan Strugnell



Above In the lab at James Cook University. Photo: Phoebe Arbon

She is partnering with Southern Ocean Mariculture, which will provide images of its Abalone in tanks.

"The images provided will need to be consistent, taken from the same position. So developing a set-up that is easy for the producer to use and that provides the information we need will be important," she says. The set-up is likely to include a scale reference for the bottom of the tank, to enable automated measuring.

Abalone range from 30 to 50 millimetres in size when they are stocked into the aquaculture grow-out tanks. While it is possible to count and measure them manually, the handling of stock is labour-intensive and can stress the animals, reducing growth and potentially increasing mortality rates.

Monitoring growth manually also involves removing the Abalone from the bottom of the tank to assess them – a laborious process that can also damage stock. A vision-based AI system that reduces handling would improve animal welfare while giving producers better ongoing information about stock in production.

In developing, training and validating an AI model to do the work automatically, Phoebe Arbon expects to create a scalable application to address what is an industry-wide problem.

She says the project has been on hold for several months as a result of COVID-19 restrictions, but she is looking forward to getting started once these are lifted. F

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FRDC RESEARCH CODE: 2018-053

Left Marine species quickly appropriate underwater infrastructure for new habitat. Photos: Western Australia Department of Primary Industries and Regional Development

Assessing end-of-life benefits for ocean infrastructure

By **Barbara Adam**

Marine life is quick to colonise built structures in ocean environments, leading to a rethink on what happens to such structures at the end of their commercial life

Euan Harvey
Professor of Marine Science, School of Molecular and Life Sciences, Curtin University

"We can actually start predicting what the benefits to the local economy would be under ... different scenarios."

If you looked at the satellite images of the waters off Karratha in northern Western Australia on any balmy weekend, you would probably see recreational fishing boats bobbing about in unusually straight lines.

These canny fishers have positioned themselves above the most abundant fishing spots in the area, which have formed in some instances around the oil and gas pipeline crossing the sea floor.

When this infrastructure was installed on the North West Shelf in the 1990s, in what was the largest resource development project in Australian history, the regulations on infrastructure removal at the end of the project were very clear. The whole lot had to be removed once the project finished; the sea floor was to be returned to its original state.

But over the decades, marine life has flourished around oil and gas infrastructure, as well as on other structures such as jetties, shipwrecks and artificial reefs.

An FRDC-funded project underway is reconsidering the decommissioning process, to determine the social and economic value of these structures.

It will, in part, help policymakers decide whether oil and gas infrastructure should remain in place when it reaches the end of its commercial life. It is also assessing the risks and concerns related to leaving these structures in place.

The project

Euan Harvey, professor of marine science in the School of Molecular and Life Sciences at Curtin University, is leading the 'Enhancing the understanding of the value provided to fisheries by man-made aquatic structures' project, which is due to report its findings at the end of the year.

Anecdotal evidence suggests commercial and recreational fishers get better catches around pipelines and platforms than on nearby natural reefs. "The biomass of fish populations around some of the platforms around Thevenard Island (off the coast of Onslow in the Pilbara region of WA) are about 200 times greater than on the natural reef," he says.

The project, designed to calculate the economic and social value of these structures, has a steering committee headed by independent chair Luke Twomey, who is CEO of the Western Australian Marine Science Institution (WAMSI). The committee includes representatives of WA's peak recreational fishing body, Recfishwest, as well as the Western Australian Fishing Industry Council, government agencies and oil and gas companies.

The research team is also a collaboration of scientists from the University of Western Australia, the Australian Institute of Marine Science, the WA Department of Primary Industries and Regional Development (DPIRD) and WAMSI.

Case studies

The project is looking at five case studies: the Busselton Jetty; the Exmouth Navy Pier; the Exmouth Integrated Artificial Reef; offshore oil and gas structures in the Echo Yodel field in the North West Shelf; and Chevron's pipelines and platforms around Thevenard Island.

After reviewing existing research and conducting surveys and focus groups with stakeholders, Euan Harvey says the research has found clear evidence that all five of the built structures do, in fact, have ecological, social and economic value.

Drawing on ecological surveys of the pipelines and platforms near Thevenard Island, they have been able to model the economic cost of removing the structures or, alternatively, transforming them into artificial reefs. "We can actually start predicting what the benefits to the local economy would

Below Artificial reefs volunteer Lindsay Shaw.
Bottom Underwater surveys show that important marine species establish themselves around infrastructure and other sunk structures.

be under the different scenarios," he says. "For example, if it became an artificial reef, what would it mean in terms of extra visitors coming, people fishing, accommodation, boat fuel, and so on."

Similarly, catch data from commercial fishers, DPIRD and the Echo Yodel field has been used to calculate the economic value of catches from those structures.

Recfishwest chief executive Andrew Rowland says recreational fishers are aware of the benefits of built marine structures, as evidenced by the popularity of the gas pipeline fishing spots near Karratha. "They improve rec fishing experiences, whether that be from jetties which give improved access, or whether it be from the habitat benefits of artificial reefs," he says.

Busselton Jetty is popular for recreational fishing, scuba diving and tourism, and the 300-metre-long Exmouth Navy Pier is considered one of the world's top shore dive sites.

Andrew Rowland says both structures have significant social and economic benefits, even though one was built as a timber industry asset and the other was a naval facility. "This project is about understanding those social and economic benefits and how we make sure those benefits are factored into future decisions," he says.

And even though recreational fishers are not currently allowed to fish in the exclusion zones around oil and gas platforms, he says the sector recognises the value of the marine life that has grown on, around and near these structures. "From our perspective, we're looking at the end of life of these structures, how we can capitalise on those ecosystem benefits for new fishing experiences," he says.

The Exmouth Integrated Artificial Reef, which consists of huge buoys donated by BHP and sunk onto an area of bare sand about four kilometres off Exmouth in mid-2018, is also popular for recreational fishers, especially tourists who may not have much fishing experience.

In just two years, the reef has become home to vast numbers of pelagic fish, as well as demersal (bottom-dwelling) species such as Red Emperor. "The fish species have gone up by a factor of seven or eight," says Euan Harvey. "So, tourists know they can go there safely, and they're probably going to catch a fish. There's a social value to that."

The concerns

Efforts to finalise the project have been affected, albeit temporarily, by the COVID-19 pandemic restrictions, which stopped researchers from handing out brochures and conducting focus groups to gauge the positions of the various interest groups.

Fran Ackerman, a research professor in Curtin University's School of Management, tracked down the developers of the focus group software the project had been using at face-to-face meetings and convinced them to create an online version. The software collates and anonymises the responses of participants. With an online version, the remainder of the planned focus groups could go ahead via Webex conference calls.

Concerns raised during focus groups about leaving the structures in place, or deploying new structures, include the potential of chemical leaching into the environment and the long-term legal liability and responsibility for clean-up, if issues are identified 50 or 100 years from now.

Euan Harvey says the project will inform future policy decisions, not only for the decommissioning of built structures in marine environments, but also for the design and installation of future marine infrastructure projects, such as wind and wave renewable energy projects. Structures could be designed with decommissioning and removal in mind.

"The biomass of fish populations around some of the platforms around Thevenard Island (off the coast of Onslow in the Pilbara region of Western Australia) are about 200 times greater than on the natural reef."

Euan Harvey

Removal of current infrastructure under existing guidelines is expected to cause significant local environmental disturbance.

"Some platforms have legs that are a couple of metres across – they're going to have to blast the sea floor if the regulators want the structure removed at or below the sea floor," he says. "On some of these structures you have threatened and endangered species. What's going to happen to them? It's a really complex issue, where you're trying to balance the ecological values with the politics and the attitudes of stakeholders." F

MORE INFORMATION
www.frdc.com.au/issues/workplace-health-and-safety-in-fisheries-and-aquaculture
www.amsa.gov.au

Central source for safety

A central web portal being developed will provide a one-stop shop for those in the fishing and aquaculture sectors looking for information about workplace health and safety

By **Catherine Norwood**

From ready-to-use safety management system templates to news about the latest safety gear, the new FishSafe Australia website brings together industry relevant information with easy to access and use resources.

The website, launching in October 2020, will join industry podcasts and social media messaging as part of the seafood industry health and safety toolkit project. It was developed through the National RD&E Seafood Industry Safety Initiative (SISI), which comprises industry leaders, the Australian Maritime Safety Authority (AMSA) and the FRDC.

The initiative aims to create a collaborative, national strategy to improve the safety of all individuals working in Australian fishing and aquaculture.

Principal investigator for the toolkit project is Tanya Adams, from workplace safety consultancy Taylored Health and Safety. She is also a member of the steering committee for the national initiative.

She says in the first year of the project a gap analysis identified that while some "pockets" and specific sectors were meeting health and safety requirements and supporting their members, this was not consistent across the industry as a whole.

The analysis also found many industry leaders have few resources on hand to drive safety and training programs. For some, safety only comes into focus when regulators step in and prevent fishing until a specific issue is addressed, or there is an accident.

The FishSafe Australia website and resources are designed to help make safety compliance easier for those who are time and resource poor, particularly smaller operators.

For instance, safety management system templates being developed will meet the requirements of the regulator, AMSA, as well as relevant state and territory work health and safety authorities. They will also be tailored to specific fishing gear and methods.

Tanya Adams says ensuring the documents can meet the needs of different agencies will help streamline safety planning and record keeping for fisheries and aquaculture businesses. Templates are already available for Abalone diving, and pot and trap and trawl fisheries. She is also working with smartphone app developers on an app that will allow operators to use digital reporting formats.

The FishSafe Australia website will provide links to safety training programs such as the SeSafe online learning program.

A critical part of the website will be a collection of incident report summaries providing an overview of workplace incidents, contributing events and recommendations to address any issues identified. This information will be compiled from various government agency reports, coroners' reports and other sources to provide practical lessons for industry about what can go wrong and how to prevent it.

Researchers at Edith Cowan University in Western Australia are gathering the data for these summaries from diverse reports on industry fatality, incident and injury data across 30 years. These will include:

- deaths or injuries associated with the operation or navigation of a vessel;
- the loss or presumed loss of a vessel;

NATIONAL RD&E SEAFOOD INDUSTRY SAFETY INITIATIVE STRATEGIC PLAN

Mission: To achieve a positive change in workplace safety culture to ensure that the Australian seafood industry "keeps its people safe".

Objective 1: Move towards zero fatalities and a reduction in workplace health and safety incidences within industry.

Objective 2: Continuously improve the safety culture and use of workplace health and safety management systems.

Objective 3: Increase industry uptake of workplace health and safety training programs and education tools.

More information: www.frdc.com.au/issues/workplace-health-and-safety-in-fisheries-and-aquaculture

MORE INFORMATION
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FRDC RESEARCH CODE: 2017-231

Left Creating safer fishing workplaces requires the right gear fitted to vessels, along with attitudes and practices that make the crew safety a priority.
Photo: Peter Whyte

- collisions between vessels, or between a vessel and an object;
- the grounding, sinking, flooding or capsizing of a vessel;
- fire onboard a vessel;
- loss of stability of a vessel that affects its safety;
- the structural failure of a vessel;
- a close-quarters situation; and
- a dangerous occurrence, which could have caused the death of, or serious personal injury to, any person on the vessel.

Commercial fishing has been identified as one of the most dangerous occupations in Australia, following a number of vessels and crew being lost at sea in the past decade. However, Tanya Adams says it is difficult to accurately assess the safety performance of the sector because information about actual and near-miss incidents is held in disparate locations.

She says a low percentage of incidents are believed to be accounted for in state-based workplace safety agency reports. In reports to AMSA, commercial fishers are over-represented in marine fatalities but under-represented in overall number of reports.

The new research project will attempt both to collate and provide a more accurate picture of industry safety practices and issues, to help prevent future incidents. It will also recommend metrics to measure past and future safety performance. The project's final report is expected to be completed by the end of 2020.

As part of SISI, a network of industry advocates is being created to promote safety messages to industry. The network will include Michael O'Brien, general manager of Australia Bay Seafoods, and Clayton Nelson, general manager of policy and external relations with Austral Fisheries, both of whom have featured on the FishSafe Australia podcast. Eric Perez, who hosts the podcast in a project separate to his role as CEO of the Queensland Seafood Industry Association (QSIA), says the podcasts help to take the safety message to fishers, who are often on the move and at sea, where it is easier to listen to a recording than to sit down and read.

"It's another avenue to reach an industry audience, along with social media, where we know many fishers are active," he says. He is helping to produce the third series of podcasts, most of which are about 12 minutes long. They are available through the PodBean app, or online at https://fishsafeaustralia.podbean.com. F

SAFETY GEAR UPDATE

Life Cell: A float-free device that holds essential safety gear including flares, torches and so on, as well as drinking water or personal items. An emergency position indicating radio beacon (EPIRB) can be mounted on the side of the case and the Life Cell can provide buoyancy to multiple users. It includes lanyards to prevent users from being separated.
More information: www.lifecellmarine.com.au

Emergency Escape Lights (EEL): These lights activate when a vessel rolls over or capsizes to provide light for an escape, and they are also water-activated in case of flooding. They have been installed on all Australia Bay Seafoods vessels, along with reflective tape to help crew escape in an emergency evacuation.
More information: www.tmq.com.au

Personal Flotation Device (PFD) waist belt: The waist belt is a manually inflatable personal flotation device (PFD) that is rated to *Australian Standards 4758.1:2015 Lifejackets, part 1: general requirements.* Different models and sizes are available, and they can be purchased at many marine safety equipment suppliers. Ideal for an operator working on deck in heavy weather, the uninflated PFD can be strapped around the lower back to optimise movement while reducing the risk of entanglement or accidental inflation. F

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FRDC RESEARCH CODES: 2016-802, 2016-803, 2016-805

Below New breeding strategies aim to bring Sydney Rock Oysters to market faster.

Breeding efforts enhance production for Sydney Rock Oysters

Words **Dyani Lewis**
Photos **NSW Department of Primary Industries**

Greater control over breeding processes is producing faster-growing, fatter and more resilient Sydney Rock Oysters, helping the native species gain ground in the marketplace

Mike Dove
Sydney Rock Oyster breeding program leader, NSW DPI

"It's a very accurate method of breeding, in terms of being able to predict gains and ensure that important genes are passed on to the next generation, while having control over inbreeding levels."

New South Wales marine scientist Mike Dove readily admits he is biased when it comes to Sydney Rock Oysters (*Saccostrea glomerata*). "For me, they're a better tasting, better eating oyster," he says.

He leads the oyster research team at New South Wales Department of Primary Industries (DPI), which has a long-established breeding program for Sydney Rock Oysters. It has three goals: improved disease resistance, superior growth and increased marketability.

Sydney Rock Oysters take twice as long to reach a premium market size compared to Pacific Oysters (*Crassostrea gigas*), which have been farmed in Australia since their introduction from Japan in the 1940s. This slower growth makes production of Sydney Rock Oysters a more costly, riskier prospect for farmers. Mike Dove says hatchery production of Sydney Rock Oysters presents an array of challenges compared to other species.

Efforts to improve breeding processes have been boosted through the recently completed three-year Future Oysters Cooperative Research Centre Program (CRC-P). This was funded through what was the federal Department of Industry, Innovation and Science, with contributions from industry, universities, state research agencies and the FRDC, which also administered the CRC-P research projects.

The CRC-P brought CSIRO, universities and industry together via the Select Oyster Company and the DPI breeding team at Port Stephens Fisheries Institute to focus on key aspects of oyster production, including breeding techniques. Refinements to these techniques are already paying dividends, accelerating development of faster-growing, more disease-resistant Sydney Rock Oysters.

Better breeding

Since 2014, NSW DPI and the Select Oyster Company, in collaboration with CSIRO, have developed a "family-based" breeding approach to improve Sydney Rock Oyster production. This involves selecting individual mating pairs from known families.

"We have the full pedigree for all the families that we breed," Mike Dove says. "It's a very accurate method of breeding, in terms of being able to predict gains and ensure that important genes are passed on to the next generation, while having control over inbreeding levels."

It is not just a question of which oysters to breed. Tweaks to how they are bred and reared are also speeding up the process. At the University of Newcastle, researchers have been looking at how hatchery conditions can improve the viability of eggs after they have been obtained from broodstock to further boost fertilisation success.

At the same time, work at the University of the Sunshine Coast is refining breeding runs. Researchers there are improving broodstock conditioning techniques and have identified a spawning-inducing factor that triggers ripe oysters to naturally release their eggs and sperm, instead of having to sacrifice the oyster to physically extract gametes. This work gives breeders greater control over the process and preserves precious broodstock.

Using naturally released eggs has the added benefit of increasing fertilisation rates, giving higher yields from each family that is created. The result has led to increased fertilisation rates in breeding runs from 27 per cent to 45 per cent. It has also reduced the number of broodstock required, which are limited and expensive, and cuts down the amount of time needed to get a breeding run underway.

"It's a huge step forward for the program, making the breeding process more reliable," says Mike Dove.


Floating bags used for single seed Sydney Rock Oyster nursery culture.

Other tweaks DPI has been working on in collaboration with CSIRO include controlling when the oysters mature and spawn. Out-of-season breeding using hatchery conditioning techniques has allowed the best families to be selected a year earlier, effectively doubling the speed of gains for certain desirable traits.

Overall, the improvements have slashed the time and cost of breeding new and improved oysters. "Previously, using the old techniques, we'd have to wait three years to select the right oysters," Mike Dove says. "We've been able to bring that down to one year just by changing the time at which we breed oysters."

Industry priorities

Deciding which characteristics to breed for has been the role of the Select Oyster Company, an industry body that distributes breeding families to commercial oyster hatcheries.

Working with oyster farmers, the Select Oyster Company has identified three main breeding goals. The first is resistance to QX – short for 'Queensland unknown' – a disease that can ravage oyster farms in affected estuaries. The second is faster-growing oysters, so that production times can be reduced. The final challenge is for the first two goals to be achieved without sacrificing the resulting oyster's condition.

"Normally there's a trade-off between oyster growth and their conditioning in terms of how fat they are when you open your oyster," says Matt Wassnig, a former oyster farmer who chairs the board of the Select Oyster Company. Breeders are now on track to produce an oyster that matures to market size 30 per cent faster than wild oysters by March 2021. In another few years, that growth advantage will hopefully come at no cost to the final oyster condition.

Disease resistance

Outbreaks of QX disease were first recorded in the 1970s. By 1976, scientists had identified the culprit of QX disease: the single-celled parasite *Marteilia sydneyi*. In NSW, only seven of the 40 estuaries where Sydney Rock Oysters are farmed have had outbreaks of QX disease, despite the fact the parasite can be found in most estuaries where Sydney Rock Oysters are grown.

When outbreaks do occur, mortality rates in affected estuaries can run as high as 98 per cent. "But we don't know when or where the next QX disease outbreak will be," says Mike Dove. If stock on farms is not disease-resistant it can spell the end of Sydney Rock Oyster production in that estuary. It is little wonder then, that oyster farmers want a QX-resistant oyster.

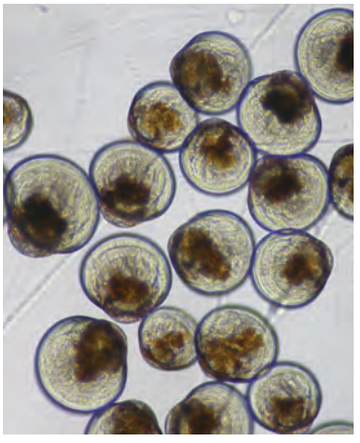
A QX outbreak first hit the Georges River in Sydney in 1994, and breeders now use it as their testing ground for resistance to QX disease. Each year the NSW DPI team takes its selectively bred oyster families to Georges River, placing them in the water at the right time and location to expose them to QX disease. This field challenge identifies the most resistant families for breeding the next generation.

"We are very fortunate that QX survival is a heritable trait that's passed on through breeding quite effectively," says Matt Wassnig. "That meant we were able to have a really solid breeding goal in a reasonably short period of time." That goal, to have 70 per cent of selected oysters resistant to QX disease, was achieved earlier this year.

There is an added benefit of breeding QX-resistant oysters. These oysters have formed the basis for ongoing research into general resilience traits, which is expected to help farmers 'future-proof' production against emerging threats such as climate change.

Below Larval rearing tanks used for family production at Port Stephens Fisheries Institute.

Below Fifteen-day-old Sydney Rock Oyster larvae. **Right** Bulk algal production at Port Stephens Fisheries Institute for oyster spat and broodstock diets.



Microbes as markers

It is possible that microbes living on and in Sydney Rock Oysters might hold some clues to improve oyster health and resilience.

In a separate FRDC-funded project, researchers at the University of Technology Sydney (UTS) are investigating the microbial ecosystem – known as the microbiome – of the oysters, measuring which bacterial species proliferate and which decline under different conditions. This includes measuring how the microbiome differs between estuaries and under different environmental conditions, including disease pressure.

For example, oysters that are affected by a disease like QX often succumb to secondary bacterial infections. The UTS team is measuring changes in the microbiome through a QX disease outbreak to identify microbes that flag which oyster families are particularly robust. This research can be applied to gain greater understanding into other disease processes that impact Sydney Rock Oysters, such as winter mortality disease.

Winter Mortality resistance

"Winter Mortality is a significant issue for many estuaries where Sydney Rock Oysters are grown. The disease is quite unpredictable and very patchy and can kill up to 80 per cent of farmed stock in particularly bad seasons," says Mike Dove.

The agent or agents that causes winter mortality are yet to be identified. It is possible that a range of factors are responsible, which makes breeding for resistance particularly difficult.

"We're trying to understand the genetics of Winter Mortality disease resistance; we haven't given up," he says. "We still place oysters in a high-risk Winter Mortality site each year to try and get the information we need to keep improving Winter Mortality resistance in the breeding population."

Year-round oysters

Currently, sales of Sydney Rock Oysters drop off at the end of autumn when the oysters have spawned out, but producers would love to have oysters available to sell year-round.

To reach this goal, the DPI research team is also working to improve commercial production of triploid oysters. Normally, oysters are diploid, meaning they have two sets of chromosomes. Triploids have three sets of chromosomes. Not only do triploids grow faster, they have a plump, saleable meat condition in months where diploid oysters have no market condition whatsoever.

Intertidal rack and tray culture of Sydney Rock Oysters.

Pacific Oyster farmers have been growing triploid oysters to extend their season since 1985, but the Sydney Rock Oyster industry is yet to develop a stable supply of triploids for industry.

Hatcheries make triploids by crossing male tetraploids – oysters with four sets of chromosomes – with eggs from regular diploids. DPI has been working with the Southern Cross Shellfish hatchery in Port Stephens to develop techniques to create tetraploid oysters, which will make production of triploid oysters more reliable for industry.

However, making Sydney Rock Oyster tetraploids is a finicky business. Diploids are chemically treated to form triploids, which are then treated again to form tetraploids. The perfect conditions for the two-step process are still being optimised, but success rates are steadily improving.

"If we can produce Sydney Rock Oyster tetraploids, industry can do more effective triploid oyster runs," says Mike Dove. "Producers will have oysters that grow faster due to both being triploid, as well as genetically selected for better growth."

In all, he says, gains across several aspects of the breeding and production process are now approaching commercial realisation, improving farm productivity to bring the delicacy of Sydney Rock Oysters to more diners, more often. The Sydney Rock Oyster breeding program also provides a strong foundation from which to respond to any unidentified future problems and needs, supporting the long-term sustainability of the industry. **F**

Research and Development Plan lifts off to further engagement

The FRDC's new R&D Plan sets the organisation on a more flexible, consultative path to achieve outcomes for Australia's diverse fishing and aquaculture stakeholders

After more than a year of consultation and development, the FRDC's R&D Plan 2020–2025 is ready for use.

The Plan establishes the focus for the organisation's activities for the next five years and outlines strategies to get there. Importantly, it will be adaptable and respond to further input from our stakeholders.

At the core of the R&D Plan and investment are five R&D outcomes and five enabling strategies that will help us achieve those outcomes.

Five R&D outcomes

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

Five enabling strategies

I. Drive digitisation and advanced analytics;
II. Strengthen adoption for transformative change;
III. Promote innovation and entrepreneurship;
IV. Build capability and capacity; and
V. Provide foundational information and support services.

These 10 items guide where we are going and why. We are now working with stakeholders to develop more detailed roadmaps for achieving each of the five outcomes.

Calling all fishing and aquaculture stakeholders

Roadmapping workshops will be held online, enabling stakeholders to collaborate from wherever they are to identify how to achieve each outcome.

The first online roadmapping workshop will focus on R&D outcome 1: Growth for enduring prosperity. This workshop will be run in collaboration with Food Innovation Australia Ltd, which is undertaking a similar process focused on growing the market share of Australia food globally.

Fishing and aquaculture stakeholders are invited to participate in online roadmapping workshops on the following dates:

Outcome 1 Growth for enduring prosperity – Thursday 15 October
Outcome 2 Best practices and production systems – Friday 16 October
Outcome 3 A culture that is inclusive and forward thinking – Wednesday 21 October
Outcome 4 Fair and secure access to aquatic resources – Friday 23 October
Outcome 5 Community trust, respect and value – Tuesday 27 October

These dates are tentative. Final dates for workshops and other FRDC meetings will be posted on our website (www.frdc.com.au/stakeholders/meetings). To participate and keep up to date on these and other FRDC meetings, subscribe at **www.frdc.com.au/subscribe**. Make sure to select 'FRDC meetings'. F

For a comprehensive overview of the R&D Plan 2020–2025, see the four-page insert at the centre of this edition of FISH magazine.

ONGOING CALLS FOR APPLICATIONS

As the FRDC develops the structures and processes to implement its new R&D Plan, it is important that urgent and necessary research is not delayed. In late October we will publish a call for applications against existing R&D priorities in line with the Plan.

This call will be made on our website and through an email alert to FRDC update subscribers.

To subscribe visit www.frdc.com.au/subscribe.

We will use a variety of approaches to call for research that will address the Plan's priorities, including competitive calls, select and direct tenders, and investment in startups and technologies.

MORE INFORMATION
National Barramundi Day, https://vimeo.com/365205086
Love Australian Prawns, www.australianprawns.com.au
FRDC RESEARCH CODES: 2012-774.10, 2015-713, 2016-272, 2017-087, 2016-501

Image used in the 'Love Australian Prawns' marketing campaign. Photo: Adpower

Seafood's brand Australia: a decade of lessons

The evolution towards an industry-wide approach to marketing Australian seafood continues, with government funding adding momentum

By **Peter Horvat**

When it comes to the sale of its products, Australia's seafood sector has generally been slow to move away from a commodity approach to one that profiles and celebrates the nation's highly diverse and high-quality offerings.

A decade ago, marketing was largely about the final step in the transaction – promotion and advertising at point of sale. But recent years have seen an increasing sophistication in seafood marketing in Australia, with a growing focus across the whole supply chain and celebrating either provenance, place or heritage of the products.

The importance of quality, consistency and form has also been identified as critical in the marketing story. This has led to different products and messaging being developed for various markets (retail, food service, export) to support branding and, finally, promotion to consumers.

Individual businesses have been the primary drivers of this approach. However, a new $4 million marketing campaign funded by the Australian Government is expected to bring a similar strategy to the industry as a whole, creating a 'seafood brand Australia', for Australians.

As this campaign gets underway, there are a few lessons of note in the past 10 years that are worth reviewing.

Marketing levy approaches

As one of the organisations encompassing the entire commercial seafood sector, the FRDC has long worked to support industry requests for marketing assistance. However, the introduction of marketing levies through the FRDC has, without question, been the biggest non-starter on this front.

Watching the success of other food marketing campaigns, such as Meat & Livestock Australia's 'We love our lamb' campaign fronted by 'Lambassador' Sam Kekovich, led to calls for a similar campaign for seafood.

This gave the FRDC the impetus to pursue the legislative changes needed to raise a marketing levy from its stakeholders.

On 12 December 2013, the *Rural Research and Development Legislation Amendment Bill 2013* was passed, allowing the FRDC and other research and development corporations (RDCs) to extend their activities into this marketing sphere, if they hadn't already done so.

The FRDC and many stakeholders were buoyed by the change. However, unlike other RDCs, levies in the seafood sector are paid on a voluntary basis. This includes the research and development levy that underpins the FRDC's operations and extends to any potential marketing levy.

Although the legislative changes allowed the FRDC to raise a statutory marketing levy, there has been no industry-wide agreement to do so.

The FRDC sought further legislative amendments to permit a sector-by-sector approach instead, which would allow for a compulsory levy to be raised from all participants within a specific sector. This was approved through the *Primary Industries Research and Development*

Amendment Bill 2017, passed on 16 August 2018.

Two sectors – wild Abalone and farmed prawns – have pursued this opportunity, undertaking the long process of addressing the government's 12 levy principles. These include developing a plan, consultation, sector vote on the levy and, finally, seeking approval from the Minister for Agriculture.

Australian Wild Abalone™

The Abalone Council of Australia (ACA) has pursued the levy path although recognising that it would be difficult to get agreement from members in five states, who were often harvesting different species.

Significant work had been done, largely through the Australian Seafood Cooperative Research Centre and the FRDC investment with ACA, to develop the foundations for marketing Abalone. This included market research, brand development, traceability and engagement with key parts of the market. Undertaking the levy process was part of this work.

The aim of the levy was clear: to secure and build value and awareness for the sector, focusing on five key markets – Australia, China, Hong Kong, Japan and Singapore – as part of a market diversification strategy. It was to run as a trial for five years. The ACA consulted with industry and refined the plan in a process that took several years.

In 2019, a final version of the 'Consumer Education and Promotion Program' was completed and put to a vote. The industry ballot, which closed on 15 December 2019 and was verified by CorpVote, provided a clear outcome. More than three-quarters of those who voted opposed a compulsory marketing levy.

A key question for the ACA is now how to manage the resources developed over the past 10 years, including websites, trademarks and other collateral into the future. A number of exporters continue to use the Australian Wild Abalone® Certification Mark on their product labels and company websites.

Prawn farmers to pave path to market

Support for a compulsory levy in the prawn-farming sector has been stronger, but not unanimous.

In 2013-14, the Australian Prawn Farmers Association (APFA) first launched the 'Love Australian Prawns' campaign, a joint initiative with the Australian Council of Prawn Fisheries (ACPF). The campaign had received research and development funding from the FRDC and also the Australian Seafood CRC, with a 'shoestring' budget of voluntary contributions from industry participants.

At this time, the APFA also began to investigate a compulsory marketing levy that could in part help to fund the fledgling campaign, but which was focused more on the promotion of farmed prawns for its members. Its planning and consultation efforts were disrupted by the outbreak of White Spot Disease on farms in Queensland in 2016.

The marketing levy proposal was put on hold and the industry agreed instead to a White Spot Disease Recovery Levy. Two years on, the APFA circled back to the marketing levy. The structure of the sector had changed significantly in the interim. Further consultation was undertaken, planning was completed in early 2019, and a formal vote was held.

Although a majority of stakeholders supported the proposal, there remained some who did not. There was also concern about the number of compulsory levies this would require from an industry only just starting to recover from the incursion of White Spot Disease. For these reasons the APFA management committee decided not to progress a compulsory marketing levy for the Australian prawn-farming industry.

Above Image from the 'Love Australian Prawns' marketing campaign. Photo: Adpower

While members of both farmed and wild-harvest prawn sectors contribute to the 'Love Australian Prawns' campaign, the ACPF also invested in a project that dealt with issues such as fisheries management and the sustainable harvesting of prawns unique to the wild-catch sector. The 'Australian Wild Prawn' project profiles one sector behind the Love Australian Prawns brand and is jointly funded by the FRDC and the ACPF.

Partnering on prawns

The 'Love Australian Prawns' campaign has gone from strength to strength over the past seven years, showing good returns for the investment with consumer awareness and support from retailers. Importantly, the campaign is funded totally by industry contributions from both the wild and farmed sectors.

The campaign is built on a solid base of market research, which provided a clear strategy and saw industry stakeholders all working together. The market research clearly showed Australian consumers love prawns and value them in their celebrations. And therein lies the core of the 'Love Australian Prawns' strategy – aligning Australian prawns with celebration events.

To deliver on this, the Adpower agency, led by Ben Hale, has helped develop a base of

Providing recipes for consumers is an important part of the 'Ask for Aussie Barra' campaign. Photo:Papaya Agency

materials including different recipe suggestions and ideas – in varying flavours and with seasonally nuanced tones. The focused campaign, with professional support, has allowed the tactics used in reaching consumers to adapt to changing marketing conditions. This has been of particular importance in navigating the impacts of the COVID-19 pandemic.

A year ago, few could have imagined the campaign would actively encourage people to ask their supermarket seafood departments for three-kilogram or five-kilogram boxes straight from the freezer.

That shift to consumers bulk purchasing frozen product for later consumption has continued past the first stage of pandemic lockdowns. The bespoke and instant updating of messages and content about product is now becoming the 'new normal' for marketers. It also highlights the power and agility of digital and social media, which is now an essential part of the marketing mix.

The Love Australian Prawns committee has finalised its 2020-21 strategy, refocusing on recipe development. This is based on feedback and data indicating more at-home entertaining for small groups, as well as the fact we are now living in a time of recession. The aim is to provide meals that are inexpensive but bring a hint of occasion and joy in what will be difficult times for many people.

Ask for Aussie Barra

The Australian Barramundi Farmers Association (ABFA) has also taken charge of its own promotion and marketing, focusing on the issue of country of origin. Its industry-funded campaign celebrates Aussie Barra and its culinary aspects, while highlighting that 60 per cent of Barramundi sold in Australia is imported. So, buyer beware!

The ABFA's market research shows nearly half of Australians do not know where their Barramundi is from. To address this, it has embarked on a three-year program calling on Australians to 'Ask for Aussie Barra'.

This multifaceted program delivered by Papaya PR has both a trade and consumer component targeting genuine purchase change. The ABFA has developed a free digital cookbook using recipes created by Australia's top chefs, and it has been downloaded nearly 2500 times.

One key activity is the creation of National Barramundi Day, which launched on Friday 18 October 2019. The launch included social media, public relations and paid media partnerships with leading key chefs from around Australia. Australian Barramundi was featured at 40 leading restaurants.

The ABFA also hosted an exclusive media event lunch with one of Australia's most recognised celebrity chefs, Matt Moran, at his iconic restaurant North Bondi Fish. The event brought together Barramundi farmers, chefs and more than 20 journalists.

The rise of the brand

The past decade, and the past five years in particular, have seen an increase in the efforts from individual fishing and seafood companies to take charge of their own marketing.

Seafood branding guru John Susman of Fishtales paved the way, helping Clean Seas to develop a complete premium marketing brand for its Hiramasa Kingfish – from the fish to the restaurant plate.

Others following suit, such as Raptis Seafoods, Spring Bay Seafoods and Petuna, promote the company and its products. Others, such as Fremantle Octopus, Glacier 51 Toothfish, Goolwa PipiCo, Cone Bay Barramundi or Two Gulfs Crab, give prominence to the origin of their product.

Branding is vitally important for the seafood industry. Consumers find it hard to tell one

Consumers find it hard to tell one whole, wet fish from another. However, when it is branded, that same fish comes with the story of the fisher or the provenance of the fish, and it provides a memorable impression.

whole, wet fish from another. However, when it is branded, that same fish comes with the story of the fisher or the provenance of the fish, and it provides a memorable impression. The brand represents more than just the product. It is the sum of people's perception of it and the associated company's reputation.

Working with government

In a state-based initiative, the NSW Professional Fisher's Association (PFA) was funded through the NSW Government's Supporting Seafood Futures program in 2019 to create a multifaceted NSW seafood brand and awareness program. The program provided matching funds for industry contributions.

The three-month campaign aimed to increase consumption of NSW seafood, drive its value through increased awareness and consumption, and build industry capabilities and cohesiveness. It included a brand identity, message and recipes, which have been promoted via television, radio and social media. This was also supported by point-of-sale materials and a number of seafood festivals.

A major component of the campaign was the creation of eight episodes of *Seafood Escape with Andrew Ettingshausen*. The FRDC assisted with funding and helped to coordinate participating chefs. Each episode showed Andrew Ettingshausen and a chef working in a different fishery across NSW, demonstrating how the catch could be cooked. These recipes are also being used as recipe cards.

The show went to air on Network Ten at the end of December and into January, and the episodes have been replayed several times since. The Sydney Fish Market, the FRDC and NSW Department of Primary Industries all contributed to the production.

Other activities of the campaign include short videos produced by Matt Blyth at Millstream Productions, that run as 15-second advertisements on TV and social media. Radio advertisements were also run across Austereo's Australian Traffic Network, with announcements after the traffic reports during the evening drive period from 4:30pm to 6pm. The message was: "NSW fishers proudly supply fresh NSW seafood to our community. Demand NSW seafood every time. It's from right here on our doorstep." The timing was focused on speaking to the consumer when they were thinking about buying dinner.

The campaign, while running over a comparatively short period, did have an impact on consumers, with post-campaign surveys showing awareness of various components. It also helped to generate community support for the seafood industry and raised the morale of fishers and those in the post-harvest sector.

Bushfires, floods and, more recently, the COVID-19 pandemic saw the campaign cut short. Most of the planned seafood festivals could not be held due to COVID-19 control restrictions.

The PFA is continuing to build on the heightened awareness of NSW seafood and is championing further engagement with consumers. It is clear industry must engage constantly with the community to achieve recognition and generate a positive response.

Future 'Eat Seafood, Australia!'

The most significant industry-wide undertaking is still to come and builds on many years of work by industry and government to deliver a national Australian seafood campaign.

In 2015, the Department of Agriculture and Water Resources began a project to improve public understanding of the seafood industry and fisheries management. While the proposed campaign did not eventuate, more recently the Australian Government has funded a new $4 million national seafood marketing campaign.

Deputy Prime Minister Michael McCormack, Minister for Agriculture David Littleproud and Assistant Minister for Forestry and Fisheries Senator Jonathon Duniam announced the campaign in June, under the $1 billion COVID-19 Relief and Recovery Fund, an initiative to help industries recover from the COVID-19 economic crisis.

Seafood Industry Australia (SIA) is leading the 'Eat Seafood, Australia!' campaign and has appointed an oversight committee, whose members have experience in big-budget marketing and consumption-driving campaigns across TV, print and digital media. These include John Susman, Tarun Richards of Humpty Doo Barramundi and Caroline Hounsell of Tassal, as well as SIA CEO Veronica Papacosta and media and communications manager Jessica McInerney. Advice from Pork Australia and Meat & Livestock Australia is assisting with the campaign development.

Activities are expected to begin in November 2020 and run for 12 months.

Clemenger BBDO Sydney has been appointed through a competitive pitching process to develop the Australian Seafood brand and launch a creative platform to encourage consumers to eat more Australian seafood.

A national approach to marketing to profile and celebrate our iconic protein source has been a long time coming. This campaign represents the industry's first steps to establish Australian Seafood as a brand in its own right, and it will set the table for future industry-led advertising initiatives. F

MARKETING SKILLS

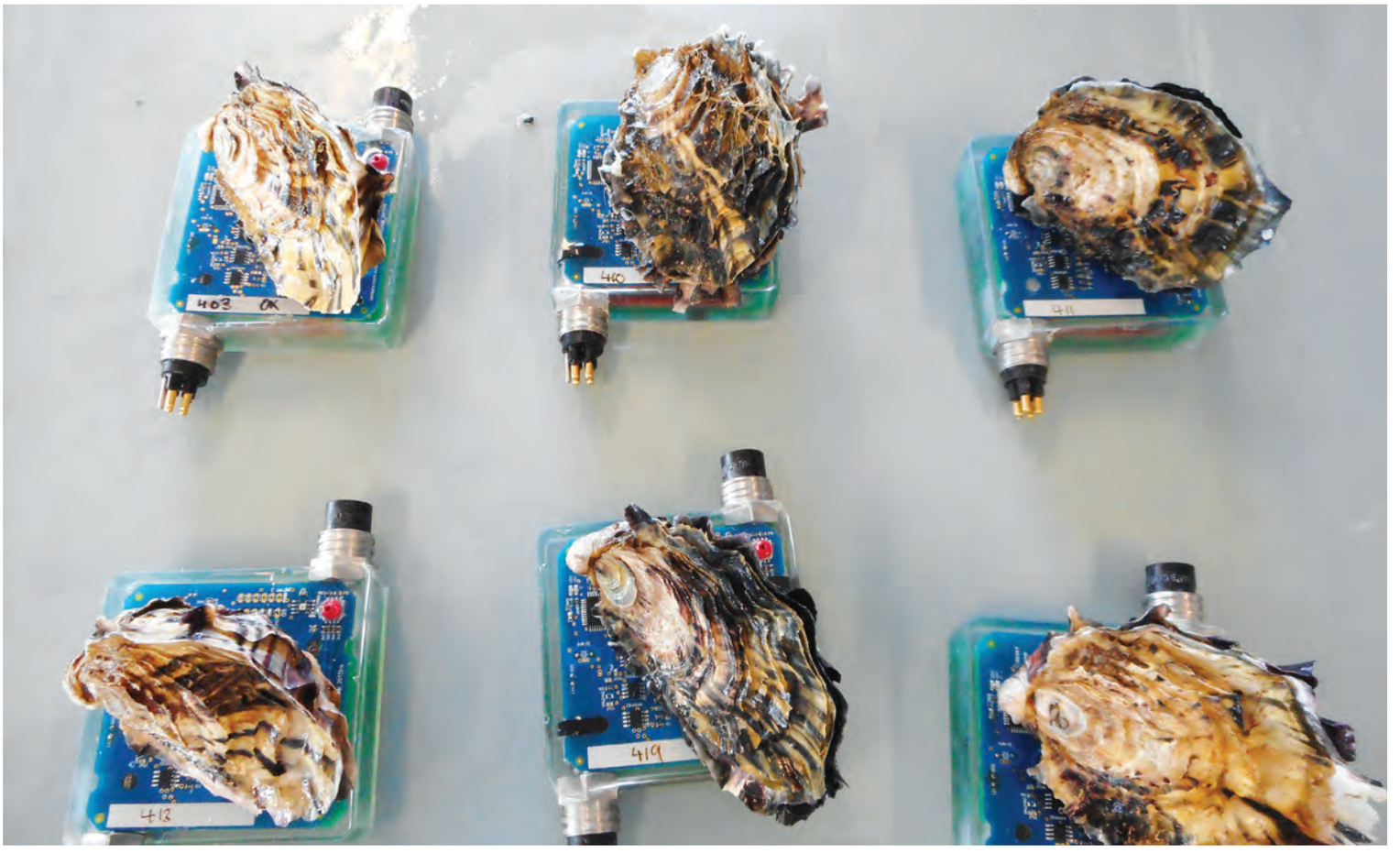
To help members of the seafood sector develop the skills needed to meet the changing marketing landscape, the Queensland Seafood Marketers Association (QSMA) is running a webinar series.

This follows successful marketing symposiums in 2018 and 2019.

The events, being held virtually in response to COVID-19 restrictions, began in late September and are being recorded for future reference, for those who cannot attend the live streams. The first events featured Ben Hale from Adpower discussing social media and John Susman from Fishtales discussing brands.

Topics presented in different sessions will include building a brand, establishing an online store, retail trade statistics, packaging and a beginner's guide to social marketing. For more on the symposium visit the QSMA website: **https://queenslandseafoodmarketers.com.au**.

MORE INFORMATION
John McCulloch, CSIRO, john.mcculloch@data61.csiro.au
FRDC RESEARCH CODE: 2016-023



Environmental updates in a heartbeat

By **Jen Marshall**

Real-time reports from sentinel oysters could provide an early warning of changing water conditions

Ashfaqur Rahman
CSIRO team leader and principal research scientist, Data61

John McCulloch
CSIRO senior engineer and project leader

Under the surface of the D'Entrecasteaux Channel in Tasmania, the temperature begins to rise, and the pulse of a Pacific Oyster stationed there begins to quicken. The oyster opens its shell to gather an inflow of nutrients from the waters, and CSIRO scientists gather information in real time from these biological and ecological interactions, using a new biosensor technology.

Investigator Ashfaqur Rahman, who leads CSIRO's data analytics team at Data61, explains that as the environment changes, the behaviour of animals – including oysters – changes in response.

"So, we wondered if we could observe the behaviours themselves to infer what changes were occurring in the environment," he says.

Bivalves such as oysters have long been recognised for their ability to provide an early warning system for environmental changes on a long-term scale, but this is the first exploration into their potential for real-time monitoring or change prediction.

Sensor technology

To measure the impacts of change on oysters, heart rate and shell opening (gape) patterns were monitored via a credit card-sized sensor glued to the bottom shell of a live oyster, and a small magnet glued to the top shell.

The sensor measures heart rate by detecting changes in the level of reflectance from infrared beams on the surface of the animal's body. As the heart beats, it changes shape, which affects the amount of light reflected back.

A magnetic field is used to measure the angle of the shell gape over time. A magnet is attached to one valve and a magnetic sensor (a Hall-effect sensor) is part of the electronics. Changes in magnetic field strength indicate whether the shell is closed or open, and how widely.

Left Sensors attached to oysters measure the animals' physiological responses to changing water conditions.
Photo: CSIRO

Getting the sensors into the field for testing required careful planning and collaboration between the project team and stakeholders, including the Tasmanian Government, a local marine assessment company Aquenal, and aquaculture operators in the trial area.

Oysters equipped with sensors were deployed with conventional water quality sensors at Coningham and Redcliffs in the D'Entrecasteaux Channel to measure relationships between water quality and animal biology and behaviour.

A low-cost radio telemetry interface was installed, feeding live data back to CSIRO. Researchers chose an emerging telemetry technology to trial, called LoRaWAN, which has a long radio range, low power consumption and low running cost.

To narrow down which water quality parameters impact oysters the most, the team began by observing a suite of standard measures that included temperature, conductivity, turbidity, dissolved oxygen (DO), pH, chlorophyll and oxidation-reduction potential (ORP).

"By using a machine learning mapping model, clear relationships have so far been found between temperature and both heart rate and gape pattern, and salinity and heart rate," says Ashfaqur Rahman.

Production advantages

CSIRO senior engineer and project leader for this biosensor research is John McCulloch, who says understanding the impacts of environmental changes on oyster biology could provide a significant advantage for farmers. Using biological cues to monitor and predict changes in growth and wellness could help farmers determine when oysters should be moved or harvested.

"In the normal course of operations, when there are changes in oyster condition, this can lead to product losses or quality downgrading," he says. "If the animals' physiology or behaviour changes, that might give us a head's up that something has changed in the water column that they're not enjoying."

But with real-time sensors in place, farmers could see when stressful conditions might be occurring or imminent and could adjust their animal husbandry and handling more quickly to optimise animal health and product quality.

"Another potential-use case for farmers is to observe behaviours over longer periods and to see how behaviours might provide an early warning for seasonal challenges, such as Pacific Oyster Mortality Syndrome (POMS), or signal water quality changes that affect growth rates through energy expenditure," says John McCulloch.

Sentinel sensor technology also has the potential to provide cost savings in the monitoring space.

"When you use fixed sensors in the marine environment, there are significant issues with biofouling and it becomes an expensive process of maintenance, with cleaning and calibration," explains John McCulloch.

"The thought was, maybe we can put an oyster biosensor out there and it won't need all that cleaning and maintenance, because the animals themselves don't need us to clean and maintain them."

While low-cost biosensors are not yet at industry-level production stage, the project was able to demonstrate proof-of-concept.

"We were able to deploy oysters with sensors in the channel for 12 months without touching them and were still able to get a clear signal from them. If farmers or managers are able to put a sentinel animal in place, and just let it monitor the environment without having to be hands-on, it has the potential to offer real value, and that's exciting."

YOUNG STUDENTS AGAPE AT HANDS-ON MARINE SCIENCE

New biosensor technology being developed by CSIRO researchers is helping to engage Tasmanian secondary students with the biology of bivalves and the career opportunities in the marine science and aquaculture sectors.

Leader of the aquaculture biosensor research projects is John McCulloch, a senior research engineer with CSIRO's Data61 division, who says the Marine Discovery Centre (MDC), situated on the D'Entrecasteaux Channel in Woodbridge, is a natural partner in creating learning opportunities using the sentinel oyster sensors.

"We wanted to let young people have a hands-on experience with oyster sensors and teaching units so they can understand the interactions between the animals and environment, and also get inspired about their local marine environments," he says.

In the past year the MDC has provided two-hour classes for more than 1500 students. Mollusc sessions include bivalve biology, physiology and anatomy, water quality issues, Tasmanian oyster farming, how sensor technology works, and how technology helps industry and environment.

The MDC also has molluscs with biosensors attached in tanks, which allows students and other visitors to see the sensors in action and view live results on a laptop.

It provides free, downloadable resources for teachers, at www.woodbridge.education.tas.edu.au.

More information: Chloe Simons, Woodbridge Marine Discovery Centre, chloe.simons@education.tas.gov.au

With real-time sensors in place, farmers could see when stressful conditions might be occurring or imminent and could adjust their animal husbandry and handling more quickly to optimise animal health and product quality.

While the initial FRDC-funded project has been completed, John McCulloch says it has identified where further research is needed to develop commercially valuable information that oyster growers can act on.

This includes a more detailed understanding of how water quality changes impact oyster biology. For instance, when oysters close, their heart rate almost stops. With available knowledge and equipment, it is difficult to know what is going on within the closed shell; however, new designs trialled in the lab can give us those details, John McCulloch says.

Increasing the sensitivity of sensors and collecting data with a finer resolution that incorporates closed-shell biology would allow environmental response patterns to be more clearly distinguished.

The CSIRO team has begun development of an improved prototype with a higher resolution, but it may be some time before we see a final product available for wide use on-farm. F

MORE INFORMATION
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FRDC RESEARCH CODE: 2019-042

Rural industries on track with trust

By **Catherine Norwood**

Research into community trust and acceptance of rural industries indicates Australians believe fishers, farmers and foresters play an important role in society

A national research collaboration project is working to identify the drivers of trust in primary industries, and strategies to improve it. The 'Community Trust in Rural Industries Program' is a partnership involving 10 Rural Research and Development Corporations including the FRDC, as well as the National Farmers' Federation and the New South Wales Department of Primary Industries.

The results from the first year of this three-year research project have already identified three key drivers of trust in rural industries: environmental responsibility, responsiveness to community concerns, and the importance of products produced by rural industries.

The research has also found large sectors of the community are uncertain about issues that relate mostly to environmental responsibility and industry responsiveness.

It has revealed that the behaviour of one rural sector affects the perception of others as well. An issue with live meat exports, for example, can influence perceptions of animal welfare in other sectors.

Work on cross-sector influences and strategies is expected to be a feature of the second year of the 'Community Trust in Rural Industries Program'.

As the coordinator of the FRDC's Human Dimensions Research subprogram, Emily Ogier is a member of the working group for the program, which is being delivered by Voconiq, a CSIRO spin-out company.

She says the significant level of uncertainty around the seafood sector's responsiveness to community concerns was unexpected, although many of the other findings from the first year of the research are similar to those of other community attitudes research the FRDC has conducted.

Emily Ogier
Coordinator, FRDC's Human Dimensions Research subprogram

"[Trust is] a simple way to think about what fisheries and aquaculture do and produce. We can make more use of the link between consumers and our products to help improve our community relationships and make them stronger."

She says while the seafood sector is getting better at "doing the right thing and letting people know", the "right thing" is always changing. "There needs ongoing engagement that allows the community to raise concerns as they change over time, and have the industry consider and respond to those concerns."

One of the other early findings that she is keen to see the sector make greater use of is the high level of trust reported for fisheries and aquaculture products. Trust can be assigned not just to the end product, the fish on the table or the prawn on the barbie, she says, but to the whole "package": who produces it, where it is produced, the provenance and care invested in supplying it.

"It's a simple way to think about what fisheries and aquaculture do and produce. We can make more use of the link between consumers and our products to help improve our community relationships and make them stronger."

The program's lead researcher, Kieren Moffat from Voconiq, says trust is crucial for industry and business because it translates community expectations and experience into acceptance.

"Trust in an industry builds acceptance for an industry and helps manage this risk. It is what enables an organisation or industry to be given the benefit of the doubt when things go wrong, it provides a licence for innovation and flexibility to experiment, and a general freedom to operate," he says.

"The 'Community Trust in Rural Industries Program' is uncovering what builds trust and acceptance of rural industries, and where there are clear opportunities for industries to take action. For Australia's rural industries we have shown that environmental responsibility, responsiveness to community concern and the important role rural industry products play in our lives are the strongest drivers of trust and acceptance.

"We are also seeking to understand how food and fibre industries relate to each other in the minds of the community, and see how the actions of one industry affect how Australians feel about other rural industries. This will help us understand the sector-wide risks and the role of collaboration in addressing them," says Kieren Moffat.

"The findings show the pathway to building and maintaining community trust is to be genuinely responsive to community sentiment, particularly around environmental sustainability and resource use. The key is to demonstrate responsiveness through action, and there are huge opportunities for industries who do this."

Research years two and three will seek to benchmark the results of the first year, but also examine certain areas in more depth and detail as required, with industries continuing to apply the learnings. F

Findings from the first year of the research can be viewed at https://frdc.com.au/project/2019-042

Community Trust in Rural Industries

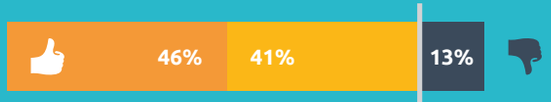
Rural industries on track with trust - key drivers, risks and opportunities revealed

YEAR ONE FINDINGS - MAY 2020

Rural industries (fishers, farmers and foresters) have collaborated to develop a pathway to proactive, transparent, long term engagement with the community via a three-year research program into the drivers of community trust.

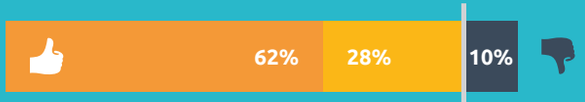
Trust and acceptance are high

Trust is high and distrust is low



46% of Australians trust rural industries
41% moderately trust and13% distrust

Acceptance is high and rejection is low



62% of Australians accept rural industries
28% moderately accept and only 10% reject

What drives trust in rural industries?

The three strongest drivers of the community's trust in rural industries are:

ENVIRONMENTAL RESPONSIBILITY

Sustainability, responsibility, minimal impact on the natural environment

RESPONSIVENESS

Listening to, respecting and responding to community concerns

PRODUCTS OF RURAL INDUSTRIES

The community highly values the sector's outputs, with its products seen to play an important role in the lives of Australians

Fishers, farmers and foresters are important

of Australians agree fishers, farmers and foresters play an important role in Australian society

of Australians agree rural industries contribute significantly to the Australian economy

of Australians agree rural industries are important to our way of life in Australia

of Australians agreed that if they hear about a rural industry acting irresponsibly, it negatively affects their opinion of all rural industries

Source: Voconiq

MORE INFORMATION
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FRDC RESEARCH CODES: 2017-061, 2018-115, 2019-096

Opportunities for expansion in northern Australia

With potenial new industries ripe for development in northern Australia, collaborative efforts will be key to success

Left Tropical rock oyster farming trials underway in the Pilbara with industry partner Maxima Rock Oyster Company. Photo: Western Australian Department of Primary Industries and Regional Development

By **Rebecca Thyer**

Sweet-tasting and fast-growing, tropical rock oysters have been enjoyed for generations by Indigenous Australians.

The oysters occur naturally along northern Australian coastlines and there is potential for them to be farmed. A collaborative research and development project is looking at how to bring these native delicacies to new consumers.

The project will address the most significant technical and regulatory issues challenging the development of northern Australia's fledgling tropical rock oyster industry.

If successful, it could help create 500 new aquaculture jobs and add more than $217 million in production value to the region over the next 20 years. This would transform northern Australia's aquaculture sector and economy.

Leading fisheries and aquaculture researchers from the Northern Territory and Western Australia are working together on this task via a three-year, $4.1 million project supported by the Cooperative Research Centre for Developing Northern Australia (CRCNA).

This project, says aquaculture specialist Jennifer Cobcroft at James Cook University (JCU), is a great example of the potential opportunities that exist in northern Australia. It also represents how the broader fisheries sector, government agencies, Indigenous communities and research providers can work together to capture and help emerging industries.

Situational analysis

Jennifer Cobcroft led a large collaborative team that investigated northern Australia's aquaculture potential, preparing a situational analysis report for the CRCNA published in May 2020.

The research found the region has multiple advantages. These include:

- high-quality land and water resources suitable for aquaculture in remote areas;
- a tropical climate supporting fast growth;
- several native species amenable to farming;
- a strong environmental and cultural provenance story; and
- close proximity to large export markets in Asia.

However, these advantages are coupled with challenges related to biosecurity, complex regulation and infrastructure issues (see breakout story, page 34.)

Jennifer Cobcroft and the project team discussed these findings with 85 stakeholders at an FRDC-supported workshop in Rockhampton earlier this year. The aim was to consider any gaps in the recommendations and propose ways to enable expansion. Importantly, the workshop demonstrated that research priorities are already well defined within specific industry association strategic plans.

Production bottlenecks

A reliable supply of oyster spat is a significant hurdle both for conducting research and for boosting production within the fledgling aquaculture operations already underway.

Michel Bermudes is the principal research scientist for marine shellfish with the Department of Primary Industries and Regional Development (DPIRD) in WA. He is working with his team to develop reliable technology for hatchery production of tropical rock oysters in Perth, as part of a CRCNA-funded project.

"We are working on two species of blacklip rock oysters: the Western Blacklip (*Saccostrea cucullata* – lineage A) and the Northern Blacklip (*Saccostrea cucullata* – lineage J, also known as *Saccostrea echinata*).

"Each species brings its own sets of challenges and opportunities. Lineage J oysters are large and fast-growing compared to the smaller lineage A species that has a natural favourable cup shape and conditions well for market. Importantly, because they are different, they are likely to provide a different consumer experience."

The work is still looking to surmount a number of challenges and it will be at least a year or two before significant numbers of spat are produced, Michel Bermudes says.

Once reliable protocols are developed, this might allow interstate biosecure hatcheries to supply spat to Queensland. Currently, the only commercial producer in northern Australia is in Queensland, based at Bowen in the state's north.

Previous attempts to produce spat from broodstock of the tropical rock oyster species sent from the Bowen farm failed as a result of the challenges of working with new species. The lack of spat continues to limit commercial production, which is currently relying on wild spat collection.

A commercial hatchery in southern Queensland has been able to successfully ➜

Right The area of interest for the Cooperative Research Centre for Developing Northern Australia (CRCNA). Source: CRCNA

produce tropical rock oyster spat, but biosecurity restrictions prevented it from being sent north.

These production issues were highlighted at the Rockhampton workshop to assess the situational analysis report. Participants said they could be addressed by creating northern Queensland's own hatchery.

Tropical rock oyster researcher at JCU, Jan Strugnell, says direct support for the emerging Queensland tropical oyster industry is critical. "The industry is at a vulnerable stage of development now and support of Australia's only commercial tropical rock oyster farmer is vital for Queensland and other jurisdictions.

"All business development endeavours, Indigenous and non-Indigenous, will be constrained by spat supply. Oyster hatcheries require high-quality water supply, specific infrastructure, a high level of biosecurity and hygiene, and skilled technical staff for successful spat production."

Despite these challenges, Jennifer Cobcroft says tropical rock oysters are now on the 'radar' for northern Australia, which is a positive.

"At the moment, there is some funding support for Tropical Rock Lobster and marine fish development." These include Coral Trout (*Plectropomus leopardus*), Cobia (*Rachycentron canadum*) and Groupers (*Epinephelus* spp.).

"We'd like to see this continue and other industries supported, including Redclaw (*Cherax quadricarinatus*) and various species of sea cucumbers. These emerging sectors have active investment driving development. With additional RD&E they can overcome bottlenecks to add substantial value in the north."

Jennifer Cobcroft says both established and emerging industries offer great opportunities that could be particularly important in a post-COVID-19 world. With an increased focus on sustainably produced, local food, they would provide new employment pathways in regional areas of northern Australia. F

LEADERSHIP IN ACTION

The top three aquaculture industries in northern Australia – Barramundi, prawns and Pearl Oysters – are diverse and their opportunities and challenges reflect this.

The CRCNA recently completed an aquaculture industry situational analysis, which highlights each industry's worth in northern Australia and its key challenges.

The CRCNA defines 'Northern Australia' as all of the Northern Territory, and those parts of Queensland and WA above and directly below or intersecting the Tropic of Capricorn. It also includes Gladstone, Carnarvon and Exmouth, as well as the local government areas of Meekatharra and Wiluna in WA.

The production values are for 2017-18, the only statistics officially released at the time of the study.

Barramundi

The Barramundi industry is valued at $74.8 million annually and employs 180 people across WA, NT and Queensland. Its top two challenges are regulatory burdens and environmental risks such as extreme weather events.

Prawns

The prawn industry is valued at $72.3 million annually and employs 220 people across Queensland. Its top two challenges are the absence of a Tiger Prawn breeding program and, with industry expanding, broodstock quality and supply.

Pearls

The Pearl Oyster industry is valued at $70.3 million annually and employs 70 people in WA. Its top two challenges are environmental risks and disease.

Challenges common across aquaculture sectors included the risk of disease outbreak, recruiting and retaining staff, and the cost and reliability of power.

Recommendations

The report made seven recommendations to address these cross-industry, pan-northern issues, proposing engagement by government agencies, industry, research providers and others.

The first is to **bolster biosecurity.** This could be done at the border through a review of policy, risk assessments and R&D programs. Other tasks would be to increase pathogen understanding, documented risks, transmission pathways and practical surveillance. It could also include establishing effective structures to develop high health lines for key production species.

Facilitating **infrastructure development** for key Aquaculture Development Hubs is also a recommendation. This would see northern Australian aquaculture industry supported in the supply chain capacity to underpin **market development and access** – both domestically and internationally.

Building aquaculture as a means for **Indigenous economic development and independence** is also a recommendation, as is **building skills** to meet industry growth. This would close the gap in demand for skilled personnel with 2340 direct new jobs, at a range of skill levels, created by 2030.

Regulatory-wise, another recommendation is building **stronger and adaptive governance** of the northern Australian aquaculture industry.

And finally, RD&E needs to be focused on **industry outcomes** that are aligned with national, jurisdiction and industry association plans. F

MORE INFORMATION
Ben Diggles, ben@digsfish.com; Pumicestone Passage restoration, https://restorepumicestonepassage.org
FRDC RESEARCH CODE: 2019-005

Cleaned and sanitised oyster shells are bagged up, ready for use in reef resoration. Photo: Ben Diggles, DigsFish Services

Creating a shellfish reef from scratch

By **Gio Braidotti**

A biosecurity risk analysis is underway to assess using recycled oyster shells to restore lost shellfish reefs

It is estimated more than 85 per cent of the world's shellfish reefs have been lost. Over-harvesting, reductions in water quality run-off and increased siltation have all contributed to the decline. In Australia, reefs were also mined extensively as a source of lime for cement.

But around the world, including in Australia, there are renewed efforts to restore shellfish reefs, driven by the many benefits they provide as building blocks in healthy estuarine and coastal marine ecosystems.

The shellfish that grow on these reefs filter large volumes of water and can improve water quality, while the reef structures themselves help to stabilise shorelines and provide habitat and food for fish and crustaceans.

Oyster shells recycled from restaurants have been used around the world for more than three decades to restore degraded shellfish reefs, especially subtidal reefs located below the low-water mark. Now, as Australia embarks on efforts to restore its own lost shellfish reefs, the FRDC is investing in research to assess the biosecurity risks of using recycled oyster shells for this purpose.

Oyster shells are considered an ideal material to help rebuild reefs as they provide the appropriate chemical signals that tell wild shellfish spat to leave the plankton they are floating in and settle on the reef.

The shells also offer a substrate to restart reef formation. Once sanitised, oyster shells can be placed in the most suitable locations at the right time of year, kickstarting the life cycle of shellfish and the formation of a new reef.

To facilitate restoration efforts while protecting both local environments and oyster industries, the FRDC has commissioned a series of oyster shell biosecurity risk assessments.

Ben Diggles, of the consultancy DigsFish Services Pty Ltd, is conducting the assessment, looking specifically at whether recycled shells are likely to spread shellfish pests and diseases.

His analysis uses qualitative disease risk assessment methods. The process involves collating scientific information about oyster pests and diseases, then comparing it against various methods used to treat shells to mitigate these risks. Treatments include desiccation, heat treatment, or exposure to fresh water or acetic acid (vinegar).

His findings will be used to inform the various regulatory frameworks across all the states dealing with treatment of the shells before their use in aquatic environments.

"The document will help reassure managers that if the shells are recycled the right way, there's no risk of spreading pests and diseases while the reefs are being restored," he says.

"You want to get all the benefit from the restoration with none of the drawbacks."

The success of several small shellfish reef restoration trials using recycled oyster shells, undertaken around Australia in the past five years, indicate these benefits may be substantial.

These trials include the community-driven restoration project in Pumicestone Passage on Queensland's Sunshine Coast. Over three years, the site saw successful multi-year recruitment of juvenile oysters to reefs made from recycled oyster shells. Additionally, the site experienced a 1070 per cent increase in overall fish numbers (including a 1640 per cent increase in harvestable fish species), and a 380 per cent increase in fish biodiversity compared to pre-project baselines.

"We now realise oyster reefs are a keystone habitat for our estuaries and inshore areas," Ben Diggles says. "That is true for the restored reefs too. For example, the Pumicestone Passage restoration project has seen an over 16-fold increase in harvestable fish numbers in an area that is open to recreational fishing."

His biosecurity assessment report is expected to finalised before the end of the year. **F**

Ben Diggles
DigsFish Services

"We now realise oyster reefs are a keystone habitat for our estuaries and inshore areas."

MORE INFORMATION
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FRDC RESEARCH CODE: 2017-175, 2017-188

Below Prawn fisheries rely on healthy prawn-producing habitats, such as mangroves. Photo: Shutterstock

Prawn fishery counts its natural capital

By **Dyani Lewis** and **Catherine Norwood**

Natural capital accounting can help fisheries businesses assess the risks and opportunities associated with the ecosystem assets they rely on

Becky Schmidt
Environmental scientist, CSIRO

Natural capital is the stock of renewable and non-renewable resources – such as soil, water, plants, animals, minerals and air – on which primary industries rely to produce food and fibre for society.

For prawn fishers in Wallis Lake, on the New South Wales coast north of Newcastle, the estuary and adjacent catchment are important natural assets that support the continued health of their fishery.

A new study is looking at the prawn-producing habitat in the estuary – made up of saltmarsh, seagrasses and mangroves – with a view to understanding how this natural capital supports the fishery's productivity and to value its contribution through the use of natural capital accounting.

It is a process that also helps identify opportunities to add value and to assess threats to the health of ecosystem assets.

Research led by CSIRO and supported by the FRDC has demonstrated how natural capital accounting can be applied in fisheries. Stakeholders can now determine if it could improve management decisions and boost productivity, not only in the prawn fishery but also in all Australian primary industries.

The research has been applied to three case studies, including Wallis Lake, prepared as part of a larger national project, 'Increasing farm gate profits: the role of natural capital accounts', funded through the Department of Agriculture, Water and the Environment's Rural R&D for Profit program. Other case studies are being prepared for cotton growers and the forestry sector.

Creating the accounts

Environmental scientist Becky Schmidt at CSIRO has led the Wallis Lake prawn fisheries case study. She says the methodology CSIRO has developed draws on the business-focused Natural Capital Protocol and the UN's System of Environmental–Economic Accounting, to determine the connections between ecosystem assets, society and the economy.

The research team consisted of Becky Schmidt and Ian Cresswell from CSIRO, University of Newcastle fishery experts Vincent Raoult and Troy Gaston, and Matt Taylor at the NSW Department of Primary Industries.

Becky Schmidt says people often do not know where to start when assessing their natural capital: "They don't know what to measure, how to measure it and what is critical."

To identify these factors, the research team consulted with many stakeholders who have an interest in the health and productivity of Wallis Lake, including commercial and recreational fishers, land managers, local and state governments, and local conservation groups. It also consulted with the broader NSW fishing industry.

The Wallis Lake estuary supports a moderate-sized prawn fishery that can produce up to 60 tonnes of prawns a year, mostly in the summer months. More than 20 fishing businesses can be involved in the annual harvest and prawns are also a popular catch for recreational fishers.

The Wallis Lake estuary has important habitats including seagrass beds, mangroves and saltmarshes. Eastern School Prawn (*Metapenaeus macleayi*) is the most commonly caught prawn in the estuary, and the habitat supports it through several stages of its life cycle.

Identifying what matters

Key natural assets for the continued operation of prawn fishing in Wallis Lake were identified as estuarine waters suitable for prawns, prawn-producing habitat, biodiversity and a renewable prawn population.

The researchers and stakeholders identified three high-priority activities or events that have the potential to impact these assets: pulses of fresh water into the estuary, agricultural activity in the catchment, and commercial fishing in the estuary.

Wallis Lake is fed by several small rivers that drain a catchment of 1200 square kilometres of mostly agricultural land. While fresh water inputs are important to Eastern School Prawn, during heavy or sustained downpours, run-off from adjacent farmland can cause water quality to decline. The knock-on effects can include widespread die-off of seagrasses, which are vital prawn habitat and essential for good water quality.

Other catchment-based activities, such as land clearing and trampling of saltmarsh by livestock, can also adversely affect water quality and the health of the estuarine ecosystems.

The project shows effective management of the whole system requires catchment and water management alongside fisheries management, so the direct impacts of both terrestrial and water-based users on the shared natural capital in the estuary can be considered.

The Wallis Lake estuary has important habitats including seagrass beds, mangroves and saltmarshes. Eastern School Prawn (Metapenaeus macleayi) is the most commonly caught prawn in the estuary, and the habitat supports it through several stages of its life cycle.

Photo: Wallis Lake Fishermen's Co-operative

In consultation with stakeholders, the researchers proposed seven natural capital accounts that could be compiled from publicly available data, and which reflect key ecosystem assets:

- precipitation in the catchment;
- fresh water pulses in the catchment;
- land use in the catchment;
- terrestrial and riparian vegetation in the catchment;
- aquatic prawn habitat;
- water quality in the prawn habitat; and
- landed-prawn biomass.

Taken together, such accounts form a picture of the overall health of the ecosystem upon which prawns depend. Compiling these accounts, with repeatable measurements added over time, is expected to provide a better understanding of the main drivers of estuary health and the prawn-fishing industry.

Industry benefits

A bird's-eye view of estuary health is not the only way fishers stand to benefit from the research. Commercial fishers who assess their operation through a rigorous natural capital accounting process could be better placed to convince investors of their business's long-term viability.

Or they could use the process to gain social licence by demonstrating to the community they are good managers of the estuary. Also, truly understanding the threats to critical natural assets and business risks gives fishers the chance to adjust their goals to recognise a changing outlook.

"Under a changing climate, we're increasingly aware resources are finite and under threat," says Becky Schmidt. "So, we need to be more efficient in our use of resources and also ensure the natural system has what it needs to function going into the future."

She says natural capital accounting has highlighted gaps in available data that indicate opportunities to improve monitoring, for example, of fresh water pulses into the estuary.

The Wallis Lake case study identified small-scale fishery enterprises are generally too small to invest heavily in scientific data collection and maintain their own set of natural capital accounts.

In contrast to land-based enterprises, which usually fully control their land, fishers are not the only estuary users; a diverse range of people use them and impact them, either directly or through impacts on their associated catchments.

But the fishers could band together, working with larger organisations such as local government or catchment agencies to gather the data required to monitor and improve management of their shared resource.

Brian Hughes, the estuary and marine officer for Hunter Local Land Services, says local councils and producers do not always work closely together. "This could really help by strengthening links between the two."

While the Wallis Lake natural capital accounts focus on local conditions, similar methods can be applied to other estuaries and fisheries, and to regional areas more broadly.

"We are trialling a new method here which we hope will add value to fisheries right across Australia," says Becky Schmidt.

The final reports, *Designing natural capital accounts for the prawn-fishing industry* and *Experimental natural capital accounts for the prawn-fishing industry in the Wallis Lake estuary*, are expected to be published later this year. F

Right
Mervi Kangas with the *RV Naturaliste*, which helps to conduct much of her fisheries research.
Photo: Evan Collis

Below left
Common Lionfish (*Pterois volitans*,) photographed at the Abrolhos Islands, WA.
Photo: Mervi Kangas

Finding the balance in a life aquatic

Good relationships are the backbone of Mervi Kangas's life's work on the water, as she strives to ensure commercial fisheries remain sustainable

By **Melissa Marino**

Mervi Kangas never tires of a good sunset. She has been privileged to see quite a few spectacular skies as the sun dipped below an ocean-filled horizon during her 35-year career as a marine scientist.

These 360-degree panoramas – along with the majesty of the annual whale migration – are the definitive bonuses of her job, which often sees her at sea monitoring populations of prawns, scallops and Blue Swimmer Crabs.

She is an invertebrate fisheries specialist and for the past 20 years has been part of the research team at Western Australia's Department of Primary Industries and Regional Development (DPIRD). At the heart of her work is striking the balance between environmental concerns and the continued success of the commercial fishing sector.

In prawn fisheries, for example, recruitment surveys predict the likely catch for the year, helping to set the season's parameters for sustainability, while enabling fishers to plan their business operations – and maximise profits.

A crucial part of achieving this balance in the sustainable management of fisheries is collaboration with the fishers themselves.

Many of Mervi Kangas's research surveys are undertaken on DPIRD's research vessel, *Naturaliste*. But she says spending time on the water with commercial fishers, independently collecting survey data on their vessels, is also important.

"I try to get out on surveys on the commercial boats a couple times a year at least, so I don't lose perspective on what it's like out there," she says.

"You're out there for quite a few nights and you have time to talk to the skipper and crew about how they're faring, what they're thinking, what they have been observing – and what they think of the decisions being made," she says. "It's always really worthwhile and interesting."

Collaboration with industry, she says, provides firsthand insight into the trawl sector and builds trust.

As the head of DPIRD's invertebrate trawl research, Mervi Kangas leads a team providing essential biological data and management advice on Saucer Scallop and multi-species prawn fisheries across the state's vast coast, and for Blue Swimmer Crabs in Shark Bay. This data is used to set quotas for the scallop and crab fisheries and the season's duration for prawn fisheries every year.

Given that advice derived from her work determines when and where fishers can operate and how much they can catch, good relationships are integral.

And the time she has invested in building these relationships has proven its worth this year, as COVID-19 restrictions limited movement, jeopardising the surveys used to set quota.

But the fishers themselves came to the rescue, allowing one of her team members to join a commercial fishing crew in the Exmouth Gulf to gather data. And in Shark Bay, the Sea Harvest fishing company refitted one of its vessels and assembled a crew and data collector to ensure a survey could take place.

Mervi Kangas says the interests of industry and the environment converge through sustainable management, such as using quotas, restricted fishing seasons and locations, and totally closing some areas to fishing.

These measures not only result in more abundant fisheries long-term, but also boost the green credentials of the commercial sector, giving fishers the social licence to operate. The datasets she has helped to build during the past 20 years with DPIRD provide the basis for independent third-party accreditation, such as Marine Stewardship Council certification awarded to Shark Bay and Exmouth fisheries.

But she says that does not mean there are no short-term conflicts, particularly when there are profit drivers, and people's livelihoods are at stake.

Fishers, and some fisheries, have been doing it hard, dealing with ageing fleets, competition for workers, unprecedented environmental challenges and the long-term impacts of marine heatwaves. This year, the COVID-19 pandemic has brought new health and safety issues, along with major market disruptions.

Overcoming such challenges is why good relationships between stakeholders, including researchers, policymakers, licence holders and fishers, based on trust, cooperation and inclusion, are so important.

"It works well because everybody is part of the process and it's not just top-down," she says.

While her work ensures the year-to-year catch is sustainable, she says her role has evolved from a focus on target species, to a broader consideration

Below Southern Pygmy Leatherjacket (*Brachaluteres jacksonianus)* at Busselton Jetty, Busselton, WA. **Bottom** *Phyllodesmium nudibranchs*, which feed on soft corals on the wreck of the *Swan* in Dunsborough, WA. Photos: Mervi Kangas

MARINE LIFE

While building relationships in the seafood sector has proved an immensely valuable part of Mervi Kangas's work, it is her love of wildlife that first brought her to marine sciences. Her interest took her to James Cook University in Townsville, where she discovered scuba diving.

"I grew up in the Adelaide foothills and I wasn't a water baby at all," she says. "For the first few years, every time I went diving I had butterflies because I never felt that confident or competent – but now, after 40 years, I just love it."

As a departmental diver, she has worked underwater, monitoring everything from chitons to pest species in port facilities. These days, she says, she prefers to dive for fun – at Ningaloo Reef for its abundance of turtles, manta rays and, at the right time, whale sharks.

Waters around local reefs north of Perth also provide great delight. "I like looking for little critters, so you have your head down and camera focused," she says. F

of ecosystems, the impacts of fishing and the sustainability of the trawl sector as a whole.

This is reflected in her work on several FRDC-funded projects, including resolving resource issues where prawn and scallop fisheries overlap, understanding biodiversity of trawl bycatch, and reducing trawl impacts on habitats and bycatch.

Research dating back almost 20 years has led to improved trawl practices – for example, the introduction of bycatch reduction devices.

Challenges for industry and its sustainability continue and are always changing, she says. With climate change, water temperatures are generally warming along the WA coastline. And in Shark Bay the temperature range is widening, with colder winters and warmer summers. The 2010-11 marine heatwave was likely the first sign of things to come.

The impact of these factors is all fodder for further research. Mervi Kangas expects future research and fisheries management will focus on strengthening the ability of the fishing sector to survive the impacts of climate change through forecasting and preparing for different scenarios. But she will not necessarily be undertaking that work.

"I don't think I'll be here for the next 35 years," she says. "I'll go and enjoy those sunsets elsewhere." F

Final reports

Abalone quota-setting workshop 2019-162

Representatives from the Western Australian Government's Industry Consultation Unit (ICU) travelled to Port Fairy, Victoria, to utilise the knowledge and experience from the Western Abalone Divers Association to develop an industry engagement process that will be implemented throughout the recovery period for the WA Area 3 Abalone Fishery. During the two-day workshop, representatives from the Victorian Fisheries Authority provided a seminar on their electronic catch-reporting system, which would be useful knowledge for those participating in the recovery process.

Attendance at the workshop had dual immediate and long-term benefits. In the short-term, this project provides the basis for industry-led decision-making in the recovery of the WA Area 3 Abalone Fishery. Moreover, workshop attendance facilitated the transfer of knowledge between Abalone jurisdictions and industry stakeholders. This will yield long-term benefits in broadening the capacity of the ICU staff for any future consultation with industry.

More information: Angus Callander, angus@wafic.org.au

Seafood Directions 2019 2017-239

The Australian seafood industry operates in a diverse and dynamic environment and, although the volume produced in Australia is small by world standards, the value and quality of our product and sustainability of our practices are globally recognised. For the Australian seafood industry to continue to be a world leader in seafood production and quality, there must be an opportunity to learn from each other and plan for the future. The role of the Seafood Directions conference is to provide a significant opportunity for fishers, managers, researchers, industry representatives and others who work in support of the industry to examine key contemporary and strategic issues, and develop blueprints that will ensure a sustainable, profitable and socially resilient seafood industry in Australia.

Over three days, from 9 to 11 October 2019, Seafood Industry Victoria (SIV) hosted the biennial Seafood Directions conference, which brought together hundreds of seafood enthusiasts from across the country and around the world. For the first time the conference was promoted and sold to the public, who joined those involved in the seafood industry and shared opinions, thoughts and suggestions, working together to create an industry workplan that will secure, promote and celebrate Australian seafood.

More information: Johnathon Davey, johnd@siv.com.au

Seismic survey catch impacts 2019-072

This project set out to examine the impact of seismic testing on Danish seine catch rates of Tiger Flathead and Eastern School Whiting, and to consider the results with respect to how future marine seismic exploration will impact these fisheries. Multiple – Before After Control Impact (M-BACI) tests were carried out to test the hypothesis that the catch rates of the key target species are impacted by marine seismic surveys. Evidence was found for the negative impact of seismic surveys on whiting and flathead catches in the Danish Seine Fishery.

More information: Ian Knuckey, ian@fishwell.com.au

Next-generation stock assessment 2016-044

This report presents the results of the first application of close-kin mark-recapture (CKMR) using both parent-offspring pairs (POP) and half-sibling pairs (HSP). This application to Southern Bluefin Tuna (SBT) has been successful, providing a decadal time series of absolute abundance, total mortality and selectivity of adults. The method and the results have been reviewed and accepted by the Scientific Committee of the Commission for the Conservation of Southern Bluefin Tuna (CCSBT) and CKMR is now adopted and funded by the CCSBT as a fisheries-independent method for monitoring the rebuilding of the spawner abundance. While the focus of this report is SBT, this extended method of CKMR (that is, POP+HSP), developed by CSIRO, is applicable to most teleosts (bony fishes) and will have wide applicability to Australian and international fisheries.

More information: Campbell Davies, campbell.davies@csiro.au

Valuing Victoria's seafood industries 2017-092

This project provides the first evaluation of the social and economic contributions of Victorian wild-catch professional fisheries and aquaculture to the communities in which the industries are located and to the entire state. This project was developed in consultation with the Victorian seafood industry, which identified the need to communicate the economic value of their industry, inclusive of the economic contribution of businesses supplying or being supplied by seafood producers. In addition, there was an evaluation of the social benefits of the industry to Victoria.

More information: Kate Barclay, kate.barclay@uts.edu.au

Saucer Scallop population dynamics 2017-057

The results of this study provide crucial information needed to rebuild the east coast fishery between Yeppoon and K'gari (Fraser Island). To do so, fishery management needs to reduce the spatial intensity of fishing effort applied and ensure that enough spawning occurs each year to support the scallop population and fishery. This project undertook analyses to understand the role of overfishing and the environment on Saucer Scallops. The analyses indicated reduced numbers of spawning scallops. Historical levels of fishing and environmental influences such as from increased sea surface temperatures have amplified scallop mortality rates.

More information: Michael F. O'Neill, michael.oneill@daf.qld.gov.au

Catch the drift leadership training 2016-401

The project delivered three 'Catch the drift' (CTD) programs within the scheduled time frame, meeting the expected participant numbers. Forty-five people registered for the three programs from across a number of sectors.

The CTD participants are well placed to ensure positive change occurs for industry and are all poised to take on new opportunities. Program evaluation found the participants and stakeholders consulted identified that the CTD achieved strong outcomes for participants and already there is evidence the industry is being rewarded with positive outcomes. CTD has delivered high-value outcomes for the Victorian seafood industry and participants, and met its objectives.

More information: Jill Briggs, jill@affectusaus.com.au

E-fish data capture and sharing 2018-026

The e-fish project provides an in-depth analysis of the challenges experienced by fisheries agencies in data integration and sharing. The project, led by the Australian Fisheries Management Authority (AFMA) in consultation with Australia's state and territory fisheries jurisdictions, investigated a solution for integrating fisheries data across data collection platforms and securely sharing data with users. The outcome of the project was a recommendation of a service-oriented architecture (SOA) coupled with application programming interfaces (APIs) for data capture and sharing, which was demonstrated through proof-of-concept testing to be a fit-for-purpose solution for fisheries agencies.

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Indigenous business development 2016-206

The findings from 21 interviews were the base for developing the information presented on the Business Nous website, which aims to assist people with the essential elements required for setting up a fishing business. The key findings suggest that to manage or own an Indigenous fishing business, standard principles need to be followed and structures implemented. The Business Nous project has developed materials that will assist to people think through the essential elements when operating a fishing business. Materials developed can be found at www.irgbusinessnous.com.au and www.irgbusinessnous.com.au/about-business-nous-project.

More information: Jill Briggs, jill@affectusaus.com.au

Sentinel sensors 2016-023

This study, undertaken by CSIRO Oceans and Atmosphere, examines the usefulness of molluscs as sentinels for environmental change using a novel biosensor. This project measured the vital signs of heart rate and behaviour in sentinel animals as they respond to multiple and interacting changes in the environment. Such complex monitoring is not possible with infrequent water sample analysis, and the lack of real-time sensors for all potential stressors creates the need for a world-first rapid biological response system.

The 'animal-eye' view allows direct measurements of how animals perceive and respond to their changing environment, thus removing the guesswork from trying to predict ecosystem health based solely on environmental monitoring data. This project adds value to existing environmental and ecosystem monitoring and modelling research, and provides the crucial missing piece in the puzzle – the biological response to environmental change. This project has proven that field-deployed biosensors can operate in harsh marine environments, without servicing or maintenance, far longer than typical water-quality sensors.

An outreach component of the project developed equipment and teaching modules for the CSIRO Marine Discovery Centre (MDC) to engage students with marine science. Staff at the MDC report that the biosensors were a highly valuable teaching resource.

More information: John McCulloch, john.mcculloch@data61.csiro.au

Wild-catch Barramundi workshop 2017-247

History has shown that Barramundi catches have not been sufficient to allow the product to maintain its place in the domestic market. This has allowed farmed and imported fish to make inroads into what have traditionally been wild-catch markets. Catches have recently improved to a level close to sustainability but stakeholders have discovered that traditional markets are no longer available. This has caused a build-up of stock and therefore a reduction in revenue. The workshop identified the root causes of the market failure through consultation with key stakeholders. This report provides a detailed action plan to understand market needs in order to position wild-caught Barramundi for future success.

More information: Marshall Betzel, nqtrawlers@bigpond.com

Community Trust in Rural Industries 2019-042

A collaboration of research and development corporations is seeking to develop a sector-wide understanding of community trust in rural industries, encompassing fishing and aquaculture, along with other primary industry sectors. The project acknowledges the significant power in approaching the issue as a collective of agriculture industries to develop a consolidated, consistent framework for community trust that may then be used in industry-specific ways. The project is working to identify key and material issues with industry stakeholders to effectively baseline community sentiment. The results from the first year of the project are available on the FRDC website.

More information: Jenny Medway, jennifer.medway@agrifutures.com.au

Rural safety and health alliance 2018-214

The Work Health and Safety (WHS) Communication Guidelines aim to help research and development corporations (RDCs) and industry associations within the agriculture, forestry and fishing sector to communicate with flair and impact to improve WHS outcomes. These guidelines are designed for use by personnel involved in messaging about work, health and safety within the agriculture, forestry and fishing industries.

More information: Jenny Medway, jennifer.medway@agrifutures.com.au

Northern prawn water resources 2016-047

This study provides the first descriptions of the estuarine prawn communities of the Mitchell, Gilbert and Flinders rivers in about 40 years. Each of the estuaries of these rivers supports high abundances of juvenile Banana Prawns that contribute strongly to the annual first-season Banana Prawn catch of the Northern Prawn Fishery.

While the impact of flow on the emigration of Banana Prawns previously has been described, this project has measured the spatial distribution of juvenile Banana Prawns in tributary habitats and main channel habitats in each river. Moreover, the project has related aspects of the population biology of juvenile Banana Prawns to the likely environmental conditions of each estuarine habitat. In doing so, the project has explored how affects on the seasonality and dimension of low flows due to water resource extraction might affect the Banana Prawn population, particularly emigration and eventual commercial catch.

Importantly, these prawn abundance and habitat extent estimates highlight the possible variation in an estuary's contribution to the fishing sector as a dependent extractive industry.

More information: Rob Kenyon, rob.kenyon@csiro.au

Gladstone Harbour fish health indicators 2017-109

As the link between land and sea environments, estuaries are complex ecosystems vulnerable to human impacts, which directly and indirectly affect plants and animals, including fish. Fish are key biological indicators of environmental contamination as they are water breathers, are common in aquatic ecosystems, play a variety of important ecological roles, are readily identified and have high importance to the community. Various wastewater sources, of industrial, agricultural and domestic origins, can pollute downstream waterways. When fish are exposed to contaminated water, they are affected at the population level (numbers and diversity of fish species) down to biochemical impacts on single cells within individual fish. Fish health indicators range from relatively low to high cost and complexity.

For this project, preference was given to testing and developing low to medium cost and complexity fish health indicators such as external measurements, pathological changes that can be seen with the naked eye, parasite count, the application of an existing health assessment index, and histopathological analysis (analysis by an aquatic veterinarian of tissue condition using a microscope). Ultimately, the results of this project will be considered for incorporation into the Gladstone Harbour Report Card, providing stakeholders and the community with accessible information about the condition of Gladstone Harbour, with potential for application to other Northern Australian ports and estuaries.

More information: Nicole Flint, n.flint@cqu.edu.au

Fresh versus frozen 2017-179

There is a strong negative perception of frozen fish amongst consumers, with many considering that frozen product is of inferior quality compared to 'fresh' (chilled) fish. The resistance to purchasing frozen fish continues, despite modern freezing technology and practices resulting in frozen product that remains as premium quality for longer than chilled fish.

The research described in this report was driven by the FRDC in an endeavour to establish whether there was a discernible difference between fresh and frozen product of the same species. Two evaluation methods were used: a Chefs' Table focus group method and an experienced seafood panel assessment by difference testing.

Both methods were used to evaluate sashimi and cooked formats of the fish samples.

Using difference-testing methodology, the seafood panellists confirmed the perception of frozen fish being indiscernible from fresh fish. The opportunities and benefits of reduced reliance on fresh fish supply were raised and discussed in terms of flexibility and stability for menu design, reduction of wastage and better supply logistics.

More information: Peter Horvat, peter.horvat@frdc.com.au

Sawfish bycatch mitigation 2016-058

This project tests the effect of electric fields on sawfish behaviour, to determine if a strong electric field can overwhelm their electrosensory system and dissuade them from approaching its source or elicit a fleeing behaviour. While sawfish clearly sensed and reacted to all electric fields tested, none of the waveforms used could repel from distances likely to be sufficient to deter sawfish from entering trawl nets. This means the available devices that produce electric fields are unlikely to be useful to reduce sawfish bycatch in prawn trawlers.

More information: Charlie Huveneers, charlie.huveneers@flinders.edu.au

Evaluate Deckhand investment readiness 2018-169

The global fishing industry predominately uses paper to record mandatory and other data about fishing. An estimated 80 per cent of fishing vessels are small (less than 12 metres) and are not suited for adopting desktop technology for data management. Fisheries management and research agencies globally are attempting to move to digital reporting of mandatory information. Real Time Data Pty Ltd has developed a tablet-based platform, called Deckhand, which addresses these industry problems with global export potential.

More information: Tom S. Robinson, tom@goolwapipico.com

Photo: Valentin Heimhuber

A legacy of collaboration

Vale Colin Creighton, AM

29 February 1959 – 9 August 2020

One of Australia's leading environmental scientists and advocates, Colin Creighton, died in August 2020.

His work over many years focused on natural resource management and the balance between productivity and preservation.

Originally from Grafton, in New South Wales, Colin Creighton's career was broad ranging and varied, with an international reach. He graduated with a degree in metallurgical engineering and postgraduate qualifications in natural resources and in management.

He was passionate about exploring smarter, more profitable and sustainable land use practices at all scales, working in partnership with farmers, foresters, fishers, conservationists, managers and policymakers to achieve more productive landscapes across Australia and its near neighbours. He was also a strong supporter of Aboriginal self-determination and of Aboriginal involvement in environmental restoration.

Colin Creighton's major achievements included leading the first National Land and Water Resources Audit for Land and Water Australia, which was completed in 2002. He was also inaugural Director of the CSIRO Water for a Healthy Country Flagship.

His most recent projects with the FRDC investigated the impacts of climate change on coastal ecologies and fisheries, and the benefits of restoring coastal habitats.

In 2018 Colin Creighton was named as a Member of the Order of Australia for significant service to environmental science and natural resource management, particularly to marine biodiversity, coastal ecology, fisheries and sustainable agriculture.

Based near Mackay, Queensland, for many years he was an adjunct principal research scientist for the Centre for Tropical Water and Aquatic Research at James Cook University. He also contributed internationally, including as inaugural President of the Global Water partnership, and in volunteering assignments in the Pacific Islands and South East Asia. **F**

Photo: Sarin Group

A pioneer of the tuna industry

Vale Sime 'Sam' Sarin, AM

10 March 1936 – 21 June 2020

Australia has lost a pioneer of its fishing and aquaculture sectors with the passing of Sime 'Sam' Sarin, who died in Port Lincoln in June, aged 84 years.

Arriving in Australia in 1958 after emigrating from Croatia, Sime Sarin helped to shift the tuna industry from low-value canning and poling to high-value tuna ranching, building his company, the Sarin Group, into the world's largest producer and marketer of premium tuna.

He settled in Port Lincoln in 1965, fishing with the *New Dolphin* and raising three children – Bruno, Belinda and David – with his wife Elida Goja.

In the early 1970s he helped to establish the Port Lincoln Tuna Processors (PLTP) and became chair of the company in 1974, developing the export of Southern Bluefin Tuna to Italy, and setting up a new cannery to process the smaller tuna.

He then became the major shareholder in the *Boston Bay* and *Maria Louisa* vessels, also establishing a new slipway and shipyard in Port Lincoln.

In the 1980s there were major cuts to catch quotas for South Bluefin Tuna. Sime Sarin created Australian Fishing Enterprises (AFE), bringing together tuna-fishing families to transition from wild catch to ranching – netting the reduced tuna quota at sea and bringing fish to inshore pens to fatten for the Japanese sashimi market. It was a major innovation in fishing operations for the Australian seafood sector.

In 2003 he added the $18 million purpose-built *Apollo* to his fleet. AFE, as part of the Sarin Group, continued to accumulate Southern Bluefin Tuna quota, holding approximately half of all Australia quota for the species at the time of Sime Sarin's death.

He also had a large involvement in the South East Trawl Fishery, with a base in Portland, and was a major property developer in Port Lincoln.

In 2017 he was inducted into the National Seafood Hall of Fame and in 2019 was named as a Member of the Order of Australia "for significant service to the fishing industry, to business, and to the community of Port Lincoln". **F**

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